

# Appendix A: Measure Descriptions

---

## Residential Electric Measure Descriptions

This section provides an overview of the selected energy-efficiency measure within the residential sector. The measures are categorized by end use. Discretionary (existing buildings) and Lost Opportunity- New Construction have many of the same measures within each end use and are thus grouped together. If significant differences in the TRC exist between the two applications, both TRCs will be given; otherwise, only an average TRC is given. Lost Opportunity—Equipment category includes additional measures and are given separately.. In addition, a description of emerging technologies is included at the end. A brief description of the current baseline technology and the energy measure is discussed. Percent savings and TRC are averaged over all applicable building types.

### Lighting

Incandescent lighting is a highly inefficient light source; as such, significant savings can be gained by switching to fluorescent lighting.

Lighting measures for typical household applications are categorized by use: low (1 hr/day), medium (2.5 hr/day), and high (4 hr/day), representing frequency of use.

**Table A–1. Residential Electric Lighting**

Category or End Use	Technology	Baseline	End Use Percent Savings	TRC
Lighting	CFL Lamps, Low Use	Incandescent 60W	9%	5.1
	CFL Lamps, Medium Use	Incandescent 60W	6%	9.4
	CFL Lamps, High Use	Incandescent 60W	43%	12.0
	CFL Fixtures, Low Use	Incandescent 2-60W	2%	0.7
	CFL Fixtures, Medium Use	Incandescent 2-60W	2%	1.7
	CFL Fixtures, High Use	Incandescent 2-60W	9%	2.7
	CFL Torchieres, Low Use	Incandescent Torchieres, 200W Halogen	1%	0.7
	CFL Torchieres, Medium Use	Incandescent Torchieres, 200W Halogen	1%	1.7
	CFL Torchieres, High Use	Incandescent Torchieres, 200W Halogen	3%	2.7

### ***CFL Lamps, Torchieres and Fixtures***

A 15W compact fluorescent light (CFL) can be a drop-in replacement for a 60W incandescent light, resulting in a 75% energy savings. Or, a 18W CFL torchiere can replace a 200W

halogen—a 91% energy savings. A specific CFL fixture can also replace standard incandescent fixtures increasing the energy savings. The lighting usage is broken up such that high and low each constitute 20% of the total lighting while medium constitutes 60% of the total lighting.

## Heating, Ventilation, and Air-Conditioning (HVAC)

Measures associated with the HVAC system improve the overall heating and cooling loads on the building. For residential buildings, only heating measures were considered, specifically those affecting the space heat and heat pump end uses.

**Table A–2. Residential Electric HVAC**

Category or End Use	Technology	Baseline	End-Use Percent Savings	TRC
Heat Pump or Space Heat	Air-to-Air Heat Exchangers	No Heat Exchanger	10%	0.2
	ENERGY STAR Home		36%	1.8
Heat Pump	“Check Me” Duct Sealing	No Duct Sealing	25%	2.2
	“Check Me” O&M Tune-Up	No Tune-Up	17%	1.3
Space Heat	Duct Insulation (R-8)	R-3	4%	1.3
	PTCS Duct Sealing	No Duct Sealing	14%	1.7
Envelope	Whole house air sealing		5%	0.6
	Insulated exterior entry doors	Non weather-stripped door	4%	0.3
	Insulation-Ceiling (R-38) Heat Pump	R-11	9%	0.9
	Insulation-Ceiling (R-38) Space Heat	R-11	9%	1.8
	Insulation-Floor (R-25) Heat Pump	R-0	11%	0.5
	Insulation-Floor (R-25) Space Heat	R-0	11%	1.0
	Insulation-Wall 2x4 (R-13)	R-0	10%	0.7
	Below Grade Insulation (R-11) Heat Pump	R-0	13%	0.6
	Below Grade Insulation (R-11) Space Heat	R-0	13%	1.2
	Insulation-Rim Joist (R-10)	R-0	2%	3.1
	ENERGY STAR Windows (Class 30)	Class 40	17%	0.5
	Spray-in Insulation R-26	R-13	30%	0.5

### ***Air-to-Air Heat Exchangers***

Advanced ventilation brings in fresh, outdoor air, but pre-heats the outside air with the warm exhaust air. Only for new construction.

## ***ENERGY STAR Home***

For manufactured or single-family homes, an ENERGY STAR rating exists to improve the overall efficiency of a home. Only for new construction.

### **Heat Pump Measures**

Measures specific to residences using a heat pump.

#### ***“Check Me” Duct Sealing***

Basically, by repairing and sealing leaky ducts, significant energy savings could be attained by ensuring the conditioned air is freely traveling to the occupied spaces. Only for existing homes.

#### ***“Check Me” O&M Tune-Up***

For heat pumps, doing a certified maintenance will improve overall efficiency. Only for existing homes.

### **Space Heat Measures**

Measures specific to residences using an electric furnace for their space heating needs.

#### ***Duct Insulation***

Adding insulation (to R-8) around the ducts in the heating system will reduce heat loss to unconditioned spaces. Only for existing homes.

#### ***PTCS Duct Sealing***

Basically, by repairing and sealing leaky ducts, significant energy savings could be attained by ensuring the conditioned air is freely traveling to the occupied spaces. Only for existing homes.

### **Building Envelope Measures**

“Building envelope” measures improve the thermal performance of the building’s walls, floor, ceiling or windows. The baseline technology and the energy-efficiency upgrades are discussed below. The building envelope energy-efficiency measures include insulation (ceiling/roof, wall, and floor) and windows. These measures result in saving for heat pump and space heat end uses. If they pass the economic screen under one end use but not the other, both TRCs are given.

## ***Whole House Air Sealing***

In existing buildings, air infiltration can account for 30% of a home's heating and cooling costs<sup>1</sup>. Windows, doors, attic, crawlspaces and outside walls contribute to air leakages. Sealing the air leaks improves overall heating and cooling losses. Only for existing homes.

## ***Insulation—Exterior Doors***

Insulated exterior entry doors with built-in weather-stripping to reduced air infiltration can decrease the heating and cooling costs. Only for existing homes.

## ***Ceiling/Roof Insulation***

This measure represents an increase in R-value. Adding insulation in existing buildings increase the thermal performance and bring the resistance value closer/up to code. R-38 represents current code in the ceiling or roof. Only for existing homes.

## ***Floor Insulation***

Similar to ceiling insulation, this measure represent an increase in R-value. Increasing the thermal performance brings the resistance value closer/up to code. Currently, R-25 represents code for typical residential homes. Only for existing homes.

## ***Wall Insulation***

The measure represent an increase in R-value thereby increasing the thermal performance of the building. In existing buildings, the type of construction dictates the level of increased R-value. Currently, R-13 represents code. Only for existing homes.

## ***Below Grade Insulation***

Adding insulation to the basement or crawlspace walls increases the thermal performance of the concrete foundation. For existing construction the increased insulation R-value is from 0 to 11. Only for existing homes.

## ***Rim Joist Insulation***

Adding insulation to the rim joists around the basement or crawlspace walls increases the thermal performance of the basement. For existing construction the increased insulation R-value is from 0 to 10. Only for existing homes.

## ***High-efficiency Windows***

The efficiency of windows is rated by its Class, where a lower class number indicates a higher efficiency window. Higher performance windows can be achieved by using double-pane glass

---

<sup>1</sup> Source: U.S. Department of Energy – Air Sealing Spec Sheet by the Office of Building Technology, State and Community Programs.

with low-emissivity (low-e) films, and/or argon gas filling the gap between the panes. For existing homes, the measure represents an increase in performance by improving the Class from 40 to Class 30. This measure only applies to existing construction due to changes in the 2007 building code.

### ***Spray-In Wall Insulation***

This measure represents an increase in R-value, thereby increasing the thermal performance of the building. Spray-in insulation can improve the R-value of 2x4 wall insulation from R-13 to R-26. Only for new construction

## **Water Heat**

In addition to a more efficient water heating system, any equipment measures that require less hot water are also included in the water heat measures below.

**Table A–3. Residential Electric Water Heat**

Category or End Use	Technology	Baseline	End Use Percent Savings	TRC Retrofit	TRC New
Water Heat	ENERGY STAR Dishwasher (EF=0.58)	Standard Dishwasher (EF=0.52)	2%	1.9	1.6
	ENERGY STAR Clothes Washer (MEF=1.8)	Standard Clothes Washer (MEF=1.0)	13%	0.9	0.7
	Heat Pump Water Heater EF = 2.9	EF = 0.88	40%	0.8	0.7
	Solar Water Heater	EF = 0.93	40%	0.3	0.3
	Low-Flow Showerheads (2.5 GPM)	5.0 GPM	3%	4.0	2.4
	Hot Water Pipe Insulation R-4	R-0	1%	3.9	3.9
	Faucet Aerators (2.5 GPM)	4.5 GPM	1%	4.8	2.4
	Drain Water Heat Recovery (GFX)	No Heat Recovery	25%		2.5

### ***ENERGY STAR Appliances***

Upgrading to an ENERGY STAR-rated appliance, such as dishwasher or clothes washer, will reduce overall water needs.

### ***Heat Pump Water Heater***

Heat pump water heaters are more efficient than standard electric water heaters. This measure assumes an energy factor (EF) for heat pump water heaters of 2.9, an increase from 0.93, common for electric residential water heaters.

**Solar Water Heater**

A solar water heater is generally mounted on the roof of a building and is designed to use the sun to heat water rather than electricity or gas. A solar water heater helps offset the electric or gas water heating costs. Note that this is a passive process, not one that involves photovoltaic cells.

**Low-Flow Showerheads**

Low-flow shower heads use the same principle as faucet aerators to achieve a flow reduction of nearly 50%, lowering the flow rate to 2.5 gpm from 5.0 gpm.

**Hot Water Pipe Insulation**

Adding R-4 insulation around the pipes will decrease heat loss.

**Faucet Aerators**

Faucet aerators, by mixing water and air, lower the water flow from 5.0 gpm to 2.75 gpm. The faucet aerator creates a fine water spray with a screen that is inserted in the faucet head.

**Drain Water Heat Recovery (GFX)**

This measure is a essentially a gray water heat recovery system that works on the premise of recovering heat from waste water. For example, as hot water passes down the drain from a shower, heat is exchanged with incoming cold water from the water main thereby pre-heating incoming cold water to the water heater tank. Only for new construction.

**Refrigeration**

**Table A-4. Residential Electric Refrigeration**

Category or End Use	Technology	Baseline	End Use Percent Savings	TRC
Refrigeration	Removal of Secondary Freezer	Base Secondary Freezer	100%	2.9

Removal of some appliances refers to a secondary appliance such as a garage refrigerator or freezer that is not considered a household necessity.

**Plug Load**

Plug-in loads that are purchased with an ENERGY STAR rating reduced the overall electric load of the household compared to standard equipment. This measure identifies the specific plug-in equipment. The following list includes both typical household entertainment equipment and home-office equipment. Office equipment such as computers, monitors, and printers can all be

ENERGY STAR-classified, indicating lower energy consumption than conventional equipment. This is, in part, achieved by allowing the machine to go into standby mode.

**Table A–5. Residential Electric Plug Load**

Category or End Use	Technology	Baseline	End Use Percent Savings	TRC
Plug Load	Efficient high definition televisions	Standard HDTV	3%	0.4
	Efficient DVD systems	Standard DVD System	0.2%	>100
	Digital Set Top Receivers	Standard Receiver	0.2%	>100
	Office Equipment: Printers, ENERGY STAR or Better	Standard Printer	1.0%	>100
	Office Equipment: Monitors, ENERGY STAR or Better	Standard Monitor	1.0%	>100
	Office Equipment: Computer, ENERGY STAR or Better	Standard Computer	0.4%	>100
	Powerstrip with Occupancy Sensor	No Occupancy Sensor	1%	0.8
	External power adapters	No External Power Adapter	0.7%	0.6

### ***ENERGY STAR Plug-In Equipment***

Efficient high-definition televisions  
 Efficient DVD systems  
 Digital set top receivers  
 Printers, monitors, and computers

### ***Power Strip with Occupancy Sensor***

Energy saving products such as power strips with an occupancy sensor are found in workstations where power strips are commonly used. The sensor will turn on and off the power to all devices such as computers, desk lights, and audio equipment that are plugged into power strip based on occupancy within the work area.

### ***External Power Adapters***

External power adapters, also known as power supplies or battery chargers, convert high voltage AC electricity from the wall outlet to the low-voltage DC power. Typical electronic products such as like MP3 players, digital cameras, laptops, and cordless and mobile phones use power adapters. This measure is ENERGY STAR compliant and on average, 35 percent more efficient than conventional models.

## Lost Opportunity—Equipment

In either existing or new construction, when new equipment needs to be purchased, savings can be gained by purchasing high-efficiency models.

**Table A–6. Residential Electric Lost Opportunity—Equipment**

Category or End Use	Technology	Baseline	End Use Percent Savings	TRC
HVAC	High Efficiency Heat Pump (13 SEER, 8.5 HSPF)	Standard Efficiency (13 SEER, 7.7 HSPF)	9%	1.2
	Premium Efficiency (13 SEER, 9.0 HSPF)	Standard Efficiency (13 SEER, 7.7 HSPF)	14%	0.3
	High Efficiency Central AC (14 SEER)	Standard Efficiency (13 SEER)	7%	0.1
	Premium Efficiency Central AC (16 SEER)	Standard Efficiency (13 SEER)	19%	0.05
	Advanced Efficiency Central AC (18 SEER)	Standard Efficiency (13 SEER)	28%	0.02
	ENERGY STAR Room AC (10.7 EER)	9.7 EER	9.4%	0.5
Appliances	ENERGY STAR Refrigerator	Standard Refrigerator	15%	1.3
	ENERGY STAR Freezer	Standard Freezer	10%	0.8

### ***High/Premium-Efficiency Air-Source Heat Pump***

A standard air-source heat pump has a SEER=13 and HSPF=7.7. A high-efficiency pump has SEER=13 and HSPF=8.5, and a premium-efficiency pump has SEER=13 and HSPF=9.0, with energy savings of 9% and 14%, respectively, over the standard. Note that this savings is only from the heating side.

### ***High/Premium/Advanced-Efficiency Central AC***

A standard central AC unit has a SEER=13. A high-efficiency unit has SEER=14, a premium-efficiency unit has SEER=16 and an advanced-efficiency unit has SEER=18, with energy savings of 7%, 19% and 28%, respectively, over the standard.

### ***ENERGY STAR Equipment***

Energy efficiency household equipment options are identified and have an ENERGY STAR rating for high efficiency compared to standard models.



ENERGY STAR Room AC (window) unit  
 ENERGY STAR Refrigerator  
 ENERGY STAR Freezer

## Residential Electric Emerging Technology

These ET measures are energy-efficiency measures that are not readily available in the current market, but are expected to be so within the 20-yr planning horizon. The different ET measures are in varying stages of “market readiness,” and the potential study included the ET measures only after they become market-ready.

### Lighting

**Table A–7. Residential Electric Emerging Technology—Lighting**

Category or End Use	Technology	Baseline	End Use Percent Savings	TRC
Lighting	LED Lighting, High Use	Incandescent 60W	54%	3.7
	LED Lighting, Medium Use	Incandescent 60W	11%	0.9
	LED Lighting, High Use	Incandescent 60W	8%	2.3

### ***LED Interior Lighting (White)***

Light emitting diodes (LEDs) are solid-state devices that convert electricity to light, potentially with very high efficiency and long life. Recently, lighting manufacturers have been able to produce "cool" white LED lighting indirectly, using ultraviolet LEDs to excite phosphors that emit a white-appearing light. Replacement for incandescent lamps. Introduced in year five.

### Plug Load

**Table A–8. Residential Electric Emerging Technology—Plug Load**

Category or End Use	Technology	Baseline	End-Use Percent Savings	TRC
Plug Load	One-Watt Standby Power	Four devices per home	10%	2.4
	Advanced Appliance Motor ECM	ENERGY STAR appliance	9%	0.4
Refrigeration	One kWh/day Refrigerator	Standard refrigerator	27%	1.8
	Solid State Refrigeration	ENERGY STAR Refrigerator	46%	0.6

**One-Watt Standby Power**

Standby power is the electricity used by electrical equipment when it is switched off, or not performing its main function. By minimizing this loss to 1 Watt or less can reduce this standby energy consumption by more than 50%. Introduced in year five.

**Advanced Appliance Motor ECM**

Applicable to ENERGY STAR appliances and dryers, electronically commutated motors (ECM) rely on electronics to provide precisely timed voltages to the coils, and use rotation position sensors for timing, resulting in greater efficiency than a standard motor. Applicable to any motor, particularly those used in dryers. Introduced in year five.

**One kWh/day Refrigerator**

Reducing the energy use of a refrigerator to less than 1 kWh/day will result in over 25% reduction in energy use from a baseline refrigerator. This measure is introduced in year 15.

**Solid State Refrigeration “Cool Chips™”**

Using thermoelectric devices to convert electricity for cooling (refrigeration) is only starting to become economical due to advances in efficiency levels. Introduced in year 15.

**Heating, Ventilation, and Air-Conditioning (HVAC)**

**Table A-9. Residential Electric Emerging Technology—HVAC**

Category or End Use	Technology	Baseline	End Use Percent Savings	TRC
Heat Pump	Advanced Cold-Climate Heat Pump (16 SEER, 9.6 HSPF)	11 EER, 8.1 HSPF	17%	0.1
	Microchannel Heat Exchangers	11EER, 8.1 HSPF	5%	1.7
	Small Scale Absorption Cooling	11EER, 8.1 HSPF	14%	0.2
	Solid State Refrigeration Cool Chips	11EER, 8.1 HSPF	22%	0.5
Heat Pump or Space Heat	Aerosol-Based Duct Sealing	No sealing	14%	1.6
	Leak Proof Duct Fittings	Standard Duct Workmanship	17%	5.5
	Green Roof	Standard Roofing	13%	0.02

### ***Advanced Cold-Climate Heat Pump***

Cold-climate heat pumps are air-to-air heat pumps that have been optimized for colder climates. The performance of these heat pumps is expected to be approximately the same as ground-source heat pumps (GSHP). Introduced in year five.

### ***Microchannel Heat Exchangers (Evaporator)***

A microchannel heat exchanger allows for a longer dwell time for the air passing over it, as compared to a standard fit-tube heat exchanger. This results in an increase in heat exchanger effectiveness. Introduced in year 10.

### ***Small Scale Absorption Cooling***

The absorption cycle is a process by which a refrigeration effect is produced through the use of two fluids and a quantity of heat input, rather than electrical input, as in the vapor compression cycle. For applications above 32 degrees F, lithium bromide is used as the absorbent and water as the refrigerant. For applications below 32 degrees F, ammonia is used as the refrigerant and water as the absorbent. Introduced in year 15.

### ***Solid State Refrigeration “Cool Chips™” for Heat Pumps***

Using thermoelectric devices to convert electricity to cooling is only starting to become economical due to advances in efficiency levels. Introduced in year 15.

### ***Aerosol-Based Duct Sealing***

A significant amount of energy use in residential buildings is associated with duct losses due to leakage. This is an aerosol duct-sealing technology that seals holes in ducts up to ¼” in diameter from the inside by spraying atomized latex aerosol into a pressurized duct system. “Check Me” for heat pumps and “PTCS” for electric furnaces. Introduced in year five.

### ***Green Roof***

A green roof is a living roof that supports soil and plant growth. A series of carefully engineered layers are applied to the roof deck. These layers are watertight, lightweight and long-lasting. Green roofs can be incorporated into new and existing buildings as long as load requirements are met. They are suited for roofs that have slopes ranging up to 20 degrees and are most successful when sufficient attention has been paid to selecting plants that will thrive in the local climate and conditions. One of the most significant advantages is that a green roof can last up to three times longer than a standard roof. The added benefit of a green roof's ability to buffer temperature extremes improves a building's energy performance by dropping the temperatures on the roof 3-7 degrees, resulting in approximately a 10% reduction in cooling loads. Introduced in year five.

### ***Leak-proof Duct Fittings***

The majority of duct leakage in residential HVAC systems is due to improperly sealed connections between ductwork and fittings. Even when duct connections are initially well-

sealed, leakage may increase over time. Although the use of mastics and mechanical fasteners is becoming more widespread, a low-cost, leak-proof system will help to transform the market. Introduced in year five.

## Residential Gas Measure Descriptions

Percent savings and TRC are averaged over all applicable building types and the TRC is given for the base-case scenario averaged for both discretionary measures and lost opportunity-equipment measures, unless they differ significantly in which case both TRCs are given.

### Heating, Ventilation, and Air-Conditioning (HVAC)

Measures associated with the HVAC system improve the overall heating and cooling loads on the building. Discretionary measures can impact all types of cooling or heating equipment. For residential buildings, only savings to the heating loads were considered.

**Table A–10. Residential Gas HVAC**

Category or End Use	Technology	Baseline	Percent End-Use Savings	TRC
Space Heat	Duct Insulation (R-8)	R-3	4%	0.8
	Duct Sealing	No Sealing	14%	1.1
	Exterior Door Insulation	Existing Door	4%	0.3
	Integrated Space & Water Heating	Standard Efficiency Furnace	13%	0.7
	Air-to-Air Heat Exchangers	No heat exchanger	10%	0.2
	ENERGY STAR Home (Single Family)		38%	0.7
	ENERGY STAR Home (Manufactured)		34%	1.5
Building Envelope	Whole House Air Sealing		6%	0.5
	Insulation - Roof / Ceiling (R-38)	R-11	9%	1.1
	Insulation – Floor (R-25)	R-0	11%	0.6
	Insulation – Wall (R-13)	R-0	10%	0.7
	Insulation – Rim Joist (R-10)	R-0	2%	0.3
	Below Grade Insulation (R-10)	R-0	13%	0.9

	Windows-High Efficiency (U=0.35)	Class 40	23%	0.7
	Spray-In Insulation (R-38)	R-19	30%	1.1

### ***Duct Insulation***

Insulating the ducts through which heated air travels will reduce energy loss in the unoccupied plenum space. The baseline value for this insulation is R-3, while the measure increases the insulation to R-8. Only for existing homes.

### ***PTSC Duct Sealing***

Basically, by repairing and sealing leaky ducts, significant energy savings could be attained by ensuring the conditioned air is freely traveling to the occupied spaces. Only for existing homes.

### ***Insulation—Exterior Doors***

Insulated exterior entry doors with built-in weather-stripping to reduced air infiltration can decrease the heating and cooling costs. Only for existing homes.

### ***Integrated Space and Water Heating***

This involves using a condensing furnace with a AFUE=90, compared to a standard efficiency AFUE=78. The condensed warm water from the space heating is used for water heat.

### ***Air-to-Air Heat Exchangers***

Advanced ventilation brings in fresh, outdoor air, but pre-heats the outside air with the warm exhaust air reducing the heating load otherwise required with incoming cold outside air. Only for new construction.

### ***ENERGY STAR Home***

For manufactured or single-family homes, an ENERGY STAR rating exists to improve the overall efficiency of a home. Only for new construction.

### **Building Envelope Measures**

“Building envelope” measures improve the thermal performance of the building’s walls, floor, ceiling or windows. The baseline technology and the energy efficiency upgrades are discussed below. The building envelope energy efficiency measures include insulation (ceiling/roof, wall, and floor) and windows.

## ***Whole House Air Sealing***

In existing buildings, air infiltration can account for 30% of a home's heating and cooling costs<sup>2</sup>. Windows, doors, attic, crawlspaces and outside walls contribute to air leakages. Sealing the air leaks improves overall heating and cooling losses. Only for existing homes.

## ***Ceiling/Roof Insulation***

This measure represents an increase in R-value. Adding insulation in existing buildings increase the thermal performance and bring the resistance value closer/up to code. R-38 represents current code in the ceiling or roof. Only for existing homes.

## ***Floor Insulation***

Similar to ceiling insulation, this measure represent an increase in R-value. Increasing the thermal performance brings the resistance value closer/up to code. Currently, R-25 represents code for typical residential homes. Only for existing homes.

## ***Wall Insulation***

The measure represent an increase in R-value thereby increasing the thermal performance of the building. In existing buildings, the type of construction dictates the level of increased R-value. Currently, R-13 represents code. Only for existing homes.

## ***Rim Joist Insulation***

Adding insulation to the rim joists around the basement or crawlspace walls increases the thermal performance of the basement. For existing construction the increased insulation R-value is from 0 to 10. Only for existing homes.

## ***Below Grade Insulation***

Adding insulation to the basement or crawlspace walls increases the thermal performance of the concrete foundation. For existing construction the increased insulation R-value is from 0 to 11. Only for existing homes.

## ***High-efficiency Windows***

The efficiency of windows is rated by its Class, where a lower class number indicates a higher efficiency window. Higher performance windows can be achieved by using double-pane glass with low-emissivity (low-e) films, and/or argon gas filling the gap between the panes. For existing homes, the measure represents an increase in performance by improving the Class from 40 to Class 30. This measure only applies to existing construction due to changes in the 2007 building code.

---

<sup>2</sup> Source: U.S. Department of Energy – Air Sealing Spec Sheet by the Office of Building Technology, State and Community Programs.

## ***Spray-In Wall Insulation***

This measure represents an increase in R-value, thereby increasing the thermal performance of the building. Spray-in insulation can improve the R-value of 2x4 wall insulation from R-19 to R-38. Only for new construction.

## **Water Heat**

In addition to a more efficient water heating system, any equipment measures that require less hot water are also included in the water heat measures below.

**Table A–11. Residential Gas Water Heat**

Category or End Use	Technology	Baseline	End Use Percent Savings	TRC
Water Heat	Solar Water Heater	EF = 0.93	40%	0.2
	Low-Flow Showerheads (1.8 GPM)	2.5 GPM	3%	2.3
	Hot Water Pipe Insulation R-4	R-0	1%	1.9
	Faucet Aerators (1.8 GPM)	2.5 GPM	1%	3.1
	Tankless Water Heater (EF=0.82)	Storage Water Heater (EF=0.59)	20%	1.3
	Integrated Space and Water Heater	Standard Water Heater	5%	0.2
	ENERGY STAR Clothes Washer (MEF=1.8)	Standard Clothes Washer (MEF=1.0)	13%	0.6
	ENERGY STAR Dishwasher (EF=0.58)	Standard Dishwasher (EF=0.52)	4%	2.2
	Drain Water Heat Recovery (GFX)	No heat recovery	25%	2.5

### ***Solar Water Heater***

A solar water heater is generally mounted on the roof of a building and is designed to use the sun to heat water rather than electricity or gas. A solar water heater helps offset the electric or gas water heating costs. Note that this is a passive process, not one that involves photovoltaic cells.

### ***Low-Flow Showerheads***

Low-flow shower heads use the same principle as faucet aerators to achieve a flow reduction of nearly 50%, lowering the flow rate to 2.5 gpm from 5.0 gpm.

### ***Hot Water Pipe Insulation***

Adding R-4 insulation around the pipes will decrease heat loss. Only for existing construction.

## **Faucet Aerators**

Faucet aerators, by mixing water and air, lower the water flow from 5.0 gpm to 2.75 gpm. The faucet aerator creates a fine water spray with a screen that is inserted in the faucet head.

## **Tankless Water Heater**

If hot water usage is only sporadic, savings can be obtained by using an on-demand, or tankless hot water system. In this system, there is no water storage tank thereby reducing standby losses; rather, a high intensity heating element heats the flowing water when needed.

## **Integrated Space and Water Heating**

This involves using a condensing furnace with high efficiency storage water heater. The condensed warm water from the space heating is used for water heat.

## **ENERGY STAR Appliance Measures**

Two energy efficiency household appliance options are identified (clothes washer and dishwasher) and have an ENERGY STAR rating for high efficiency compared to standard models. Clothes washers reduce hot water use, which translates to energy savings. High-efficiency dishwashers improve the wash and dry cycles compared to standard models with a 20% increase in energy factor.

## **Drain Water Heat Recovery (GFX)**

This measure is essentially a gray water heat recovery system that works on the premise of recovering heat from waste water. For example, as hot water passes down the drain from a shower, heat is exchanged with incoming cold water from the water main thereby pre-heating incoming cold water to the water heater tank.

## **Lost Opportunity—Equipment**

In either existing or new construction, when new equipment needs to be purchased, savings can be gained by purchasing high-efficiency models.

**Table A-12. Residential Gas Lost Opportunity—Equipment**

Category or End Use	Technology	Baseline	End Use Percent Savings	TRC
	High Water Heater (EF=0.64)	EF = 0.59	8%	2.3
Water Heat	High Efficiency Furnace (AFUE=80)	AFUE=78	3%	2.5
	Premium Efficiency Furnace (AFUE=90)	AFUE=78	13%	0.7
	Advanced Efficiency Furnace (AFUE=96)	AFUE=78	19%	0.2



	ENERGY STAR Dishwasher (EF=0.58)	Standard Dishwasher (EF=0.46)	4%	2.6
	ENERGY STAR Clothes Washer (MEF=1.8)	Standard Clothes Washer (MEF=1.0)	13%	0.6

### **High-Efficiency Storage Water Heater**

A standard water heater has an energy factor (EF) of 0.59, while a high-efficiency water heater gas EF=0.64, resulting in an 8% energy savings.

### **High/Premium/Advanced-Efficiency Furnace**

A standard central furnace has an AFUE=78. A high-efficiency unit has AFUE=80, a premium-efficiency unit has AFUE=90 and an advanced-efficiency unit has AFUE=96, with energy savings of 3%, 13% and 19%, respectively, over the standard.

### **ENERGY STAR Equipment**

Energy efficiency household equipment options are identified and have an ENERGY STAR rating for high efficiency compared to standard models.

- ENERGY STAR Clothes Washer
- ENERGY STAR Dishwasher

## **Residential Gas Emerging Technology**

These ET measures are energy-efficiency measures that are not readily available in the current market, but are expected to be so within the 20-yr planning horizon. The different ET measures are in varying stages of “market readiness,” and the potential study included the ET measures only after they become market ready. All residential ET gas measures apply to the HVAC system.

**Table A–13. Residential Gas Emerging Technology**

Category or End Use	Technology	Baseline	End Use Percent Savings	TRC
Space Heat	Aerosol-Based Duct Sealing	No sealing	19%	2.5
	Green Roof	Standard Roofing	13%	0.03
	Leak Proof Duct Fittings	Standard Duct Workmanship	17%	6.8

### **Aerosol-Based Duct Sealing**

A significant amount of energy use in residential buildings is associated with duct losses due to leakage. This is an aerosol duct-sealing technology that seals holes in ducts up to ¼” in diameter

from the inside by spraying atomized latex aerosol into a pressurized duct system. Introduced in year five.

### ***Green Roof***

A green roof is a living roof that supports soil and plant growth. A series of carefully engineered layers are applied to the roof deck. These layers are watertight, lightweight and long-lasting. Green roofs can be incorporated into new and existing buildings as long as load requirements are met. They are suited for roofs that have slopes ranging up to 20 degrees and are most successful when sufficient attention has been paid to selecting plants that will thrive in the local climate and conditions. One of the most significant advantages is that a green roof can last up to three times longer than a standard roof. The added benefit of a green roof's ability to buffer temperature extremes improves a building's energy performance by dropping the temperatures on the roof 3-7 degrees, resulting in approximately a 10% reduction in cooling loads. Introduced in year five.

### ***Leak-proof Duct Fittings***

The majority of duct leakage in residential HVAC systems is due to improperly sealed connections between ductwork and fittings. Even when duct connections are initially well-sealed, leakage may increase over time. Although the use of mastics and mechanical fasteners is becoming more widespread, a low cost, leak-proof system will help to transform the market. Introduced in year five.

## **Commercial Electric Measure Descriptions**

This section provides an overview of the selected energy-efficiency measure within the commercial sector. The measures are categorized by end use. Discretionary (existing buildings) and Lost Opportunity- New Construction have many of the same measures within each end use and are thus grouped together. If significant differences in the TRC exist between the two applications, both TRCs will be given; otherwise, only an average TRC is given. Lost Opportunity—Equipment category includes additional measures and are given separately.. In addition, a description of emerging technologies is included at the end. A brief description of the current baseline technology and the energy measure is discussed. Percent savings and TRC are averaged over all applicable building types.

### **Lighting**

Incandescent lighting is a highly inefficient light source; as such, significant savings can be gained by switching to light-emitting diodes (LEDs) or fluorescent lighting. In addition, lighting technologies have improved and so upgrades will save energy. Finally, electricity can be saved by simply not using the lights as much.

**Table A–14. Commercial Electric Lighting**

Category or End Use	Technology	Baseline	End Use Percent Savings	TRC Existing	TRC New
Lighting	LED Exit Signs (5W)	CFL Exit Sign (16W)	1%	2.2	6.7
	LED Refrigeration Case Lights (10W)	Fluorescent Case Lights (34W)	12%	67.0	63.0
	Induction Lighting (55W)	Metal Halide (150W)	1%	0.5	0.5
	Bi-Level Control, Stairwell Lighting	Continuous Full Power Lighting in Stairways	2%	1.0	1.0
	Occupancy Sensor Control, Fluorescent	No Occupancy Sensor	5%	0.5	0.4
	Stepped Dimming Fluorescent Fixtures	No Dimming Controls	8%	1.0	1.9
	Continuous Dimming, Fluorescent Fixtures	No Dimming Controls	11%	2.2	4.1
	Integrated Lighting, Classrooms	1.2 W/sq. ft.	25%	0.5	0.5
	Reduce Interior Lighting Power Density Low Reduction (W/sq. ft.)		15%	2.6	5.4
	Reduce Interior Lighting Power Density High Reduction (W/sq. ft.)		27%	2.5	5.3

**LED**

Light-emitting diodes (LEDs) are highly efficient bulbs that can be used for refrigeration case lights and exit signs, a 70% energy savings over a fluorescent bulb. Currently, LEDs are not cost-effective to be used in general lighting applications.

**Induction Lighting**

A 100W incandescent lamp can be replaced by a 55 W induction lamp, a 45% energy savings per bulb. An induction lamp has an induction coil at its center powered by an electronic unit that produces a magnetic field that energizes a mercury electron-ion plasma material in the glass assembly surrounding the coil.

**Bi-Level Control, Stairwell Lighting**

Rather than having stairwell lighting continuously operating at full power, a bi-level control will use an occupancy sensor such that the lighting power is 50% during unoccupied times.

## Occupancy Sensors

If a space is unoccupied for a designated amount of time, an occupancy sensor will turn off the lights. The lights will turn on again once the sensor detects a person has entered the space.

## Stepped/Continuously Dimming

Rather than a light operating at full power, a dimming switch will allow light levels to vary from 0-100% brightness. A stepped dimming switch has several discrete levels of brightness, while a continuously dimming switch will allow variation throughout the range.

## Integrated Lighting, Classrooms

Integrated lighting includes daylighting control, super T8 lights, and dimming controls.

## Reduced Interior Lighting Power Density

A generic way to indicate improved efficiency lighting, whether it be by replacing an incandescent bulb with a fluorescent bulb, or a fluorescent bulb with a metal halide bulb, etc. A low reduction is of 15% in power density and between 25-40% for a high reduction .

## Heating, Ventilation, and Air-Conditioning (HVAC)

Measures associated with the HVAC system improve the overall heating and cooling loads on the building. Discretionary measures can impact all types of cooling or heating equipment or be specific to a particular type of equipment.

**Table A–15. Commercial Electric HVAC**

Category or End Use	Technology	Baseline	Percent End-Use Savings	TRC Existing	TRC New
Cooling Chillers	Cooling Tower-Decrease Approach Temperature 6°F Δ T	10°F ΔT	8%	3.6	
	Direct Digital Control System-Installation	Pneumatic	10%	1.9	0.1
	Direct Digital Control System-Optimization	No Optimization	1%	0.1	
	Chilled Water / Condenser Water Settings-Optimization	EMS already installed - No Optimization	5%	1.3	1.4
	Chilled Water Piping Loop w/ VSD Control	3-way valves, with constant speed pump	12%	1.1	1.2
	Chiller-Water Side Economizer	No Economizer	10%	0.7	
	Cooling Tower-Two-Speed Fan Motor	Cooling Tower-One-Speed Fan Motor	14%	17.0	17.0
	Cooling Tower-VSD Fan Control	Cooling Tower-One-Speed Fan Motor	4%	2.6	2.7
	Pipe Insulation R-4	R-0	1%	6.5	6.6
	Retro-Commissioning		15%	0.5	0.2
	Automated Ventilation VFD Control (Occupancy Sensors / CO2 Sensors)	Constant Ventilation	5%	0.4	0.6

Category or End Use	Technology	Baseline	Percent End-Use Savings	TRC Existing	TRC New
	Convert Constant Volume Air System to Variable Volume	Constant Volume Air System	12%	1.8	
	Chiller-Tune-Up / Diagnostics	No Tune-Up	10%	1.0	
Cooling DX	DX Package-Air Side Economizer	No Economizer	15%	4.5	
	Direct / Indirect Evaporative Cooling, Pre-Cooling		10%	0.6	0.7
	Terminal HVAC units-Occupancy Sensor Control	No Occupancy Sensor	35%	3.8	3.8
	Programmable Thermostat	No Programmable Thermostat	10%	11.0	
	Retro-Commissioning		15%	1.1	0.3
	Automated Ventilation VFD Control (Occupancy Sensors / CO2 Sensors)	Constant Ventilation	5%	1.8	1.2
	DX Tune-Up / Diagnostics	No Tune-Up	10%	0.8	
	Convert Constant Volume Air System to Variable Volume	Constant Volume Air System	12%	3.9	
Cooling Heat Pump	Direct / Indirect Evaporative Cooling, Pre-Cooling		10%	0.6	0.7
	Programmable Thermostat	No Programmable Thermostat	10%	11.0	
	Retro-Commissioning		15%	1.1	0.3
	Automated Ventilation VFD Control (Occupancy Sensors / CO2 Sensors)	Constant Ventilation	5%	1.0	1.2
Space Heat	Exhaust Air to Ventilation Air Heat Recovery	No Heat Recovery	20%	1.5	1.3
	Programmable Thermostat	No Programmable Thermostat	20%	6.7	
	Terminal HVAC units-Occupancy Sensor Control	No Occupancy Sensor	35%	16.0	16.0
	Retro-Commissioning		15%	0.9	0.2
	Automated Ventilation VFD Control (Occupancy Sensors / CO2 Sensors)	Constant Ventilation	10%	2.1	2.1
	Convert Constant Volume Air System to Variable Volume	Constant Volume Air System	12%	3.7	
HVAC	Duct Insulation (R-8)	R-3	3%	29.0	
	Duct Repair and Sealing (50% Reduction in Duct Lose)		1%	8.3	
Envelope	Windows-High Efficiency U = 0.35	U = 0.67	6%	2.8	9.0
	Insulation - Roof / Ceiling (R-19)	R-0	5%	0.8	
	Insulation - Floor (R-19)	R-0	3%	0.5	
HAVC Aux	Optimized Variable Volume Lab Hood Design		3%		4.5

## **Chiller-specific Measures**

The two primary components of a chiller are the chiller itself (screw, centrifugal, or reciprocating) and the cooling tower. Chiller-specific measures can apply to the system itself, or to any of the sub-components.

### ***Cooling Tower—Decrease Approach Temperature***

The approach temperature is the difference between the tower water leaving and the wet-bulb temperatures. As a result, the cooling tower will be oversized but the chiller can be smaller. On an total energy usage basis, over-sizing a cooling tower requires less energy than a larger chiller. Only for existing construction.

### ***Direct Digital Control System—Installation***

Adding a direct digital control system allows for electronic remote control of all the building zones independently. The baseline equipment would have a pneumatic control. Only for existing construction.

### ***Direct Digital Control System—Optimization***

The optimization of the control system is upgrading a high-efficiency energy management system to a premium efficiency system.

### ***Chilled Water/Condenser Water Settings—Optimization***

As part of the entire direct digital control system, this measure optimizes the control of the chilled water temperature and/or flow settings.

### ***Chilled Water Piping Loop with VSD Control***

A VSD, or variable-speed drive, replaces a constant speed pump with 3-way valves. Varying the speed of the drive allows the pump to run at its optimal load; thus, minimizing its energy requirements.

### ***Water-Side Economizer***

This measure reflects the addition of a water-side economizer that consists of a coil attached to a condenser-water loop. The coil operates whenever a cooling load exists, and the outdoor conditions can produce condenser water colder than the mixed-air temperature. A water-side economizer is used if an outdoor-air economizer is not practical. Only for existing buildings.

### ***Cooling Tower-Two-Speed Fan Motor***

Using a fan that can operate at two speeds, rather than one, allows for better optimization of the fan. A one-speed fan will cycle on and off to maintain tower set point, while a two speed fan will

cycle between off, low speed and high speed to maintain the set point. Adding in the low-speed option uses less energy than a single, high speed fan.

### ***Cooling Tower-VSD Fan Control***

One step more sophisticated than the two-speed fan motor is the variable speed drive (VSD). A VSD drive is able to modulate the air flow so that the heat rejection exactly matches the load at the desired setpoint.

### ***Pipe Insulation***

The chilled water is carried through pipes between the cooling tower and chillers. Insulating these pipes minimizes heat loss.

### **DX Package/Cooling Heat Pump-specific Measures**

A DX system, or direct-expansion air conditioning system is what is generally referred to as a “Central AC” unit. These measures may also apply to the cooling side of a heat pump.

### ***Air-Side Economizer***

An air-side economizer varies the proportion of outside air to return air to maintain the mixed air temperature set point.

### ***Direct/Indirect Evaporative Cooling, Pre-Cooling***

Including an evaporative cooler before the DX system will reduce the overall cooling load. A direct evaporative cooler is a low-energy system that evaporates water into the air stream, thus reducing the temperature of the air, but increasing the humidity. An indirect evaporative cooler uses a secondary air stream that is cooled by water and goes through a heat exchanger with the primary air stream, cooling it but not affecting the humidity. A direct/indirect system will cool the air stream first through an indirect cooler, then cool it further through a direct cooler.

### ***Terminal HVAC Units—Occupancy Control***

Including an occupancy sensor will ensure that the HVAC system only operated when the room is occupied. This measure is specific to hotel/motel buildings.

### ***Programmable Thermostat***

A programmable thermostat simply controls the set point temperatures automatically. This allows for lower energy use by ensuring the HVAC system is not running during low-occupancy hours.

### **Space Heat Measures**

Measures applicable to any electric space heating system.

## ***Exhaust Air to Ventilation Air Heat Recovery***

The air that is exhausted out of a building during the heating season will be warmer than the air outside. Capturing some of this heat and transferring it to the incoming air lowers the overall heating load.

### **All HVAC Measures**

#### ***Retro-Commissioning***

“Retro-commissioning” is the process of optimizing the operation of an existing building through simple, low- or no-cost repairs and operational changes. For example, temperature controls will be set to operate only during occupied periods, ensuring that the ideal static pressure is being met for the fans.

#### ***Automatic Ventilation VFD Control***

This measure allows the ventilation to only run only when CO<sub>2</sub> levels are above a specified level. Without it, the ventilation system would run constantly.

#### ***Tune-Up/Diagnostics***

Simply put, this measure increases the overall efficiency of the HVAC equipment by doing any required maintenance or tune-up. The baseline building will have no tune-up performed. This measure has specific savings depending on what type of equipment is installed. Only for existing construction.

#### ***Convert Constant Volume Air System to Variable Volume***

Similar to using VSD control, converting to a variable volume system will allow for the drives to operate at an optimal load level and thus, minimize energy consumption. The baseline building only runs at a single volume flow. Only for existing construction.

#### ***Duct Insulation***

Packaged DX and heat-pump equipment is generally coupled with a ducting system inside the building. Insulating the ducts will reduce energy loss in the unoccupied plenum space. The baseline value for this insulation is R-3, while the measure increases the insulation to R-8. Only for existing construction.

#### ***Duct Repair and Sealing***

Similar to duct insulation, this measure is applicable to building using packaged DX equipment or heat pumps. Basically, by repairing and sealing leaky ducts, significant energy savings could be attained by ensuring the conditioned air is traveling to the occupied spaces. Only for existing construction.

### **HVAC Aux. Measures**



Measures specific to the HVAC ventilation or exhaust system.

### ***Optimized Variable Volume Lab Hood Design***

For buildings such as universities, schools, and hospitals that use lab hoods, a small savings can be obtained by using a variable, rather than constant, volume lab hood. By allowing the volumetric flow rate to vary will allow a constant speed through the duct, regardless of sash opening.

### **Building Envelope Measures**

“Building envelope” measures improve the thermal performance of the building’s floor and ceiling insulation and window efficiency. Insulation improvements are simply an increase in the “R-value” of the building envelope. The greater the R-value, the better the thermal performance. The baseline value for existing construction is assumed to be R-0, ensuring that the maximum savings are reflected. The efficiency of windows is rated by its “U-value,” which is effectively 1/R-value. In other words, the smaller the U-value, the better the thermal performance. A U-value=1 indicates a single-pane, ¼”, clear glass window. Higher performance windows can be achieved by using double-pane glass with low-emissivity (low-e) films, and/or argon gas filling the gap between the panes.

### ***Windows—High-efficiency***

This measure represents an increase in performance by changing the U-value from 0.67 to 0.35.

### ***Ceiling/Roof Insulation***

This measure represents an increase in R-value to current code values of R-19 in the roof or ceiling, for single-story buildings. Note that this measure is only cost-effective for the space heat end use (TRC=1.8). Only for existing construction.

### ***Floor Insulation***

Similar to ceiling/roof insulation, the measure represents an increase in R-value to current code levels of R-19 for the floor space. Only for existing construction.

## **Water Heat**

In addition to a more efficient water heating system, any equipment measures that require less hot water fall under the auspices of water heat measures.

**Table A–16. Commercial Electric Water Heat**

Category or End Use	Technology	Baseline	Percent End-Use Savings	TRC
Water Heat	Faucet Aerators (1.6 GPM)	4.0 GPM	2%	4.4
	Low-Flow Spray Heads (1.6 GPM)	3.0 GPM	2%	3.5

Low-Flow Showerheads (2.5 GPM)	5.0 GPM	2%	1.8
Chemical Dishwashing System	High Temp Commercial Dishwasher	4%	1.9
Water Cooled Refrigeration with Heat Recovery	No Heat Recovery	3%	0.9
Commercial High Efficiency Clothes Washers	Commercial Standard Clothes Washer	23%	0.7
Water Heater Temperature Setback (115 F)	140 F	15%	43.0
Demand controlled Circulating Systems		5%	0.1
Solar Water Heater	Standard Water Heater EF = 0.93	40%	0.5
Hot Water Pipe Insulation (R-4)	No Insulation	5%	7.5

### ***Faucet Aerators***

Faucet aerators, by mixing water and air, lower the water flow from 4.5 gpm to 2.75 gpm. The faucet aerator creates a fine water spray with a screen that is inserted in the faucet head.

### ***Low-Flow Spray Heads***

Low-flow spray heads used the same principle as faucet aerators to achieve a flow reduction of nearly 50%, lowering the flow rate to 1.6 GPM from 3.0 GPM.

### ***Low-Flow Showerheads***

Low-flow shower heads use the same principle as faucet aerators to achieve a flow reduction of 50%, lowering the flow rate to 2.5 gpm from 5.0 gpm.

### ***Chemical Dishwashing System***

Instead of sanitizing the dishes with hot water, chemicals are used instead. This allows for a lower hot water temperature setting with the same cleaning result.

### ***Water-Cooled Refrigeration with Heat Recovery***

The heat that is extracted from a refrigeration unit can be recaptured for hot water requirements rather than dumped into the ambient.

### ***Commercial High-Efficiency Clothes Washers***

ENERGY STAR<sup>®</sup> clothes washers for commercial use.

### ***Water Heater Temperature Setback***

Often, the setpoint temperature on a hot water system is set higher than generally required. This measure reflects the savings obtained by reducing the setpoint temperature from 140°F to 115°F. Only for existing construction.

## ***Demand-Controlled Circulating Systems***

In order to ensure hot water demands are met, some buildings will have continuously circulating hot water systems resulting in energy loss through pipes. To reduce this loss, a demand-controlled circulating system can be installed to only circulate hot water when required.

## ***Solar Water Heater***

A solar water heater is generally mounted on the roof of a building and is designed to use the sun to heat water rather than electricity or gas. Note that this is a passive process, not one that involves photovoltaic cells.

## ***Hot Water Pipe Insulation***

Adding R-4 insulation around the pipes will decrease heat loss. Only for existing construction.

## **Refrigeration**

Measures that improve refrigeration and/or freezer energy requirements are listed here.

**Table A–17. Commercial Electric Refrigeration**

Category or End Use	Technology	Baseline	Percent End-Use Savings	TRC
Refrigeration	Installation of Floating Condenser Head Pressure Controls	No Floating Condenser Head Pressure Controls	7%	11.0
	Anti-Sweat (Humidistat) Controls	No Anti-Sweat Controls	5%	39.0
	Refrigeration Compressor VSD retrofit	Constant Speed Drive	6%	2.4
	High Efficiency Case Fans	Standard Efficiency Case Fans	2%	0.3
	Night Covers for Display Cases	No Night Covers	6%	66.0
	Strip Curtains for Walk-Ins	No Strip Curtains	4%	6.0
	Reduced Speed or Cycling of Evaporator Fans		1%	0.5

### ***Installation of Floating Condenser Head Pressure Controls***

This technology allows more heat to be rejected through the condenser at low outside air temperatures, thereby increasing the compressor efficiency.

### ***Anti-Sweat (Humidistat) Controls***

An humidistat control allows the user to turn off refrigeration display case anti-sweat heaters off when ambient relative humidity is low enough that sweating will not occur. The baseline scenario without the control generally run these heaters continuously.

## **Refrigeration Compressor VSD Retrofit**

A variable speed compressor modulates the motor speed in response to changes in load. When low-load conditions exist, the current to the compressor motor is decreased, decreasing the compressor work done on the refrigerant.

## **High-efficiency Case Fans**

The fans used for circulating cool air in a refrigerated space can be upgraded to a higher efficiency.

## **Door/Cover Upgrade**

There are two measures to reduce heat loss from a refrigerator or freezer unit by improving the barrier between the cold space and ambient air. These measures include night covers for display cases and strip curtains for walk-ins.

## **Reduced Speed or Cycling of Evaporator Fans**

By allowing the evaporator fans to run less frequently or at a lower speed, the evaporator is run to fit the system need, rather than having the fans run continuously at high speed. Only for new construction.

## **Plug Load**

Mostly applicable to office space, plug loads include any devices that do not have a secondary energy conversion use, like refrigeration or heating.

**Table A–18. Commercial Electric Plug Load**

Category or End Use	Technology	Baseline	Percent End-Use Savings	TRC
Plug Load	Office Computer Network Energy Management	Computers Left On	7%	8.6
	Office Equipment: Monitors, ENERGY STAR or Better	Standard Monitor	2%	0.2
	Office Equipment: Copiers, ENERGY STAR or Better	Standard Copier	1%	0.1
	Office Equipment: Printers, ENERGY STAR or Better	Standard Printer	1%	0.1
	Vending Machines- Controls	No Controls	1%	0.1
	Vending Machines- High Efficiency	Standard Vending Machine	2%	0.5

## Lost Opportunity—Equipment

In either existing or new construction, when new equipment needs to be purchased, savings can be gained by purchasing high-efficiency models.

**Table A–19. Commercial Electric Lost Opportunity—Equipment**

Category or End Use	Technology	Baseline	End Use Percent Savings	TRC
Cooling Chiller	High Efficiency (0.507 kW/ton)	Standard Efficiency (0.634 kW/ton)	20%	4.4
	Premium Efficiency (0.475 kW/ton)	Standard Efficiency (0.634 kW/ton)	25%	0.3
Cooling DX	High Efficiency (EER=11.3)	Standard Efficiency (EER=10.3)	9%	1.1
	Premium Efficiency (EER=12.2)	Standard Efficiency (EER=10.3)	16%	0.5

### ***High/Premium-Efficiency Centrifugal Chiller***

The efficiency of a standard chiller is around 0.634 kW/ton, but high-efficiency chillers with a rated efficiency of 0.507 kW/ton or premium-efficiency with 0.475 kw/ton efficiency are available, resulting in a 20% or 25% energy savings, respectively.

### ***High/Premium-Efficiency DX Package***

Increasing the Energy Efficiency Ratio (EER) of DX package chillers from 10.3 to 11.3 or 12.2 will save 9% and 16%, respectively, of the energy use.

## **Commercial Electric Emerging Technologies**

These ET measures are energy-efficiency measures that are not readily available in the current market, but are expected to be so within the 20-yr planning horizon. The different ET measures are in varying stages of “market readiness,” and the potential study included the ET measures only after they become market ready.

## Lighting

**Table A–20. Commercial Electric Emerging Technologies—Lighting**

Category or End Use	Technology	Baseline	End Use Percent Savings	TRC
Lighting	Advanced High Intensity Discharge (HID) Light Sources	400 Watt HID Probe-start Metal Halide Lamp	12%	4.2
	Advanced/Integrated Daylighting controls (ADCs) (10W)	General purpose (2) T8 w/ electronic ballast	8%	0.2
	Cost-Effective Load Shed Ballast and Controller	T8 lamps w/ load shed ballast dimmed at 30%, 100	1%	0.04
	Hospitality Bathroom Lighting	Standard bathroom light used as nightlight	2%	0.4
	Hybrid Solar Lighting	12 60W Fluorescent fixtures w 2 T8 lamps each	52%	0.4
	LED Solid State White Lighting	Incandescent (75 W)	6%	0.1
	Low Wattage Ceramic Metal Halide Lamps	100W Halogen-IR PAR lamps, 11 hrs/day, 4015 hrs/y	17%	0.7
	Scotopic (High CCT) Lighting	(2) 32W T8 Lamps w/ 3500K CCT, electronic ballast	17%	2.0

### ***Advanced HID Light***

Conventional high intensity discharge (HID) lamps use an electrical arc column across tungsten electrodes to produce light. Typically, the arc column uses 90% of the electric power, with the remaining 10% dissipated as electrode losses. Advanced HID lamps would shift some energy (infrared) from the arc to near UV or visible emission, improving efficiency. The goal is to raise lumens to 40% above current rate. Introduced in year 15.

### ***Advanced/Integrated Daylighting Controls (ADCs)***

In most office spaces, lighting has traditionally been designed to provide an equal amount of light for all occupant spaces; however, lighting may not be needed equally in all spaces. Part-time occupancy and natural daylight may eliminate lighting needs, and individual workers needs and expectations vary. Advanced lighting controls allow more flexibility in maintaining light levels for individual spaces. Introduced in year five.

### ***Cost-effective Load Shed Ballast and Controller***

This technology is an instant-start ballast that would receive a signal from a controller to dim lighting fixtures during peak demand periods. The controller would communicate with an outside source, such as a utility company or energy management system, and then send a signal to the ballast to dim lights. Introduced in year 15.

### ***Hospitality Bathroom Lighting***

One of the largest energy end-uses in hotels is bathroom lighting, largely due to guests leaving the bathroom light on as a night light. This new technology uses high intensity LEDs and motion sensors to efficiently provide a night light for hotel guests. The nightlight is an integrated unit that fits into a standard wall switch. Introduced in year five.

### ***Hybrid Solar Lighting***

Hybrid solar lighting combines roof-top sunlight collectors, light pipes and special luminaries that augment traditional fluorescent lighting with sunlight. Introduced in year 15.

### ***LED Solid State White Lighting***

Light emitting diodes (LEDs) are solid-state devices that convert electricity to light, potentially with very high efficiency and long life. Recently, lighting manufacturers have been able to produce "cool" white LED lighting indirectly, using ultraviolet LEDs to excite phosphors that emit a white-appearing light. Replacement for incandescent lamps. Introduced in year five.

### ***Low-Wattage Ceramic Metal Halide Lamps***

Advances in metal halide lamp technology have led to the production of ceramic metal halide (CMH) lamps that use ceramic rather than typical quartz arc tubes. Ceramic arc tubes can tolerate a higher temperature than quartz, resulting in improved quality of light color as desired in retail and other color-sensitive applications. CMH lamps represent an attractive alternative to halogen lamps commonly used in these applications due to longer lamp life and 50% less energy required. Introduced in year five.

### ***Scotopic (High CCT) Lighting***

Scotopic lighting (high correlated color temperatures) stimulates the eyes' photoreceptors, increasing visual acuity. Scotopic lighting appears brighter to occupants even when light levels were reduced. Introduced in year five.

## Heating, Ventilation, and Air-Conditioning (HVAC)

**Table A–21. Commercial Electric Emerging Technologies—HVAC**

Category or End Use	Technology	Baseline	End Use Percent Savings	TRC
Cooling Chillers	Wireless Performance Monitoring, Diagnostics and Control	Standard BAS system	10%	0.5
	Active Window Insulation	No Window Treatment	21%	0.5
	Hotel Key Card Room Energy Control System	No Control	25%	1.4
	Leak Proof Duct Fittings	Standard Duct Workmanship	21%	20.7
	Green Roof	Standard Roofing	13%	0.05
Cooling DX	Active Window Insulation	No Window Treatment	21%	4.5
	Hotel Key Card Room Energy Control System	No Control	25%	1.9
	Leak Proof Duct Fittings	Standard Duct Workmanship	21%	36.0
	Green Roof	Standard Roofing	13%	0.09
Cooling Heat Pump	Active Window Insulation	No Window Treatment	21%	1.1
	Hotel Key Card Room Energy Control System	No Control	25%	2.4
	Leak Proof Duct Fittings	Standard Duct Workmanship	21%	36.0
	Green Roof	Standard Roofing	13%	0.09
Space Heat	Wireless Performance Monitoring, Diagnostics and Control	Standard BAS system	10%	1.1
	Hotel Key Card Room Energy Control System	No Control	25%	5.8
	Leak Proof Duct Fittings	Standard Duct Workmanship	21%	28.0
	Green Roof	Standard Roofing	13%	0.07
HVAC Aux	Underfloor Ventilation with Low Static Pressure	Standard Ventilation	20%	0.6

### ***Wireless Performance Monitoring, Diagnostics and Control***

These are second-generation building automation systems that allow for wireless optimization and operation of building systems such as HVAC through computerized monitoring and control software and interfaces. Applicable to Cooling Chillers and Space Heat end uses. Introduced in year 15.

### ***Active Window Insulation***

The use of an active window insulation (automated venetian blind) system as a daylighting strategy offers potential savings in cooling-related energy use. As part of a "smart" integrated system, automated blinds can provide dynamic control of daylight exposure in coordinating cooling requirements and current building operating conditions. Applicable all cooling end uses (chillers, heat pumps and DX). Introduced in year five.



## ***Hotel Key Card Room Energy Control System***

This is a key card system to control room HVAC and lighting during non-occupied periods. Occupancy is determined by the key card and/or additional sensors. The central system first sets temperature at a minimum level then gives control to the guest for temperature and lighting when the guest enters the room. New construction only. Introduced in year 10.

## ***Leak-proof Duct Fittings***

The majority of duct leakage in residential HVAC systems is due to improperly sealed connections between ductwork and fittings. Even when duct connections are initially well-sealed, leakage may increase over time. Although the use of mastics and mechanical fasteners is becoming more widespread, a low cost, leak-proof system will help to transform the market. Introduced in year five.

## ***Green Roof***

A green roof is a living roof that supports soil and plant growth. A series of carefully engineered layers are applied to the roof deck. These layers are watertight, lightweight and long-lasting. Green roofs can be incorporated into new and existing buildings as long as load requirements are met. They are suited for roofs that have slopes ranging up to 20 degrees and are most successful when sufficient attention has been paid to selecting plants that will thrive in the local climate and conditions. One of the most significant advantages is that a green roof can last up to three times longer than a standard roof. The added benefit of a green roof's ability to buffer temperature extremes improves a building's energy performance by dropping the temperatures on the roof 3-7 degrees, resulting in approximately a 10% reduction in cooling loads. Introduced in year five.

### **HVAC Aux. Measures**

## ***Under-floor Ventilation with Low Static Pressure***

A process by which 100% outside air is introduced under the floor at a low velocity and a temperature slightly below desired room temperature. The occupants, office equipment, and external cooling loads warm the air. Introduced in year five.

## **Refrigeration**

**Table A–22. Commercial Electric Emerging Technologies—Refrigeration**

Category or End Use	Technology	Baseline	End Use Percent Savings	TRC
Refrigeration	Efficient Fan Motor Options	Standard Fan	14%	1.7

## ***Efficient Fan Motor Options for Commercial Refrigeration***

Fan and fan motors used in condensers and evaporators account for 20% of the annual energy use and operate at overall efficiencies as low as 7-15%. New axial fan blade designs enable improved fan performance, and advanced electric motors such as brushless DC or electronically commutated motors (ECM) offer motor performance solutions. Introduced in year five.

## **Commercial Gas Measure Descriptions**

Percent savings and TRC are averaged over all applicable building types and the TRC is given for the base-case scenario averaged for both discretionary measures and lost opportunity-equipment measures, unless they differ significantly in which case both TRCs are given.

### Space Heat

**Table A–23. Commercial Gas Space Heat**

Category or End Use	Technology	Baseline	Percent End-Use Savings	TRC
Space Heat	Boiler Economizer	No Economizer	10%	0.5
	Programmable Thermostat	No Programmable Thermostat	2%	3.0
	Exhaust Air to Ventilation Air Heat Recovery	No Heat Recovery	20%	0.7
	Convert Constant Volume Air System to VAV	Constant Volume Air System	12%	1.7
	Boiler Tune-Up	No Boiler Tune-Up	2%	0.3
	Duct Insulation (R-8)	R-3	2%	3.1
	Duct Repair and Sealing		2%	1.2
	Windows-High Efficiency (U=0.35)	U = 0.67	5%	0.7 existing 1.9 new
	Insulation - Roof / Ceiling (R-19)	R=0	10%	0.7
	Insulation – Floor (R-19)	R=0	5%	0.3
	Retro-Commissioning		15%	0.3
	Automated Ventilation VFD Control	Constant Ventilation	10%	0.99

### ***Boiler Economizer***

Similar to a condensing water heater, a boiler economizer captures heat that would otherwise be lost in the flue gas. In this case, the flue gas energy can be used to pre-heat the water entering the boiler.

### ***Programmable Thermostat***

A programmable thermostat simply controls the setpoint temperatures automatically. This allows for lower energy use by ensuring the heating system is not running during low-occupancy hours. Only for existing construction.

### ***Exhaust Air to Ventilation Air Heat Recovery***

The air that is exhausted out of a building during the heating season will be warmer than the air outside. Capturing some of this heat and transferring it to the incoming air lowers the overall heating load.

### ***Convert Constant Volume Air System to Variable Volume***

Converting to a variable volume system will allow for the drives to operate at an optimal load level and thus, minimize energy consumption. The baseline building system, as the measure name suggests, only runs at a single volume flow. Only for existing construction.

### ***Boiler Tune-Up***

Simply put, this measure increases the overall efficiency of the boiler by doing any required maintenance or tune-up. The baseline building will have no tune-up performed. Only for existing construction.

### ***Duct Insulation***

Heating systems are generally coupled with a ducting system inside the building. Insulating the ducts will reduce energy loss in the unoccupied plenum space. The baseline value for this insulation is R-3, while the measure increases the insulation to R-8. Only for existing construction.

### ***Duct Repair and Sealing***

Basically, by repairing and sealing leaky ducts, significant energy savings could be attained by ensuring the conditioned air is traveling to the occupied spaces. Only for existing construction.

### ***Windows—High-efficiency***

This measure represents an increase in performance by changing the U-value from 0.67 to 0.35.

### ***Ceiling/Roof Insulation***

The measure represents an increase in R-value to current code values of R-19 in the roof or ceiling for single-story buildings. Only for existing construction.

### ***Floor Insulation***

Similar to ceiling/roof insulation, the measure represents an increase in R-value to current code levels of R-19 for the floor space. Only for existing construction.

### ***Retro-Commissioning***

“Retro-commissioning” is the process of optimizing the operation of an existing building through simple, low- or no-cost repairs and operational changes. For example, temperature controls will

be set to operate only during occupied periods, ensuring that the ideal static pressure is being met for the fans.

### **Automatic Ventilation VFD Control**

This measure allows the ventilation to only run on an as-needed basis. Without it, the ventilation system would run constantly. With it, a CO<sub>2</sub> sensor will detect when ventilation is required, reducing the overall HVAC load.

### **Water Heat**

In addition to a more efficient water heating system, any equipment measures that require less hot water fall under the auspices of water heat measures.

**Table A–24. Commercial Gas Water Heat**

Category or End Use	Technology	Baseline	Percent End-Use Savings	TRC
Water Heat	Faucet Aerators (1.6 GPM)	4.0 GPM	3%	13.0
	Low-Flow Spray Heads (1.6 GPM)	3.0 GPM	2%	3.0
	Low-Flow Showerheads (2.5 GPM)	5.0 GPM	2%	2.8
	Chemical Dishwashing System	High Temp Commercial Dishwasher	5%	1.3
	Tankless Hot Water System (EF=0.81)	EF=0.59	27%	3.3
	Commercial High Efficiency Clothes Washers	Commercial Standard Clothes Washer	35%	0.7
	Water Heater Temperature Setback (115° F)	140° F	5%	15.0
	Condensing Water Heater (EF=0.9)	EF=0.59	34%	3.5
	Solar Water Heater	EF=0.59	40%	0.8
	Pipe Insulation (R=4)	R=0	2%	6.2
	Demand controlled Circulating Systems		5%	0.2

### **Faucet Aerators**

Faucet aerators, by mixing water and air, lower the water flow from 4.5 gpm to 2.75 gpm. The faucet aerator creates a fine water spray with a screen that is inserted in the faucet head.

### **Low-Flow Spray Heads**

Low-flow spray heads used the same principle as faucet aerators to achieve a flow reduction of nearly 50%, lowering the flow rate to 1.6 gpm from 3.0 gpm.

### **Low-Flow Showerheads**

Low-flow shower heads use the same principle as faucet aerators to achieve a flow reduction of 50%, lowering the flow rate to 2.5 gpm from 5.0 gpm.

### ***Chemical Dishwashing System***

Instead of sanitizing the dishes with hot water, chemicals are used instead. This allows for a lower hot water temperature setting with the same cleaning result.

### ***Tankless Hot Water System***

If hot water usage is only sporadic, savings can be obtained by using an on-demand, or tankless hot water system. In this system, there is not hot water storage tank, reducing standby losses; rather, a high intensity heating element heats the flowing water when needed. The energy factor can be increased from 0.59 to 0.81 with a tankless system.

### ***Commercial High-Efficiency Clothes Washers***

ENERGY STAR clothes washers for commercial use.

### ***Water Heater Temperature Setback***

Often, the setpoint temperature on a hot water system is set higher than generally required. This measure reflects the savings obtained by reducing the setpoint temperature from 140°F to 115°F. Only for existing construction.

### ***Condensing Water Heater***

Condensing water heaters recover much of the energy lost by water vapor leaving with the flue gases. A large or second heat exchanger that reduces the flue-gas temperature to the point where this water vapor condenses allows the water heater to capture this otherwise lost energy.

### ***Solar Water Heater***

A solar water heater is generally mounted on the roof of a building and is designed to use the sun to heat water rather than electricity or gas. Note that this is a passive process, not one that involves photovoltaic cells.

### ***Hot Water Pipe Insulation***

Adding R-4 insulation around the pipes will decrease heat loss.

### ***Demand-Controlled Circulating Systems***

In order to ensure hot water demands are met, some buildings will have continuously circulating hot water systems resulting in energy loss through pipes. To reduce this loss, a demand-controlled circulating system can be installed to only circulate hot water when required.

## Cooking

**Table A–25. Commercial Gas Cooking**

Category or End Use	Technology	Baseline	End Use Percent Savings	TRC
Cooking	Power Burner Fryer	Standard Fryer	5%	0.6
	Power Burner Oven	Standard Oven	5%	0.2

### ***Power Burner Fryer/Oven***

The power burner range is an improved atmospheric burner. The term "power" means that a blower drives gas and air flow to the burner. Gas and air are mixed in a plenum and the mixture is regulated to achieve more efficient combustion. During combustion, the flame moves sideways from the burner and impinges on a bowl made of low-carbon stainless steel located underneath the burner and increases the amount of radiant heat transmitted to the cooking utensil.

## Pool Heat

**Table A–26. Commercial Gas Pool Heat**

Category or End Use	Technology	Baseline	End Use Percent Savings	TRC Existing	TRC New
Pool Heat	Installation of Solar Pool/Spa Heating Systems		16%	1.1	0.6
	Installation of Swimming Pool / Spa Covers	No Cover	35%	12.0	8.2

### ***Installation of Solar Pool/Spa Heating Systems***

Using the energy from the sun to supplement the heat required for pool or spa heating systems can save 16% of the energy required.

### ***Installation of Swimming Pool/Spa Cover***

Simply covering a pool or spa when not in use can save 35% of the heating load.

## Lost Opportunity—Equipment

In either existing or new construction, when new equipment needs to be purchased, savings can be gained by purchasing high-efficiency models.

**Table A–27. Commercial Gas Lost Opportunity—Equipment**

Category or End Use	Technology	Baseline	End Use Percent Savings	TRC
Water Heat	High Efficiency (EF=0.64)	Standard Efficiency (EF=0.59)	8%	13.0
	Premium Efficiency (EF=0.70)	Standard Efficiency (EF=0.59)	16%	3.4
	Premium Efficiency (EF=0.92)	Standard Efficiency (EF=0.59)	30%	4.8
Space Heat	High Efficiency (85%)	Standard Efficiency (75%)	12%	1.8

***High/Premium-Efficiency Water Heater***

The energy factor (EF) of a standard water heater is around 0.59, but high-efficiency water heaters can have an EF=0.64 or premium-efficiency with EF=0.70 are available, resulting in a 8% or 16% energy savings, respectively. For Hotel/Motel buildings, an even higher efficiency EF=0.92 water heater can be installed with a 30% savings.

***High-Efficiency Gas Furnace/Boiler***

A standard central boiler has an efficiency of approximately 75%, but a high-efficiency boiler can have an 85% efficiency, resulting in an energy savings of 12%.

**Commercial Gas Emerging Technologies**

These ET measures are energy-efficiency measures that are not readily available in the current market, but are expected to be so within the 20-yr planning horizon. The different ET measures are in varying stages of “market readiness,” and the potential study included the ET measures only after they become market ready. All ET gas measures are space heat measures.

**Table A–28. Commercial Gas Emerging Technologies**

Category or End Use	Technology	Baseline	Percent End-Use Savings	TRC
Space Heat	Wireless Performance Monitoring, Diagnostics and Control	Building with standard BAS system	10%	0.4
	Leak Proof Duct Fittings	Standard Duct Workmanship	15%	5.0
	Green Roof	Standard Roof	13%	0.03

***Wireless Performance Monitoring, Diagnostics and Control***

Second-generation building automation systems that allow for wireless optimization and operation of building systems such as HVAC through computerized monitoring and control software and interfaces. Introduced in year 15.

## **Leak-proof Duct Fittings**

The majority of duct leakage in residential HVAC systems is due to improperly sealed connections between ductwork and fittings. Even when duct connections are initially well-sealed, leakage may increase over time. Although the use of mastics and mechanical fasteners is becoming more widespread, a low cost, leak-proof system will help to transform the market. Introduced in year five.

## **Green Roof**

A green roof is a living roof that supports soil and plant growth. A series of carefully engineered layers are applied to the roof deck. These layers are watertight, lightweight and long-lasting. Green roofs can be incorporated into new and existing buildings as long as load requirements are met. They are suited for roofs that have slopes up to 20 degrees and are most successful when sufficient attention has been paid to selecting plants that will thrive in the local climate and conditions. One of the most significant advantages is that a green roof can last up to three times longer than a standard roof. The added benefit of a green roof's ability to buffer temperature extremes improves a building's energy performance by dropping the temperatures on the roof 3-7 degrees, resulting in approximately a 10% reduction in cooling loads. Introduced in year five.

## **Industrial Electric Measure Descriptions**

In the tables, the End-Use Percent savings and TRC are averaged over all applicable building types for year 20 and the TRC is given for the base-case scenario.

**. Table A–28. Industrial Electric**

Category or End Use	Measure	End Use Percent Savings	TRC
Process	Cooling Improvements	7%	10.0
	Fan System Improvements	16%	10.0
	Pump System Improvements	38%	10.0
	Other Motor Improvements	10%	10.0
	Air Compressor Improvements	19%	13.0
	Air Compressor O&M	14%	7.7
	Refrigeration	7%	10.0
Building	Lighting	14%	4.6
	HVAC	11%	2.9

### **Process-Related Measures**



Any measures to improve the industrial process, not specific to the building itself.

## Process Cooling Improvements

Improvements that will decrease the energy required for process-related cooling. Examples would include avoid frost formation on evaporators, shutting of cooling water when not required, using economic thickness of insulation for low temperatures.

## Fan System Improvements

Savings from variable-speed drives (VSD) and/or improvements to the design of the fan system, such as better fans, ducting and flow design.

## Pump System Improvements

Similar to fan system improvements, with savings from a VSD and/or improvements to the overall pump system, such as better pumps, more efficient piping and eliminating unnecessary flows.

## Other Motor Improvements

Improvements to motors not specific to fans or pumps. This would include using higher efficiency motors, improved rewind practices and correct motor sizing.

## Air Compressor Improvements

Air compressor energy efficiency, used in the industrial process, can be improved by installing compressor air intakes in coolest locations, or using optimum-sized compressors, amongst others.

## Air Compressor O&M

Changing operation and maintenance (O&M) procedures of an air compressor can improve the overall energy efficiency of a plant. Some O&M examples include reducing the pressure of compressed air to the minimum required, cooling compressor air intake with a heat exchanger or eliminating leaks.

## Refrigeration Improvements

Refrigeration improvements can include isolating hot equipment from refrigerated area, using highest allowable temperature for refrigerated space or modify refrigeration system to operate at a lower pressure.

### **Building-Related Measures**

Any measures to improve building itself, not specific to the industrial process.

## Lighting Improvements

Any changes to overall illumination levels, use of natural lighting, or technology improvements to use more efficient bulbs or ballasts that will decrease the overall lighting energy consumption.

## HVAC Improvements

There are many changes that can be made to reduce the energy consumption in HVAC control of a plant. Many are measures found in the commercial and residential lists. A sample of improvements include: air condition only space in use, install timers and/or thermostats, lower ceiling to reduce conditioned space, install or upgrade insulation on distribution system.

## Industrial Gas Measure Descriptions

The measures percent savings and TRC are averaged over all industrial segments.

**Table A–29. Industrial Gas**

Category or End Use	Measure	End Use Percent Savings	TRC
Process	Boiler Upgrade	7%	7.0
	Boiler O&M	5%	4.6
	Steam Distribution	14%	10.0
Building	HVAC	11%	2.0

### Process Boiler Upgrades

The boiler is generally used to create hot water. Savings can be found by installing a waste heat boiler to provide direct power or using flue gas heat to preheat boiler feedwater.

### Process Boiler O&M

Such improvements would include reducing water temperature to the minimum required or replacing/cleaning filters.

### Steam Distribution Systems

Any elimination in leaks or improved insulation to the ducting will reduce loss in a distribution system.

### HVAC Improvements

There are many changes that can be made to reduce the energy consumption in HVAC control of a plant. Many are measures found in the commercial and residential lists. A sample of improvements include: install timers and/or thermostats, lower ceiling to reduce conditioned space, install or upgrade insulation on distribution system.

## Fuel Conversion Measure Descriptions

For fuel conversion, four end uses were considered: Space Heating, Zone Heating, Water Heating and Appliances. The associated measures are given in the table below.

**Table A–30. Fuel Conversion**

End Use	Gas Measure
Space Heating	90 AFUE condensing furnace
	96 AFUE condensing furnace
Zone Heating	84% efficient wall heater
Water Heating	EF=0.64 storage water heater
	EF=0.82 tankless water heater
Appliances	Gas dryer w/ moisture sensor
	Convection gas range

For space and water heating, the first measure is the highest-efficiency measure that is cost-effective from the energy-efficiency scenario. However, within the fuel conversion cost-effectiveness screen, the higher-efficiency measures also pass. Since those measures are currently less commonly available, it is likely that the higher-efficiency measures will become phased in over time. Thus, over the first 10 years, the higher-efficiency space and water heaters are linearly increasing in market share from zero (year 1) to 50% (year 10) and maintained at 50% from years 11-20. Descriptions of these measures can be found in the residential gas energy-efficiency measure descriptions section.

## **Distributed Generation Measure Descriptions**

### **Non-Renewable Generation**

#### **Combined Heat and Power**

A more energy-efficient use of a non-renewable generation unit is as a combined heat and power (CHP) plant. CHP starts with a standard non-renewable generator, but improves the overall utility by capturing the waste heat produced by the generator. For example, a typical spark-ignition engine has an electrical efficiency of only about 35%. The “lost” energy is primarily waste heat. A CHP unit will capture much of this waste heat and use it for space heating or water heat. Thus, there are cost savings for the water heating in addition to electricity generation. Three engine generator technologies are considered for use with CHP: reciprocating engines, microturbines and fuel cells.

#### ***Reciprocating Engine (CHP-RE)***

Reciprocating engines generate power by a compression/expansion cycle of a piston moving back and forth within a cylinder. The movement of the piston is driven by heating/cooling of the gas inside the cylinder. The linear movement of the piston drives a generator, creating electricity. In this study, only natural-gas fueled spark-ignition engines were considered. These spark-ignition engines can range in capacity from 1-5000 kW.

### ***Microturbines (CHP-MT)***

A microturbine (MT) is a small gas turbine. Natural gas is generally used, but a MT is known to be fairly flexible with the quality of fuel used, making them attractive for use with biogas. Microturbines range in capacity from 30-400 kW.

### ***Fuel Cells (CHP-FC)***

Fuel cells produce power electrochemically rather than by combustion. A fuel cell is composed of two electrodes separated by an electrolyte. The fuel (hydrogen) enters via one electrode while the air/O<sub>2</sub> enters the other. The hydrogen is split into its proton and electron components and is then driven in opposite directions, completing a circuit and creating a current. The only waste products are H<sub>2</sub>O in this situation. However, due to the relative scarcity of H<sub>2</sub> gas, a reformer is often coupled with the fuel cell that transforms a hydrocarbon (e.g., methane) into H<sub>2</sub> for the fuel cell and also creates waste CO<sub>2</sub>. There are several different types of fuel cells, most commonly used are PAFC (phosphoric acid fuel cell) and PEMFC (proton-exchange membrane fuel cell). PAFC are currently available in 200 kW units, and PEMFCs are generally in 150 kW units.

## **Renewable Generation**

Renewable generation encompasses all generation that uses a renewable energy source for the fuel. In other words, a fossil fuel is not consumed. There are two main categories of renewable generation: biomass and clean energy.

### **Biomass**

Sometimes referred to as “resource recovery,” biomass is used as the fuel to drive a generator. The source of the biomass can vary, but can be broadly categorized into “industrial biomass” or “anaerobic digesters.”

#### ***Industrial Biomass***

Industrial Biomass refers to the waste-recovery used for generation found at industrial facilities, such as pulp and paper industry, lumber mills, etc. The waste products from these processes is combusted in a steam or gas turbine. The turbines are used in a CHP capacity, capturing the excess heat for space/water or process heating. Industrial biomass is generally large scale, >1 MW.

#### ***Anaerobic Digesters***

Anaerobic digesters create methane gas by the breakdown of municipal solid waste, landfill gas or dairy farm waste. Any of the above CHP technologies (RE, MT or FC) can be used to combust this recovered methane to generate electricity required by the facility. The captured heat is fed back into the digester to maintain appropriate temperatures.

## Clean Energy

This is generation that is achieved without the consumption of a hydrocarbon fuel. The two main sources for clean energy are wind, and solar photovoltaics (PV).

### ***Wind***

Wind energy is captured by rotors that spin and drive a turbine. Energy output is based on wind speed and swept area of the rotors. Thus, different sized rotors can be used to achieve different power requirements. Depending on time of day and time of year, energy output is variable. Wind turbines can range in size from <1 kW to >1 MW.

### ***PV***

Solar energy is often generated by use of photovoltaic (PV) cells. The conversion efficiency from sunlight to electricity is relatively low (~<20%) and highly dependent on weather conditions, time of day, and time of year, which can result in fairly low capacity factors. PV panels are modular and thus can come in a wide range of capacities.

## Emerging Technologies

Since only technology classes are considered, emerging technologies do not change these categorizations. Rather, the ET scenario assumes price reductions (for PV, CHP-MT, CHP-FC, and anaerobic digesters), capacity factor increases (wind), and sector penetration (residential CHP added).

## Measure Data Sources

### Residential (Cost and Lifetime)

- Home Depot website
- Lowe's website
- Sears website
- RS Means (labor cost)
- Deer database
- Previous studies (2003 PSE study, Tacoma Power potential study (2006))
- Cost data provided by PSE
- Engineering judgment

## Commercial

- Deer database
- Trane
- Previous studies (2003 PSE study, Tacoma Power potential study (2006), MidAmerican Energy study (2005), GRE potential study (2006))
- Cost data provided by PSE
- Engineering judgment

## Industrial

- Energy Information Administration: Manufacturing Energy Consumption Survey
- Office of Energy Efficiency and Renewable Energy (DOE-EERE) Office of Industrial Technologies: U.S. Industrial Electric Motor Systems Market Opportunities Assessment
- DOE-EERE Industrial Technologies Program: Industrial Assessment Centers Database

# **Appendix B: Energy Efficiency and Emerging Technologies: Inputs and Assumptions**

---

Appendix B follows.



**Table B-1. Residential Electric Measures**

Building Type	End Use	Vintage	Measure Name	Base Usage	Incomplete Factor	Technical Feasibility	Measure Life	Per Unit Cost	Energy Savings
Manufactured	Central_AC	Existing	Central AC - Advanced Technology	408.0828968			15	\$1,125	28%
Manufactured	Central_AC	Existing	Central AC - High Efficiency	408.0828968			15	\$225	7%
Manufactured	Central_AC	Existing	Central AC - Premium Efficiency	408.0828968			15	\$688	19%
Manufactured	Central_AC	New	Central AC - Advanced Technology	422.40914			15	\$1,125	28%
Manufactured	Central_AC	New	Central AC - High Efficiency	422.40914			15	\$225	7%
Manufactured	Central_AC	New	Central AC - Premium Efficiency	422.40914			15	\$688	19%
Manufactured	Dryer	Existing	Advanced Appliance Motor ECM	808.859336	100%	80%	14	\$239	11%
Manufactured	Dryer	New	Advanced Appliance Motor ECM	678.4723584	100%	80%	14	\$239	11%
Manufactured	Freezer	Existing	Freezer - Energy Star or better	561.6549503			15	\$60	10%
Manufactured	Freezer	New	Freezer - Energy Star or better	559.4267898			18	\$60	10%
Manufactured	Heat_Pump	Existing	ASHP - High Efficiency	4131.201203			20	\$236	9%
Manufactured	Heat_Pump	Existing	ASHP - Premium Efficiency	4131.201203			20	\$534	14%
Manufactured	Heat_Pump	Existing	Advanced Cold-Climate Heat Pump	4131.201203	100%	29%	20	\$4,300	17%
Manufactured	Heat_Pump	Existing	Check Me O & M Tune-up	4131.201203	75%	90%	3	\$225	17%
Manufactured	Heat_Pump	Existing	CheckMe! Heat Pump Duct Sealing	4131.201203	93%	50%	20	\$850	25%
Manufactured	Heat_Pump	Existing	ES Windows (Class 30)	4131.201203	85%	95%	25	\$2,300	17%
Manufactured	Heat_Pump	Existing	Insulation-Ceiling	4131.201203	90%	5%	25	\$765	9%
Manufactured	Heat_Pump	Existing	Insulation-Floor	4131.201203	92%	88%	25	\$1,400	11%
Manufactured	Heat_Pump	Existing	Insulation-Wall 2x4	4131.201203	15%	75%	25	\$1,660	10%
Manufactured	Heat_Pump	Existing	Micro Channel Heat Exchangers (Evaporator)	4131.201203	100%	75%	18.4	\$145	5%
Manufactured	Heat_Pump	Existing	Small Scale Absorption Cooling	4131.201203	100%	14%	20	\$3,000	18%
Manufactured	Heat_Pump	Existing	Solid State refrigeration cool chips for heat pumps	4131.201203	100%	29%	18.4	\$2,000	26%
Manufactured	Heat_Pump	Existing	Whole house air sealing	4131.201203	93%	90%	10	\$300	5%
Manufactured	Heat_Pump	New	ASHP - High Efficiency	3124.262035			20	\$236	9%
Manufactured	Heat_Pump	New	ASHP - Premium Efficiency	3124.262035			20	\$534	14%
Manufactured	Heat_Pump	New	Advanced Cold-Climate Heat Pump	3124.262035	100%	29%	20	\$4,300	17%
Manufactured	Heat_Pump	New	Air-to-Air Heat Exchangers	3124.262035	85%	20%	15	\$1,440	10%
Manufactured	Heat_Pump	New	ES Labeled - New Manufactured Housing	3124.262035	95%	70%	23	\$1,100	34%
Manufactured	Heat_Pump	New	Leak Proof Duct Fittings	3124.262035	100%	90%	30	\$160	17%
Manufactured	Heat_Pump	New	Micro Channel Heat Exchangers (Evaporator)	3124.262035	100%	75%	18.4	\$145	5%
Manufactured	Heat_Pump	New	Small Scale Absorption Cooling	3124.262035	100%	14%	20	\$3,000	9%
Manufactured	Heat_Pump	New	Solid State refrigeration cool chips for heat pumps	3124.262035	100%	29%	18.4	\$2,000	18%
Manufactured	Lighting	Existing	CFL Fixtures, High Use	2164.03587	65%	95%	10	\$60	9%
Manufactured	Lighting	Existing	CFL Fixtures, Low Use	2164.03587	75%	95%	10	\$60	2%
Manufactured	Lighting	Existing	CFL Fixtures, Medium Use	2164.03587	70%	95%	10	\$60	2%
Manufactured	Lighting	Existing	CFL Lamps, High Use	2164.03587	65%	95%	6	\$5	43%
Manufactured	Lighting	Existing	CFL Lamps, Low Use	2164.03587	75%	95%	12	\$5	9%
Manufactured	Lighting	Existing	CFL Lamps, Medium Use	2164.03587	70%	95%	8	\$5	6%
Manufactured	Lighting	Existing	CFL Torchieries, High Use	2164.03587	65%	95%	8	\$90	3%
Manufactured	Lighting	Existing	CFL Torchieries, Low Use	2164.03587	75%	95%	8	\$90	1%
Manufactured	Lighting	Existing	CFL Torchieries, Medium Use	2164.03587	70%	95%	8	\$90	1%
Manufactured	Lighting	Existing	LED Interior Lighting (White), High Use	2164.03587	100%	50%	10	\$28	54%
Manufactured	Lighting	Existing	LED Interior Lighting (White), Low Use	2164.03587	100%	50%	10	\$28	11%
Manufactured	Lighting	Existing	LED Interior Lighting (White), Medium Use	2164.03587	100%	50%	10	\$28	8%
Manufactured	Lighting	New	CFL Fixtures, High Use	2164.03587	55%	95%	10	\$60	9%
Manufactured	Lighting	New	CFL Fixtures, Low Use	2164.03587	70%	95%	10	\$60	2%
Manufactured	Lighting	New	CFL Fixtures, Medium Use	2164.03587	60%	95%	10	\$60	2%
Manufactured	Lighting	New	CFL Lamps, High Use	2164.03587	55%	95%	6	\$5	43%
Manufactured	Lighting	New	CFL Lamps, Low Use	2164.03587	70%	95%	12	\$5	9%
Manufactured	Lighting	New	CFL Lamps, Medium Use	2164.03587	60%	95%	8	\$5	6%

Building Type	End Use	Vintage	Measure Name	Base Usage	Incomplete Factor	Technical Feasibility	Measure Life	Per Unit Cost	Energy Savings
Manufactured	Lighting	New	CFL Torchieries, High Use	2164.03587	55%	95%	8	\$90	3%
Manufactured	Lighting	New	CFL Torchieries, Low Use	2164.03587	70%	95%	8	\$90	1%
Manufactured	Lighting	New	CFL Torchieries, Medium Use	2164.03587	60%	95%	8	\$90	1%
Manufactured	Lighting	New	LED Interior Lighting (White), High Use	2164.03587	100%	50%	10	\$28	54%
Manufactured	Lighting	New	LED Interior Lighting (White), Low Use	2164.03587	100%	50%	10	\$28	11%
Manufactured	Lighting	New	LED Interior Lighting (White), Medium Use	2164.03587	100%	50%	10	\$28	8%
Manufactured	Plug_Load	Existing	1-Watt Standby Power	1933.842831	100%	21%	7	\$120	14%
Manufactured	Plug_Load	Existing	Advanced Appliance Motor ECMs, (2) Other	1933.842831	100%	80%	14	\$1,082	10%
Manufactured	Plug_Load	Existing	Digital set top Receivers	1933.842831	80%	100%	6	\$0	0%
Manufactured	Plug_Load	Existing	Efficient DVD systems	1933.842831	70%	100%	7	\$0	0%
Manufactured	Plug_Load	Existing	Efficient high definition televisions	1933.842831	95%	100%	8	\$250	5%
Manufactured	Plug_Load	Existing	Office Equipment: Computer, Energy Star or Better	1933.842831	65%	100%	4	\$0	1%
Manufactured	Plug_Load	Existing	Office Equipment: Monitors, Energy Star or Better	1933.842831	50%	100%	4	\$0	2%
Manufactured	Plug_Load	Existing	Office Equipment: Printers, Energy Star or Better	1933.842831	85%	100%	5	\$0	2%
Manufactured	Plug_Load	Existing	Power supply transformer/convertor - External pow	1933.842831	90%	100%	15	\$47	1%
Manufactured	Plug_Load	Existing	Powerstrip with Occupancy Sensor	1933.842831	100%	100%	20	\$90	1%
Manufactured	Plug_Load	New	1-Watt Standby Power	1933.842831	100%	21%	7	\$120	14%
Manufactured	Plug_Load	New	Advanced Appliance Motor ECMs, (2) Other	1933.842831	100%	80%	14	\$1,082	10%
Manufactured	Plug_Load	New	Digital set top Receivers	1933.842831	80%	100%	6	\$0	0%
Manufactured	Plug_Load	New	Efficient DVD systems	1933.842831	70%	100%	7	\$0	0%
Manufactured	Plug_Load	New	Efficient high definition televisions	1933.842831	95%	100%	8	\$250	5%
Manufactured	Plug_Load	New	Office Equipment: Computer, Energy Star or Better	1933.842831	65%	100%	4	\$0	1%
Manufactured	Plug_Load	New	Office Equipment: Monitors, Energy Star or Better	1933.842831	50%	100%	4	\$0	2%
Manufactured	Plug_Load	New	Office Equipment: Printers, Energy Star or Better	1933.842831	85%	100%	5	\$0	2%
Manufactured	Plug_Load	New	Power supply transformer/convertor - External pow	1933.842831	90%	100%	15	\$47	1%
Manufactured	Plug_Load	New	Powerstrip with Occupancy Sensor	1933.842831	100%	100%	20	\$90	2%
Manufactured	Refrigeration	Existing	1 kWh/day Refrigerator	660.1565818	100%	90%	18	\$160	27%
Manufactured	Refrigeration	Existing	Refrigerator, Energy Star or better	660.1565818			18	\$80	15%
Manufactured	Refrigeration	Existing	Removal of Old Refrigerator	660.1565818	100%	2%	7	\$200	100%
Manufactured	Refrigeration	Existing	Solid state refrigeration (cool chips ™)	660.1565818	100%	90%	19	\$860	52%
Manufactured	Refrigeration	New	1 kWh/day Refrigerator	657.2166478	100%	90%	18	\$160	27%
Manufactured	Refrigeration	New	Refrigerator, Energy Star or better	657.2166478			18	\$80	15%
Manufactured	Refrigeration	New	Solid state refrigeration (cool chips ™)	657.2166478	100%	90%	19	\$860	40%
Manufactured	Room_AC	Existing	Room AC - Energy Star	192.4457643			12	\$33	9%
Manufactured	Room_AC	New	Room AC - Energy Star	204.0696333			12	\$33	9%
Manufactured	Space_Heat	Existing	Duct Insulation	6971.605182	20%	50%	25	\$300	3%
Manufactured	Space_Heat	Existing	ES Windows (Class 30)	6971.605182	85%	95%	25	\$2,300	17%
Manufactured	Space_Heat	Existing	Insulation-Ceiling	6971.605182	90%	5%	25	\$765	9%
Manufactured	Space_Heat	Existing	Insulation-Floor	6971.605182	92%	88%	25	\$1,400	11%
Manufactured	Space_Heat	Existing	Insulation-Wall 2x4	6971.605182	15%	75%	25	\$1,660	10%
Manufactured	Space_Heat	Existing	PTCS Duct Sealing	6971.605182	50%	50%	20	\$1,000	9%
Manufactured	Space_Heat	Existing	Whole house air sealing	6971.605182	93%	90%	10	\$300	5%
Manufactured	Space_Heat	New	Air-to-Air Heat Exchangers	3067.951106	85%	20%	15	\$1,440	10%
Manufactured	Space_Heat	New	ES Labeled - New Manufactured Housing	3067.951106	95%	70%	23	\$1,100	34%
Manufactured	Space_Heat	New	Leak Proof Duct Fittings	3067.951106	100%	90%	30	\$160	17%
Manufactured	Water_Heat	Existing	Energy Star Clothes Washer	2635.123624	50%	95%	14	\$600	13%
Manufactured	Water_Heat	Existing	Energy Star Dishwasher	2635.123624	20%	75%	13	\$45	2%
Manufactured	Water_Heat	Existing	Faucet Aerators	2635.123624	55%	95%	5	\$5	1%
Manufactured	Water_Heat	Existing	Heat Pump Water Heater	2635.123624	95%	65%	10	\$1,750	40%
Manufactured	Water_Heat	Existing	Hot Water Pipe Insulation	2635.123624	62%	75%	15	\$8	1%
Manufactured	Water_Heat	Existing	Low-Flow Showerheads	2635.123624	45%	95%	7	\$20	3%

Building Type	End Use	Vintage	Measure Name	Base Usage	Incomplete Factor	Technical Feasibility	Measure Life	Per Unit Cost	Energy Savings
Manufactured	Water_Heat	Existing	Solar Water Heater	2635.123624	95%	45%	15	\$5,500	40%
Manufactured	Water_Heat	New	Energy Star Clothes Washer	2294.708748	50%	98%	14	\$600	13%
Manufactured	Water_Heat	New	Energy Star Dishwasher	2294.708748	20%	75%	13	\$45	2%
Manufactured	Water_Heat	New	Faucet Aerators	2294.708748	45%	100%	5	\$5	1%
Manufactured	Water_Heat	New	Heat Pump Water Heater	2294.708748	95%	65%	10	\$1,750	40%
Manufactured	Water_Heat	New	Low-Flow Showerheads	2294.708748	45%	95%	7	\$20	2%
Manufactured	Water_Heat	New	Solar Water Heater	2294.708748	95%	45%	15	\$5,500	40%
Multi_Family	Central_AC	Existing	Central AC - Advanced Technolgy	175.4174762			15	\$1,125	28%
Multi_Family	Central_AC	Existing	Central AC - High Efficiency	175.4174762			15	\$225	7%
Multi_Family	Central_AC	Existing	Central AC - Premium Efficiency	175.4174762			15	\$688	19%
Multi_Family	Central_AC	New	Central AC - Advanced Technolgy	205.5508698			15	\$1,125	28%
Multi_Family	Central_AC	New	Central AC - High Efficiency	205.5508698			15	\$225	7%
Multi_Family	Central_AC	New	Central AC - Premium Efficiency	205.5508698			15	\$688	19%
Multi_Family	Dryer	Existing	Advanced Appliance Motor ECM	725.8048846	100%	80%	14	\$239	11%
Multi_Family	Dryer	New	Advanced Appliance Motor ECM	608.8061668	100%	80%	14	\$239	11%
Multi_Family	Freezer	Existing	Freezer - Energy Star or better	417.3812341			15	\$60	10%
Multi_Family	Freezer	New	Freezer - Energy Star or better	417.3812341			15	\$60	10%
Multi_Family	Heat_Pump	Existing	ASHP - High Efficiency	1541.643376			20	\$236	9%
Multi_Family	Heat_Pump	Existing	ASHP - Premium Efficiency	1541.643376			20	\$534	14%
Multi_Family	Heat_Pump	Existing	Advanced Cold-Climate Heat Pump	1541.643376	100%	29%	20	\$4,300	17%
Multi_Family	Heat_Pump	Existing	CheckMe Aerosol-Based Duct Sealing	1541.643376	100%	19%	25	\$450	19%
Multi_Family	Heat_Pump	Existing	ES Windows (Class 30)	1541.643376	85%	85%	30	\$1,760	17%
Multi_Family	Heat_Pump	Existing	Insulated exterior entry doors with built-in weather-	1541.643376	75%	100%	10	\$300	4%
Multi_Family	Heat_Pump	Existing	Insulation-Wall 2x4	1541.643376	15%	75%	30	\$624	10%
Multi_Family	Heat_Pump	Existing	Micro Channel Heat Exchangers (Evaporator)	1541.643376	100%	75%	18.4	\$145	5%
Multi_Family	Heat_Pump	Existing	Small Scale Absorption Cooling	1541.643376	100%	14%	20	\$2,000	18%
Multi_Family	Heat_Pump	Existing	Solid State refrigeration cool chips for heat pumps	1541.643376	100%	29%	18.4	\$1,000	26%
Multi_Family	Heat_Pump	Existing	Whole house air sealing	1541.643376	100%	90%	10	\$650	5%
Multi_Family	Heat_Pump	New	ASHP - High Efficiency	1165.88315			20	\$236	9%
Multi_Family	Heat_Pump	New	ASHP - Premium Efficiency	1165.88315			20	\$534	14%
Multi_Family	Heat_Pump	New	Advanced Cold-Climate Heat Pump	1165.88315	100%	29%	20	\$4,300	17%
Multi_Family	Heat_Pump	New	Air-to-Air Heat Exchangers	1165.88315	85%	75%	15	\$1,440	10%
Multi_Family	Heat_Pump	New	Green Roof	1165.88315	100%	25%	30	\$19,700	13%
Multi_Family	Heat_Pump	New	Leak Proof Duct Fittings	1165.88315	100%	90%	30	\$160	17%
Multi_Family	Heat_Pump	New	Micro Channel Heat Exchangers (Evaporator)	1165.88315	100%	75%	18.4	\$145	5%
Multi_Family	Heat_Pump	New	Small Scale Absorption Cooling	1165.88315	100%	14%	20	\$2,000	9%
Multi_Family	Heat_Pump	New	Solid State refrigeration cool chips for heat pumps	1165.88315	100%	29%	18.4	\$1,000	18%
Multi_Family	Lighting	Existing	CFL Fixtures, High Use	1471.240718	65%	95%	10	\$60	9%
Multi_Family	Lighting	Existing	CFL Fixtures, Low Use	1471.240718	75%	95%	10	\$60	2%
Multi_Family	Lighting	Existing	CFL Fixtures, Medium Use	1471.240718	70%	95%	10	\$60	2%
Multi_Family	Lighting	Existing	CFL Lamps, High Use	1471.240718	65%	95%	6	\$5	43%
Multi_Family	Lighting	Existing	CFL Lamps, Low Use	1471.240718	75%	95%	12	\$5	9%
Multi_Family	Lighting	Existing	CFL Lamps, Medium Use	1471.240718	70%	95%	8	\$5	6%
Multi_Family	Lighting	Existing	CFL Torchieries, High Use	1471.240718	65%	95%	8	\$90	3%
Multi_Family	Lighting	Existing	CFL Torchieries, Low Use	1471.240718	75%	95%	8	\$90	1%
Multi_Family	Lighting	Existing	CFL Torchieries, Medium Use	1471.240718	70%	95%	8	\$90	1%
Multi_Family	Lighting	Existing	LED Interior Lighting (White), High Use	1471.240718	100%	50%	10	\$28	54%
Multi_Family	Lighting	Existing	LED Interior Lighting (White), Low Use	1471.240718	100%	50%	10	\$28	11%
Multi_Family	Lighting	Existing	LED Interior Lighting (White), Medium Use	1471.240718	100%	50%	10	\$28	8%
Multi_Family	Lighting	New	CFL Fixtures, High Use	1471.240718	55%	95%	10	\$60	9%
Multi_Family	Lighting	New	CFL Fixtures, Low Use	1471.240718	70%	95%	10	\$60	2%

Building Type	End Use	Vintage	Measure Name	Base Usage	Incomplete Factor	Technical Feasibility	Measure Life	Per Unit Cost	Energy Savings
Multi_Family	Lighting	New	CFL Fixtures, Medium Use	1471.240718	60%	95%	10	\$60	2%
Multi_Family	Lighting	New	CFL Lamps, High Use	1471.240718	55%	95%	6	\$5	43%
Multi_Family	Lighting	New	CFL Lamps, Low Use	1471.240718	70%	95%	12	\$5	9%
Multi_Family	Lighting	New	CFL Lamps, Medium Use	1471.240718	60%	95%	8	\$5	6%
Multi_Family	Lighting	New	CFL Torchieries, High Use	1471.240718	55%	95%	8	\$90	3%
Multi_Family	Lighting	New	CFL Torchieries, Low Use	1471.240718	70%	95%	8	\$90	1%
Multi_Family	Lighting	New	CFL Torchieries, Medium Use	1471.240718	60%	95%	8	\$90	1%
Multi_Family	Lighting	New	LED Interior Lighting (White), High Use	1471.240718	100%	50%	10	\$28	54%
Multi_Family	Lighting	New	LED Interior Lighting (White), Low Use	1471.240718	100%	50%	10	\$28	11%
Multi_Family	Lighting	New	LED Interior Lighting (White), Medium Use	1471.240718	100%	50%	10	\$28	8%
Multi_Family	Plug_Load	Existing	1-Watt Standby Power	2344.293072	100%	21%	7	\$120	9%
Multi_Family	Plug_Load	Existing	Advanced Appliance Motor ECMs, (2) Other	2344.293072	100%	80%	14	\$1,082	8%
Multi_Family	Plug_Load	Existing	Digital set top Receivers	2344.293072	80%	100%	6	\$0	0%
Multi_Family	Plug_Load	Existing	Efficient DVD systems	2344.293072	70%	100%	7	\$0	0%
Multi_Family	Plug_Load	Existing	Efficient high definition televisions	2344.293072	95%	100%	8	\$250	4%
Multi_Family	Plug_Load	Existing	Office Equipment: Computer, Energy Star or Better	2344.293072	65%	100%	4	\$0	0%
Multi_Family	Plug_Load	Existing	Office Equipment: Monitors, Energy Star or Better	2344.293072	50%	100%	4	\$0	1%
Multi_Family	Plug_Load	Existing	Office Equipment: Printers, Energy Star or Better	2344.293072	85%	100%	5	\$0	1%
Multi_Family	Plug_Load	Existing	Power supply transformer/converter - External pow	2344.293072	90%	100%	15	\$47	1%
Multi_Family	Plug_Load	Existing	Powerstrip with Occupancy Sensor	2344.293072	100%	100%	20	\$90	2%
Multi_Family	Plug_Load	New	1-Watt Standby Power	2344.293072	100%	21%	7	\$120	9%
Multi_Family	Plug_Load	New	Advanced Appliance Motor ECMs, (2) Other	2344.293072	100%	80%	14	\$1,082	8%
Multi_Family	Plug_Load	New	Digital set top Receivers	2344.293072	80%	100%	6	\$0	0%
Multi_Family	Plug_Load	New	Efficient DVD systems	2344.293072	70%	100%	7	\$0	0%
Multi_Family	Plug_Load	New	Efficient high definition televisions	2344.293072	95%	100%	8	\$250	4%
Multi_Family	Plug_Load	New	Office Equipment: Computer, Energy Star or Better	2344.293072	65%	100%	4	\$0	0%
Multi_Family	Plug_Load	New	Office Equipment: Monitors, Energy Star or Better	2344.293072	50%	100%	4	\$0	1%
Multi_Family	Plug_Load	New	Office Equipment: Printers, Energy Star or Better	2344.293072	85%	100%	5	\$0	1%
Multi_Family	Plug_Load	New	Power supply transformer/converter - External pow	2344.293072	90%	100%	15	\$47	1%
Multi_Family	Plug_Load	New	Powerstrip with Occupancy Sensor	2344.293072	100%	100%	20	\$90	2%
Multi_Family	Refrigeration	Existing	1 kWh/day Refrigerator	550.7538215	100%	90%	18	\$160	27%
Multi_Family	Refrigeration	Existing	Refrigerator, Energy Star or better	550.7538215			18	\$80	15%
Multi_Family	Refrigeration	Existing	Removal of Old Refrigerator	550.7538215	100%	1%	7	\$200	100%
Multi_Family	Refrigeration	Existing	Solid state refrigeration (cool chips ™)	550.7538215	100%	90%	19	\$860	52%
Multi_Family	Refrigeration	New	1 kWh/day Refrigerator	639.7255077	100%	90%	18	\$160	27%
Multi_Family	Refrigeration	New	Refrigerator, Energy Star or better	639.7255077			18	\$80	15%
Multi_Family	Refrigeration	New	Solid state refrigeration (cool chips ™)	639.7255077	100%	90%	19	\$860	40%
Multi_Family	Room_AC	Existing	Room AC - Energy Star	169.1600191			12	\$33	9%
Multi_Family	Room_AC	New	Room AC - Energy Star	172.5398786			12	\$33	9%
Multi_Family	Space_Heat	Existing	Duct Insulation	2215.543912	20%	25%	30	\$245	3%
Multi_Family	Space_Heat	Existing	ES Windows (Class 30)	2215.543912	85%	85%	30	\$1,760	17%
Multi_Family	Space_Heat	Existing	Insulated exterior entry doors with built-in weather-s	2215.543912	75%	100%	10	\$300	4%
Multi_Family	Space_Heat	Existing	Insulation-Wall 2x4	2215.543912	15%	75%	30	\$624	10%
Multi_Family	Space_Heat	Existing	PTCS Aerosol-Based Duct Sealing	2215.543912	100%	19%	25	\$450	9%
Multi_Family	Space_Heat	Existing	PTCS Duct Sealing	2215.543912	50%	25%	20	\$630	9%
Multi_Family	Space_Heat	Existing	Whole house air sealing	2215.543912	100%	90%	10	\$650	5%
Multi_Family	Space_Heat	New	Air-to-Air Heat Exchangers	1258.240321	85%	75%	15	\$1,440	10%
Multi_Family	Space_Heat	New	Green Roof	1258.240321	100%	50%	30	\$19,700	13%
Multi_Family	Space_Heat	New	Leak Proof Duct Fittings	1258.240321	100%	90%	30	\$160	17%
Multi_Family	Water_Heat	Existing	Energy Star Clothes Washer	2368.757886	52%	85%	14	\$600	13%
Multi_Family	Water_Heat	Existing	Energy Star Dishwasher	2368.757886	20%	80%	13	\$45	2%

Building Type	End Use	Vintage	Measure Name	Base Usage	Incomplete Factor	Technical Feasibility	Measure Life	Per Unit Cost	Energy Savings
Multi_Family	Water_Heat	Existing	Faucet Aerators	2368.757886	50%	95%	5	\$5	1%
Multi_Family	Water_Heat	Existing	Heat Pump Water Heater	2368.757886	95%	65%	10	\$1,750	40%
Multi_Family	Water_Heat	Existing	Hot Water Pipe Insulation	2368.757886	62%	70%	15	\$8	1%
Multi_Family	Water_Heat	Existing	Low-Flow Showerheads	2368.757886	45%	95%	7	\$20	3%
Multi_Family	Water_Heat	Existing	Solar Water Heater	2368.757886	95%	45%	15	\$5,500	40%
Multi_Family	Water_Heat	New	Energy Star Clothes Washer	2057.847911	52%	97%	14	\$600	13%
Multi_Family	Water_Heat	New	Energy Star Dishwasher	2057.847911	20%	80%	13	\$45	2%
Multi_Family	Water_Heat	New	Faucet Aerators	2057.847911	40%	100%	5	\$5	1%
Multi_Family	Water_Heat	New	Heat Pump Water Heater	2057.847911	95%	65%	10	\$1,750	40%
Multi_Family	Water_Heat	New	Low-Flow Showerheads	2057.847911	45%	95%	7	\$20	2%
Multi_Family	Water_Heat	New	Solar Water Heater	2057.847911	95%	45%	15	\$5,500	40%
Single_Family	Central_AC	Existing	Central AC - Advanced Technology	314.8976925			15	\$1,125	28%
Single_Family	Central_AC	Existing	Central AC - High Efficiency	314.8976925			15	\$225	7%
Single_Family	Central_AC	Existing	Central AC - Premium Efficiency	314.8976925			15	\$688	19%
Single_Family	Central_AC	New	Central AC - Advanced Technology	372.6103485			15	\$1,125	28%
Single_Family	Central_AC	New	Central AC - High Efficiency	372.6103485			15	\$225	7%
Single_Family	Central_AC	New	Central AC - Premium Efficiency	372.6103485			15	\$688	19%
Single_Family	Dryer	Existing	Advanced Appliance Motor ECM	963.4708986	100%	80%	14	\$239	11%
Single_Family	Dryer	New	Advanced Appliance Motor ECM	808.1607564	100%	80%	14	\$239	11%
Single_Family	Freezer	Existing	Freezer - Energy Star or better	573.8991968			15	\$60	10%
Single_Family	Freezer	New	Freezer - Energy Star or better	573.8991968			15	\$60	10%
Single_Family	Heat_Pump	Existing	ASHP - High Efficiency	3874.648182			20	\$236	9%
Single_Family	Heat_Pump	Existing	ASHP - Premium Efficiency	3874.648182			20	\$534	14%
Single_Family	Heat_Pump	Existing	Advanced Cold-Climate Heat Pump	3874.648182	100%	29%	20	\$4,300	17%
Single_Family	Heat_Pump	Existing	Below Grade Insulation	3874.648182	85%	70%	20	\$1,200	13%
Single_Family	Heat_Pump	Existing	Check Me O & M Tune-up	3874.648182	70%	90%	3	\$225	17%
Single_Family	Heat_Pump	Existing	CheckMe Aerosol-Based Duct Sealing	3874.648182	100%	19%	25	\$750	19%
Single_Family	Heat_Pump	Existing	CheckMe! Heat Pump Duct Sealing	3874.648182	93%	50%	20	\$1,000	25%
Single_Family	Heat_Pump	Existing	ES Windows (Class 30)	3874.648182	85%	95%	30	\$3,101	17%
Single_Family	Heat_Pump	Existing	Insulation-Ceiling	3874.648182	80%	90%	30	\$720	9%
Single_Family	Heat_Pump	Existing	Insulation-Floor	3874.648182	92%	92%	30	\$1,350	11%
Single_Family	Heat_Pump	Existing	Insulation-Rim Joist	3874.648182	75%	60%	30	\$80	2%
Single_Family	Heat_Pump	Existing	Insulation-Wall 2x4	3874.648182	15%	75%	30	\$1,064	10%
Single_Family	Heat_Pump	Existing	Micro Channel Heat Exchangers (Evaporator)	3874.648182	100%	75%	18.4	\$145	5%
Single_Family	Heat_Pump	Existing	Small Scale Absorption Cooling	3874.648182	100%	14%	20	\$3,000	18%
Single_Family	Heat_Pump	Existing	Solid State refrigeration cool chips for heat pumps	3874.648182	100%	29%	18.4	\$2,000	26%
Single_Family	Heat_Pump	Existing	Whole house air sealing	3874.648182	93%	90%	10	\$650	5%
Single_Family	Heat_Pump	New	ASHP - High Efficiency	2930.24126			20	\$236	9%
Single_Family	Heat_Pump	New	ASHP - Premium Efficiency	2930.24126			20	\$534	14%
Single_Family	Heat_Pump	New	Advanced Cold-Climate Heat Pump	2930.24126	100%	29%	20	\$4,300	17%
Single_Family	Heat_Pump	New	Air-to-Air Heat Exchangers	2930.24126	85%	75%	15	\$1,440	10%
Single_Family	Heat_Pump	New	Green Roof	2930.24126	100%	25%	30	\$19,500	13%
Single_Family	Heat_Pump	New	Leak Proof Duct Fittings	2930.24126	100%	90%	30	\$160	17%
Single_Family	Heat_Pump	New	Micro Channel Heat Exchangers (Evaporator)	2930.24126	100%	75%	18.4	\$145	5%
Single_Family	Heat_Pump	New	NW ES Homes - Site Built	2930.24126	90%	100%	27	\$1,350	38%
Single_Family	Heat_Pump	New	Small Scale Absorption Cooling	2930.24126	100%	14%	20	\$3,000	9%
Single_Family	Heat_Pump	New	Solid State refrigeration cool chips for heat pumps	2930.24126	100%	29%	18.4	\$2,000	18%
Single_Family	Heat_Pump	New	Spray in insulation - BIBS or icynene 2*4 Wall	2930.24126	100%	75%	30	\$2,511	30%
Single_Family	Lighting	Existing	CFL Fixtures, High Use	2176.807147	65%	95%	10	\$60	9%
Single_Family	Lighting	Existing	CFL Fixtures, Low Use	2176.807147	75%	95%	10	\$60	2%
Single_Family	Lighting	Existing	CFL Fixtures, Medium Use	2176.807147	70%	95%	10	\$60	2%

Building Type	End Use	Vintage	Measure Name	Base Usage	Incomplete Factor	Technical Feasibility	Measure Life	Per Unit Cost	Energy Savings
Single_Family	Lighting	Existing	CFL Lamps, High Use	2176.807147	65%	95%	6	\$5	43%
Single_Family	Lighting	Existing	CFL Lamps, Low Use	2176.807147	75%	95%	12	\$5	9%
Single_Family	Lighting	Existing	CFL Lamps, Medium Use	2176.807147	70%	95%	8	\$5	6%
Single_Family	Lighting	Existing	CFL Torchieries, High Use	2176.807147	65%	95%	8	\$90	3%
Single_Family	Lighting	Existing	CFL Torchieries, Low Use	2176.807147	75%	95%	8	\$90	1%
Single_Family	Lighting	Existing	CFL Torchieries, Medium Use	2176.807147	70%	95%	8	\$90	1%
Single_Family	Lighting	Existing	LED Interior Lighting (White), High Use	2176.807147	100%	50%	10	\$28	54%
Single_Family	Lighting	Existing	LED Interior Lighting (White), Low Use	2176.807147	100%	50%	10	\$28	11%
Single_Family	Lighting	Existing	LED Interior Lighting (White), Medium Use	2176.807147	100%	50%	10	\$28	8%
Single_Family	Lighting	New	CFL Fixtures, High Use	2176.807147	55%	95%	10	\$60	9%
Single_Family	Lighting	New	CFL Fixtures, Low Use	2176.807147	70%	95%	10	\$60	2%
Single_Family	Lighting	New	CFL Fixtures, Medium Use	2176.807147	60%	95%	10	\$60	2%
Single_Family	Lighting	New	CFL Lamps, High Use	2176.807147	55%	95%	6	\$5	43%
Single_Family	Lighting	New	CFL Lamps, Low Use	2176.807147	70%	95%	12	\$5	9%
Single_Family	Lighting	New	CFL Lamps, Medium Use	2176.807147	60%	95%	8	\$5	6%
Single_Family	Lighting	New	CFL Torchieries, High Use	2176.807147	55%	95%	8	\$90	3%
Single_Family	Lighting	New	CFL Torchieries, Low Use	2176.807147	70%	95%	8	\$90	1%
Single_Family	Lighting	New	CFL Torchieries, Medium Use	2176.807147	60%	95%	8	\$90	1%
Single_Family	Lighting	New	LED Interior Lighting (White), High Use	2176.807147	100%	50%	10	\$28	54%
Single_Family	Lighting	New	LED Interior Lighting (White), Low Use	2176.807147	100%	50%	10	\$28	11%
Single_Family	Lighting	New	LED Interior Lighting (White), Medium Use	2176.807147	100%	50%	10	\$28	8%
Single_Family	Plug_Load	Existing	1-Watt Standby Power	5179.286913	100%	21%	7	\$120	8%
Single_Family	Plug_Load	Existing	Advanced Appliance Motor ECMs, (2) Other	5179.286913	100%	80%	14	\$1,082	4%
Single_Family	Plug_Load	Existing	Digital set top Receivers	5179.286913	80%	100%	6	\$0	0%
Single_Family	Plug_Load	Existing	Efficient DVD systems	5179.286913	70%	100%	7	\$0	0%
Single_Family	Plug_Load	Existing	Efficient high definition televisions	5179.286913	95%	100%	8	\$250	2%
Single_Family	Plug_Load	Existing	Office Equipment: Computer, Energy Star or Better	5179.286913	65%	100%	4	\$0	0%
Single_Family	Plug_Load	Existing	Office Equipment: Monitors, Energy Star or Better	5179.286913	50%	100%	4	\$0	1%
Single_Family	Plug_Load	Existing	Office Equipment: Printers, Energy Star or Better	5179.286913	85%	100%	5	\$0	1%
Single_Family	Plug_Load	Existing	Power supply transformer/converter - External pow	5179.286913	90%	100%	15	\$47	0%
Single_Family	Plug_Load	Existing	Powerstrip with Occupancy Sensor	5179.286913	100%	100%	20	\$90	1%
Single_Family	Plug_Load	New	1-Watt Standby Power	5179.286913	100%	21%	7	\$120	8%
Single_Family	Plug_Load	New	Advanced Appliance Motor ECMs, (2) Other	5179.286913	100%	80%	14	\$1,082	4%
Single_Family	Plug_Load	New	Digital set top Receivers	5179.286913	80%	100%	6	\$0	0%
Single_Family	Plug_Load	New	Efficient DVD systems	5179.286913	70%	100%	7	\$0	0%
Single_Family	Plug_Load	New	Efficient high definition televisions	5179.286913	95%	100%	8	\$250	2%
Single_Family	Plug_Load	New	Office Equipment: Computer, Energy Star or Better	5179.286913	65%	100%	4	\$0	0%
Single_Family	Plug_Load	New	Office Equipment: Monitors, Energy Star or Better	5179.286913	50%	100%	4	\$0	1%
Single_Family	Plug_Load	New	Office Equipment: Printers, Energy Star or Better	5179.286913	85%	100%	5	\$0	1%
Single_Family	Plug_Load	New	Power supply transformer/converter - External pow	5179.286913	90%	100%	15	\$47	0%
Single_Family	Plug_Load	New	Powerstrip with Occupancy Sensor	5179.286913	100%	100%	20	\$90	0%
Single_Family	Refrigeration	Existing	1 kWh/day Refrigerator	655.8284793	100%	90%	18	\$160	27%
Single_Family	Refrigeration	Existing	Refrigerator, Energy Star or better	655.8284793			18	\$80	15%
Single_Family	Refrigeration	Existing	Removal of Old Refrigerator	655.8284793	100%	10%	7	\$200	100%
Single_Family	Refrigeration	Existing	Solid state refrigeration (cool chips ™)	655.8284793	100%	90%	19	\$860	52%
Single_Family	Refrigeration	New	1 kWh/day Refrigerator	653.5074788	100%	90%	18	\$160	27%
Single_Family	Refrigeration	New	Refrigerator, Energy Star or better	653.5074788			18	\$80	15%
Single_Family	Refrigeration	New	Solid state refrigeration (cool chips ™)	653.5074788	100%	90%	19	\$860	40%
Single_Family	Room_AC	Existing	Room AC - Energy Star	222.308448			12	\$33	9%
Single_Family	Room_AC	New	Room AC - Energy Star	222.308448			12	\$33	9%
Single_Family	Space_Heat	Existing	Below Grade Insulation	6181.398559	85%	70%	20	\$1,200	13%

Building Type	End Use	Vintage	Measure Name	Base Usage	Incomplete Factor	Technical Feasibility	Measure Life	Per Unit Cost	Energy Savings
Single_Family	Space_Heat	Existing	Duct Insulation	6181.398559	20%	50%	30	\$376	4%
Single_Family	Space_Heat	Existing	ES Windows (Class 30)	6181.398559	85%	95%	30	\$3,101	17%
Single_Family	Space_Heat	Existing	Insulation-Ceiling	6181.398559	80%	90%	30	\$720	9%
Single_Family	Space_Heat	Existing	Insulation-Floor	6181.398559	98%	75%	30	\$1,350	11%
Single_Family	Space_Heat	Existing	Insulation-Rim Joist	6181.398559	75%	60%	30	\$80	2%
Single_Family	Space_Heat	Existing	Insulation-Wall 2x4	6181.398559	15%	75%	30	\$1,064	10%
Single_Family	Space_Heat	Existing	PTCS Aerosol-Based Duct Sealing	6181.398559	100%	19%	25	\$750	9%
Single_Family	Space_Heat	Existing	PTCS Duct Sealing	6181.398559	50%	50%	20	\$1,000	25%
Single_Family	Space_Heat	Existing	Whole house air sealing	6181.398559	93%	90%	10	\$650	5%
Single_Family	Space_Heat	New	Air-to-Air Heat Exchangers	2982.257473	85%	75%	15	\$1,440	10%
Single_Family	Space_Heat	New	Green Roof	2982.257473	100%	50%	30	\$19,500	13%
Single_Family	Space_Heat	New	Leak Proof Duct Fittings	2982.257473	100%	90%	30	\$160	17%
Single_Family	Space_Heat	New	NW ES Homes - Site Built	2982.257473	90%	100%	27	\$1,350	38%
Single_Family	Space_Heat	New	Spray in insulation - BIBS or icynene 2*4 Wall	2982.257473	100%	75%	30	\$2,511	30%
Single_Family	Water_Heat	Existing	Energy Star Clothes Washer	3139.220119	45%	100%	14	\$600	13%
Single_Family	Water_Heat	Existing	Energy Star Dishwasher	3139.220119	20%	90%	13	\$45	2%
Single_Family	Water_Heat	Existing	Faucet Aerators	3139.220119	55%	95%	5	\$5	1%
Single_Family	Water_Heat	Existing	Heat Pump Water Heater	3139.220119	95%	70%	10	\$1,750	40%
Single_Family	Water_Heat	Existing	Hot Water Pipe Insulation	3139.220119	62%	75%	15	\$8	1%
Single_Family	Water_Heat	Existing	Low-Flow Showerheads	3139.220119	45%	95%	7	\$20	3%
Single_Family	Water_Heat	Existing	Solar Water Heater	3139.220119	95%	45%	15	\$5,500	40%
Single_Family	Water_Heat	New	Drain Water Heat Recovery (GFX)	2733.763884	95%	65%	15	\$460	25%
Single_Family	Water_Heat	New	Energy Star Clothes Washer	2733.763884	45%	100%	14	\$600	13%
Single_Family	Water_Heat	New	Energy Star Dishwasher	2733.763884	20%	90%	13	\$45	2%
Single_Family	Water_Heat	New	Faucet Aerators	2733.763884	45%	100%	5	\$5	1%
Single_Family	Water_Heat	New	Heat Pump Water Heater	2733.763884	95%	70%	10	\$1,750	40%
Single_Family	Water_Heat	New	Low-Flow Showerheads	2733.763884	45%	95%	7	\$20	2%
Single_Family	Water_Heat	New	Solar Water Heater	2733.763884	95%	45%	15	\$5,500	40%

**Table A-2. Residential Gas Measures**

Building Type	End Use	Vintage	Measure Name	Base Usage	Incomplete Factor	Technical Feasibility	Measure Life	Per Unit Cost	Energy Savings
Manufactured	Space_Heat	Existing	Advanced Efficiency - Condensing Furnace	370			18	\$950	19%
Manufactured	Space_Heat	Existing	Duct Insulation	370	20%	50%	25	\$300	3%
Manufactured	Space_Heat	Existing	ES Windows (Class 30)	370	85%	75%	25	\$2,300	25%
Manufactured	Space_Heat	Existing	High Efficiency Condensing Furnace	370			18	\$40	3%
Manufactured	Space_Heat	Existing	Insulation-Ceiling	370	90%	55%	25	\$765	9%
Manufactured	Space_Heat	Existing	Insulation-Floor	370	40%	40%	25	\$1,400	11%
Manufactured	Space_Heat	Existing	Insulation-Wall 2x4	370	15%	100%	25	\$1,660	10%
Manufactured	Space_Heat	Existing	PTCS Duct Sealing	370	30%	50%	20	\$1,000	9%
Manufactured	Space_Heat	Existing	Premium Efficiency - Condensing Furnace	370			18	\$600	13%
Manufactured	Space_Heat	Existing	Whole house air sealing	370	40%	90%	10	\$300	6%
Manufactured	Space_Heat	New	Advanced Efficiency - Condensing Furnace	319			18	\$950	19%
Manufactured	Space_Heat	New	Air-to-Air Heat Exchangers	319	85%	20%	15	\$1,440	10%
Manufactured	Space_Heat	New	ES Labeled - New Manufactured Housing	319	95%	100%	23	\$1,100	34%
Manufactured	Space_Heat	New	High Efficiency Condensing Furnace	319			18	\$40	3%
Manufactured	Space_Heat	New	Leak Proof Duct Fittings	319	95%	90%	30	\$160	17%
Manufactured	Space_Heat	New	Premium Efficiency - Condensing Furnace	319			18	\$600	13%
Manufactured	Water_Heat	Existing	Energy Star Clothes Washer	223	50%	100%	14	\$600	13%
Manufactured	Water_Heat	Existing	Energy Star Dishwasher	223	36%	100%	13	\$50	4%
Manufactured	Water_Heat	Existing	Faucet Aerators	223	55%	95%	5	\$5	1%
Manufactured	Water_Heat	Existing	HE Storage Water Heater	223			13	\$70	8%
Manufactured	Water_Heat	Existing	Hot Water Pipe Insulation	223	62%	50%	10	\$8	1%
Manufactured	Water_Heat	Existing	Low-Flow Showerheads	223	45%	95%	7	\$20	3%
Manufactured	Water_Heat	Existing	Solar Water Heater	223	95%	45%	15	\$5,500	40%
Manufactured	Water_Heat	Existing	Tankless Water Heater	223	90%	30%	13	\$450	20%
Manufactured	Water_Heat	New	Energy Star Clothes Washer	264	50%	100%	14	\$600	13%
Manufactured	Water_Heat	New	Energy Star Dishwasher	264	36%	100%	13	\$50	4%
Manufactured	Water_Heat	New	Faucet Aerators	264	45%	100%	5	\$5	1%
Manufactured	Water_Heat	New	HE Storage Water Heater	264			13	\$70	8%
Manufactured	Water_Heat	New	Low-Flow Showerheads	264	45%	95%	7	\$20	2%
Manufactured	Water_Heat	New	Solar Water Heater	264	95%	45%	15	\$5,500	40%
Manufactured	Water_Heat	New	Tankless Water Heater	264	90%	30%	13	\$450	20%
Multi_Family	Space_Heat	Existing	Advanced Efficiency - Condensing Furnace	289			18	\$950	19%
Multi_Family	Space_Heat	Existing	Duct Insulation	289	20%	25%	30	\$245	3%
Multi_Family	Space_Heat	Existing	ES Windows (Class 30)	289	85%	75%	30	\$1,760	27%
Multi_Family	Space_Heat	Existing	High Efficiency Condensing Furnace	289			18	\$40	3%
Multi_Family	Space_Heat	Existing	Insulated exterior entry doors with built-in weather-stripping	289	60%	100%	10	\$300	4%
Multi_Family	Space_Heat	Existing	Insulation-Wall 2x4	289	15%	60%	30	\$624	10%
Multi_Family	Space_Heat	Existing	Integrated Space and Water Heating	289	95%	10%	20	\$1,300	13%
Multi_Family	Space_Heat	Existing	PTCS Aerosol-Based Duct Sealing	289	100%	19%	25	\$450	19%
Multi_Family	Space_Heat	Existing	PTCS Duct Sealing	289	75%	50%	20	\$630	9%
Multi_Family	Space_Heat	Existing	Premium Efficiency - Condensing Furnace	289			18	\$600	13%
Multi_Family	Space_Heat	Existing	Whole house air sealing	289	40%	90%	10	\$486	6%
Multi_Family	Space_Heat	New	Advanced Efficiency - Condensing Furnace	251			18	\$950	19%
Multi_Family	Space_Heat	New	Air-to-Air Heat Exchangers	251	85%	75%	15	\$1,440	10%
Multi_Family	Space_Heat	New	Green Roof	251	100%	50%	30	\$19,700	13%
Multi_Family	Space_Heat	New	High Efficiency Condensing Furnace	251			18	\$40	3%
Multi_Family	Space_Heat	New	Integrated Space and Water Heating	251	95%	30%	20	\$1,300	13%



Building Type	End Use	Vintage	Measure Name	Base Usage	Incomplete Factor	Technical Feasibility	Measure Life	Per Unit Cost	Energy Savings
Multi_Family	Space_Heat	New	Leak Proof Duct Fittings	251	95%	90%	30	\$160	17%
Multi_Family	Space_Heat	New	Premium Efficiency - Condensing Furnace	251			18	\$600	13%
Multi_Family	Water_Heat	Existing	Energy Star Clothes Washer	194	52%	100%	14	\$600	13%
Multi_Family	Water_Heat	Existing	Energy Star Dishwasher	194	35%	100%	13	\$50	4%
Multi_Family	Water_Heat	Existing	Faucet Aerators	194	50%	95%	5	\$5	1%
Multi_Family	Water_Heat	Existing	HE Storage Water Heater	194			13	\$70	8%
Multi_Family	Water_Heat	Existing	Hot Water Pipe Insulation	194	62%	25%	10	\$8	1%
Multi_Family	Water_Heat	Existing	Integrated Space and Water Heating	194	95%	25%	20	\$1,200	5%
Multi_Family	Water_Heat	Existing	Low-Flow Showerheads	194	45%	95%	7	\$20	3%
Multi_Family	Water_Heat	Existing	Solar Water Heater	194	95%	45%	15	\$5,500	40%
Multi_Family	Water_Heat	Existing	Tankless Water Heater	194	90%	50%	13	\$450	20%
Multi_Family	Water_Heat	New	Energy Star Clothes Washer	230	52%	100%	14	\$600	13%
Multi_Family	Water_Heat	New	Energy Star Dishwasher	230	35%	100%	13	\$50	4%
Multi_Family	Water_Heat	New	Faucet Aerators	230	40%	100%	5	\$5	1%
Multi_Family	Water_Heat	New	HE Storage Water Heater	230			13	\$70	8%
Multi_Family	Water_Heat	New	Integrated Space and Water Heating	230	95%	25%	20	\$1,200	5%
Multi_Family	Water_Heat	New	Low-Flow Showerheads	230	45%	95%	7	\$20	2%
Multi_Family	Water_Heat	New	Solar Water Heater	230	95%	45%	15	\$5,500	40%
Multi_Family	Water_Heat	New	Tankless Water Heater	230	90%	50%	13	\$450	20%
Single_Family	Space_Heat	Existing	Advanced Efficiency - Condensing Furnace	614			18	\$950	19%
Single_Family	Space_Heat	Existing	Below Grade Insulation	614	85%	70%	20	\$1,200	13%
Single_Family	Space_Heat	Existing	Duct Insulation	614	20%	50%	30	\$376	4%
Single_Family	Space_Heat	Existing	ES Windows (Class 30)	614	85%	75%	30	\$3,101	17%
Single_Family	Space_Heat	Existing	High Efficiency Condensing Furnace	614			18	\$40	3%
Single_Family	Space_Heat	Existing	Insulation-Ceiling	614	80%	90%	30	\$720	9%
Single_Family	Space_Heat	Existing	Insulation-Floor	614	40%	40%	30	\$1,350	11%
Single_Family	Space_Heat	Existing	Insulation-Rim Joist	614	75%	60%	30	\$80	2%
Single_Family	Space_Heat	Existing	Insulation-Wall 2x4	614	15%	75%	30	\$1,064	10%
Single_Family	Space_Heat	Existing	Integrated Space and Water Heating	614	95%	25%	20	\$1,300	13%
Single_Family	Space_Heat	Existing	PTCS Aerosol-Based Duct Sealing	614	100%	19%	25	\$750	19%
Single_Family	Space_Heat	Existing	PTCS Duct Sealing	614	30%	50%	20	\$1,000	25%
Single_Family	Space_Heat	Existing	Premium Efficiency - Condensing Furnace	614			18	\$600	13%
Single_Family	Space_Heat	Existing	Whole house air sealing	614	40%	90%	10	\$650	6%
Single_Family	Space_Heat	New	Advanced Efficiency - Condensing Furnace	528			18	\$950	19%
Single_Family	Space_Heat	New	Air-to-Air Heat Exchangers	528	85%	75%	15	\$1,440	10%
Single_Family	Space_Heat	New	Green Roof	528	100%	50%	30	\$19,500	13%
Single_Family	Space_Heat	New	High Efficiency Condensing Furnace	528			18	\$40	3%
Single_Family	Space_Heat	New	Integrated Space and Water Heating	528	95%	35%	20	\$1,300	13%
Single_Family	Space_Heat	New	Leak Proof Duct Fittings	528	95%	90%	30	\$160	17%
Single_Family	Space_Heat	New	NW ES Homes - Site Built	528	90%	40%	26.7	\$3,656	38%
Single_Family	Space_Heat	New	Premium Efficiency - Condensing Furnace	528			18	\$600	13%
Single_Family	Space_Heat	New	Spray in insulation - BIBS or icynene 2*6 Wall	528	100%	75%	30	\$2,511	30%
Single_Family	Water_Heat	Existing	Energy Star Clothes Washer	273	45%	100%	14	\$600	13%
Single_Family	Water_Heat	Existing	Energy Star Dishwasher	273	30%	100%	13	\$50	4%
Single_Family	Water_Heat	Existing	Faucet Aerators	273	55%	95%	5	\$5	1%
Single_Family	Water_Heat	Existing	HE Storage Water Heater	273			13	\$70	8%
Single_Family	Water_Heat	Existing	Hot Water Pipe Insulation	273	62%	50%	10	\$8	1%
Single_Family	Water_Heat	Existing	Integrated Space and Water Heating	273	95%	50%	20	\$1,200	5%
Single_Family	Water_Heat	Existing	Low-Flow Showerheads	273	45%	95%	7	\$20	3%

Building Type	End Use	Vintage	Measure Name	Base Usage	Incomplete Factor	Technical Feasibility	Measure Life	Per Unit Cost	Energy Savings
Single_Family	Water_Heat	Existing	Solar Water Heater	273	95%	45%	15	\$5,500	40%
Single_Family	Water_Heat	Existing	Tankless Water Heater	273	90%	60%	13	\$450	20%
Single_Family	Water_Heat	New	Drain Water Heat Recovery (GFX)	323	95%	50%	15	\$400	25%
Single_Family	Water_Heat	New	Energy Star Clothes Washer	323	45%	100%	14	\$600	13%
Single_Family	Water_Heat	New	Energy Star Dishwasher	323	30%	100%	13	\$50	4%
Single_Family	Water_Heat	New	Faucet Aerators	323	45%	100%	5	\$5	1%
Single_Family	Water_Heat	New	HE Storage Water Heater	323			13	\$70	8%
Single_Family	Water_Heat	New	Integrated Space and Water Heating	323	95%	50%	20	\$1,200	5%
Single_Family	Water_Heat	New	Low-Flow Showerheads	323	45%	95%	7	\$20	2%
Single_Family	Water_Heat	New	Solar Water Heater	323	95%	45%	15	\$5,500	40%
Single_Family	Water_Heat	New	Tankless Water Heater	323	90%	60%	13	\$450	25%

**Table A-3. Commercial Electric Measures**

Building Type	End Use	Vintage	Measure Name	Base Usage	Incomplete Factor	Technical Feasibility	Measure Life	Per Unit Cost	Energy Savings
Dry_Goods_Retail	Cooling_Chillers	Existing	Automated Ventilation VFD Control (Occupancy Sensors / CO2 Sensors)	1.16084	95%	75%	10	\$0.24	\$0.05
Dry_Goods_Retail	Cooling_Chillers	Existing	Chilled Water / Condenser Water Settings-Optimization	1.16084	45%	95%	10	\$0.23	\$0.05
Dry_Goods_Retail	Cooling_Chillers	Existing	Chilled Water Piping Loop w/ VSD Control	1.16084	75%	90%	15	\$0.38	\$0.12
Dry_Goods_Retail	Cooling_Chillers	Existing	Chiller Tune-Up / Diagnostics	1.16084	65%	98%	3	\$0.09	\$0.10
Dry_Goods_Retail	Cooling_Chillers	Existing	Chiller-Centrifugal, VSD Control, 300 tons	1.16084			20	\$0.50	\$0.25
Dry_Goods_Retail	Cooling_Chillers	Existing	Chiller-Water Side Economizer	1.16084	95%	45%	20	\$0.59	\$0.10
Dry_Goods_Retail	Cooling_Chillers	Existing	Convert Constant Volume Air System to VAV	1.16084	15%	85%	15	\$0.19	\$0.12
Dry_Goods_Retail	Cooling_Chillers	Existing	Cooling Tower-Decrease Approach Temperature	1.16084	98%	70%	15	\$0.07	\$0.08
Dry_Goods_Retail	Cooling_Chillers	Existing	Cooling Tower-Two-Speed Fan Motor	1.16084	75%	95%	15	\$0.04	\$0.14
Dry_Goods_Retail	Cooling_Chillers	Existing	Cooling Tower-VSD Fan Control	1.16084	90%	95%	15	\$0.06	\$0.04
Dry_Goods_Retail	Cooling_Chillers	Existing	Direct Digital Control System-Installation	1.16084	20%	60%	10	\$0.15	\$0.10
Dry_Goods_Retail	Cooling_Chillers	Existing	Direct Digital Control System-Optimization	1.16084	99%	100%	5	\$0.12	\$0.01
Dry_Goods_Retail	Cooling_Chillers	Existing	High Efficiency Centrifugal Chiller, 300 ton	1.16084			20	\$0.15	\$0.20
Dry_Goods_Retail	Cooling_Chillers	Existing	Insulation - Floor	1.16084	95%	60%	20	\$0.47	\$0.02
Dry_Goods_Retail	Cooling_Chillers	Existing	Insulation - Roof / Ceiling	1.16084	90%	75%	20	\$0.47	\$0.03
Dry_Goods_Retail	Cooling_Chillers	Existing	Pipe Insulation	1.16084	50%	65%	20	\$0.03	\$0.01
Dry_Goods_Retail	Cooling_Chillers	Existing	Retro-Commissioning	1.16084	85%	92%	3	\$0.27	\$0.15
Dry_Goods_Retail	Cooling_Chillers	Existing	Windows-High Efficiency	1.16084	85%	80%	30	\$0.23	\$0.10
Dry_Goods_Retail	Cooling_Chillers	New	Automated Ventilation VFD Control (Occupancy Sensors / CO2 Sensors)	1.22194	95%	75%	10	\$0.24	\$0.05
Dry_Goods_Retail	Cooling_Chillers	New	Chilled Water / Condenser Water Settings-Optimization	1.22194	45%	95%	10	\$0.23	\$0.05
Dry_Goods_Retail	Cooling_Chillers	New	Chilled Water Piping Loop w/ VSD Control	1.22194	75%	90%	15	\$0.38	\$0.12
Dry_Goods_Retail	Cooling_Chillers	New	Chiller-Centrifugal, VSD Control, 300 tons	1.22194			20	\$0.50	\$0.25
Dry_Goods_Retail	Cooling_Chillers	New	Cooling Tower-Two-Speed Fan Motor	1.22194	10%	95%	15	\$0.04	\$0.14
Dry_Goods_Retail	Cooling_Chillers	New	Cooling Tower-VSD Fan Control	1.22194	80%	95%	15	\$0.06	\$0.04
Dry_Goods_Retail	Cooling_Chillers	New	Direct Digital Control System-Optimization	1.22194	99%	100%	5	\$0.12	\$0.01
Dry_Goods_Retail	Cooling_Chillers	New	Green Roof	1.22194	100%	25%	40	\$15.00	\$0.13
Dry_Goods_Retail	Cooling_Chillers	New	High Efficiency Centrifugal Chiller, 300 ton	1.22194			20	\$0.15	\$0.20
Dry_Goods_Retail	Cooling_Chillers	New	Leak Proof Duct Fittings	1.22194	100%	49%	30	\$0.07	\$0.21
Dry_Goods_Retail	Cooling_Chillers	New	Pipe Insulation	1.22194	50%	100%	20	\$0.03	\$0.01
Dry_Goods_Retail	Cooling_Chillers	New	Retro-Commissioning	1.22194	85%	92%	3	\$1.00	\$0.15
Dry_Goods_Retail	Cooling_Chillers	New	Windows-High Efficiency	1.22194	85%	80%	30	\$0.28	\$0.10
Dry_Goods_Retail	Cooling_DX	Existing	Automated Ventilation VFD Control (Occupancy Sensors / CO2 Sensors)	1.97186	95%	75%	10	\$0.48	\$0.05
Dry_Goods_Retail	Cooling_DX	Existing	Convert Constant Volume Air System to VAV	1.97186	15%	85%	15	\$0.48	\$0.12
Dry_Goods_Retail	Cooling_DX	Existing	DX Package-Air Side Economizer	1.97186	85%	10%	10	\$0.39	\$0.15
Dry_Goods_Retail	Cooling_DX	Existing	DX Tune-Up / Diagnostics	1.97186	85%	98%	3	\$0.20	\$0.10
Dry_Goods_Retail	Cooling_DX	Existing	Direct / Indirect Evaporative Cooling, Pre-Cooling	1.97186	90%	50%	10	\$0.73	\$0.10
Dry_Goods_Retail	Cooling_DX	Existing	Duct Insulation	1.97186	20%	65%	20	\$0.03	\$0.03
Dry_Goods_Retail	Cooling_DX	Existing	Duct Repair and Sealing	1.97186	50%	65%	20	\$0.04	\$0.01
Dry_Goods_Retail	Cooling_DX	Existing	High Efficiency DX Package	1.97186			20	\$0.50	\$0.09
Dry_Goods_Retail	Cooling_DX	Existing	Insulation - Floor	1.97186	95%	60%	20	\$0.47	\$0.02
Dry_Goods_Retail	Cooling_DX	Existing	Insulation - Roof / Ceiling	1.97186	90%	75%	20	\$0.47	\$0.03
Dry_Goods_Retail	Cooling_DX	Existing	Premium Efficiency DX Package	1.97186			20	\$0.75	\$0.16
Dry_Goods_Retail	Cooling_DX	Existing	Programmable Thermostat	1.97186	48%	100%	10	\$0.05	\$0.10
Dry_Goods_Retail	Cooling_DX	Existing	Retro-Commissioning	1.97186	85%	92%	3	\$0.27	\$0.15
Dry_Goods_Retail	Cooling_DX	Existing	Windows-High Efficiency	1.97186	85%	80%	30	\$0.23	\$0.05
Dry_Goods_Retail	Cooling_DX	New	Automated Ventilation VFD Control (Occupancy Sensors / CO2 Sensors)	2.11564	95%	75%	10	\$0.24	\$0.05
Dry_Goods_Retail	Cooling_DX	New	Direct / Indirect Evaporative Cooling, Pre-Cooling	2.11564	90%	50%	10	\$0.73	\$0.10
Dry_Goods_Retail	Cooling_DX	New	Green Roof	2.11564	100%	25%	40	\$15.00	\$0.13
Dry_Goods_Retail	Cooling_DX	New	High Efficiency DX Package	2.11564			20	\$0.50	\$0.09
Dry_Goods_Retail	Cooling_DX	New	Leak Proof Duct Fittings	2.11564	100%	49%	30	\$0.07	\$0.21
Dry_Goods_Retail	Cooling_DX	New	Premium Efficiency DX Package	2.11564			20	\$0.75	\$0.16
Dry_Goods_Retail	Cooling_DX	New	Retro-Commissioning	2.11564	85%	92%	3	\$1.00	\$0.15
Dry_Goods_Retail	Cooling_DX	New	Windows-High Efficiency	2.11564	85%	80%	30	\$0.08	\$0.05
Dry_Goods_Retail	Cooling_HeatPump	Existing	Automated Ventilation VFD Control (Occupancy Sensors / CO2 Sensors)	2.01300	95%	75%	10	\$0.24	\$0.05
Dry_Goods_Retail	Cooling_HeatPump	Existing	Direct / Indirect Evaporative Cooling, Pre-Cooling	2.01300	90%	50%	10	\$0.73	\$0.10
Dry_Goods_Retail	Cooling_HeatPump	Existing	Duct Insulation	2.01300	20%	65%	20	\$0.03	\$0.03
Dry_Goods_Retail	Cooling_HeatPump	Existing	Duct Repair and Sealing	2.01300	50%	65%	20	\$0.04	\$0.01

Building Type	End Use	Vintage	Measure Name	Base Usage	Incomplete Factor	Technical Feasibility	Measure Life	Per Unit Cost	Energy Savings
Dry_Goods_Retail	Cooling_HeatPump	Existing	Insulation - Floor	2.01300	95%	60%	20	\$0.47	\$0.02
Dry_Goods_Retail	Cooling_HeatPump	Existing	Insulation - Roof / Ceiling	2.01300	90%	75%	20	\$0.47	\$0.03
Dry_Goods_Retail	Cooling_HeatPump	Existing	Programmable Thermostat	2.01300	48%	100%	10	\$0.05	\$0.10
Dry_Goods_Retail	Cooling_HeatPump	Existing	Retro-Commissioning	2.01300	85%	92%	3	\$0.27	\$0.15
Dry_Goods_Retail	Cooling_HeatPump	Existing	Windows-High Efficiency	2.01300	85%	80%	30	\$0.23	\$0.05
Dry_Goods_Retail	Cooling_HeatPump	New	Automated Ventilation VFD Control (Occupancy Sensors / CO2 Sensors)	2.06461	95%	75%	10	\$0.24	\$0.05
Dry_Goods_Retail	Cooling_HeatPump	New	Direct / Indirect Evaporative Cooling, Pre-Cooling	2.06461	90%	50%	10	\$0.73	\$0.10
Dry_Goods_Retail	Cooling_HeatPump	New	Green Roof	2.06461	100%	25%	40	\$15.00	\$0.13
Dry_Goods_Retail	Cooling_HeatPump	New	Leak Proof Duct Fittings	2.06461	100%	49%	30	\$0.07	\$0.21
Dry_Goods_Retail	Cooling_HeatPump	New	Retro-Commissioning	2.06461	85%	92%	3	\$1.00	\$0.15
Dry_Goods_Retail	Cooling_HeatPump	New	Windows-High Efficiency	2.06461	85%	80%	30	\$0.08	\$0.05
Dry_Goods_Retail	Lighting	Existing	Advanced High Intensity Discharge (HID) Light Sources	4.63565	100%	6%	4	\$0.07	\$0.10
Dry_Goods_Retail	Lighting	Existing	Advanced/Integrated Daylighting controls (ADCs)	4.63565	100%	66%	20	\$2.50	\$0.12
Dry_Goods_Retail	Lighting	Existing	Bi-Level Control, Stairwell Lighting	4.63565	98%	95%	7	\$0.10	\$0.02
Dry_Goods_Retail	Lighting	Existing	Continuous Dimming, Fluorescent Fixtures	4.63565	90%	60%	18	\$0.44	\$0.10
Dry_Goods_Retail	Lighting	Existing	Induction Lighting	4.63565	99%	25%	25	\$0.59	\$0.01
Dry_Goods_Retail	Lighting	Existing	LED Exit Signs	4.63565	98%	100%	25	\$0.12	\$0.01
Dry_Goods_Retail	Lighting	Existing	LED Solid State White Lighting	4.63565	100%	7%	6	\$1.76	\$0.01
Dry_Goods_Retail	Lighting	Existing	Low Wattage Ceramic Metal Halide Lamps	4.63565	100%	6%	7	\$1.34	\$0.14
Dry_Goods_Retail	Lighting	Existing	Occupancy Sensor Control, Fluorescent	4.63565	95%	85%	14	\$0.58	\$0.01
Dry_Goods_Retail	Lighting	Existing	Reduce Interior Lighting Power Density 15% Reduction (W/sqft)	4.63565	75%	98%	7	\$0.26	\$0.15
Dry_Goods_Retail	Lighting	Existing	Reduce Interior Lighting Power Density 25% Reduction (W/sqft)	4.63565	90%	85%	7	\$0.48	\$0.25
Dry_Goods_Retail	Lighting	Existing	Scotopic (High CCT) Lighting	4.63565	100%	13%	15	\$0.55	\$0.16
Dry_Goods_Retail	Lighting	Existing	Stepped Dimming Fluorescent Fixtures	4.63565	85%	60%	18	\$0.70	\$0.08
Dry_Goods_Retail	Lighting	New	Advanced High Intensity Discharge (HID) Light Sources	4.31466	100%	6%	4	\$0.07	\$0.18
Dry_Goods_Retail	Lighting	New	Advanced/Integrated Daylighting controls (ADCs)	4.31466	100%	66%	20	\$2.50	\$0.12
Dry_Goods_Retail	Lighting	New	Bi-Level Control, Stairwell Lighting	4.31466	98%	95%	7	\$0.10	\$0.03
Dry_Goods_Retail	Lighting	New	Continuous Dimming, Fluorescent Fixtures	4.31466	90%	60%	18	\$0.22	\$0.10
Dry_Goods_Retail	Lighting	New	Induction Lighting	4.31466	99%	25%	25	\$0.59	\$0.01
Dry_Goods_Retail	Lighting	New	LED Exit Signs	4.31466	98%	100%	25	\$0.04	\$0.01
Dry_Goods_Retail	Lighting	New	LED Solid State White Lighting	4.31466	100%	7%	6	\$1.76	\$0.01
Dry_Goods_Retail	Lighting	New	Low Wattage Ceramic Metal Halide Lamps	4.31466	100%	6%	7	\$1.34	\$0.25
Dry_Goods_Retail	Lighting	New	Occupancy Sensor Control, Fluorescent	4.31466	95%	85%	14	\$0.58	\$0.01
Dry_Goods_Retail	Lighting	New	Reduce Interior Lighting Power Density 15% Reduction (W/sqft)	4.31466	75%	98%	7	\$0.12	\$0.15
Dry_Goods_Retail	Lighting	New	Reduce Interior Lighting Power Density 25% Reduction (W/sqft)	4.31466	90%	85%	7	\$0.22	\$0.25
Dry_Goods_Retail	Lighting	New	Scotopic (High CCT) Lighting	4.31466	100%	13%	15	\$0.55	\$0.16
Dry_Goods_Retail	Lighting	New	Stepped Dimming Fluorescent Fixtures	4.31466	85%	60%	18	\$0.35	\$0.08
Dry_Goods_Retail	Plug_Load	Existing	Office Computer Network Energy Management	0.14599	33%	100%	4	\$0.00	\$0.06
Dry_Goods_Retail	Plug_Load	Existing	Office Equipment: Copiers, Energy Star or Better	0.14599	65%	100%	4	\$0.01	\$0.01
Dry_Goods_Retail	Plug_Load	Existing	Office Equipment: Monitors, Energy Star or Better	0.14599	60%	100%	4	\$0.01	\$0.02
Dry_Goods_Retail	Plug_Load	Existing	Office Equipment: Printers, Energy Star or Better	0.14599	62%	100%	4	\$0.02	\$0.01
Dry_Goods_Retail	Plug_Load	Existing	Vending Machines- Controls	0.14599	85%	95%	3	\$0.02	\$0.01
Dry_Goods_Retail	Plug_Load	Existing	Vending Machines- High Efficiency	0.14599	85%	100%	14	\$0.02	\$0.02
Dry_Goods_Retail	Plug_Load	New	Office Computer Network Energy Management	0.14599	33%	100%	4	\$0.00	\$0.06
Dry_Goods_Retail	Plug_Load	New	Office Equipment: Copiers, Energy Star or Better	0.14599	65%	100%	4	\$0.01	\$0.01
Dry_Goods_Retail	Plug_Load	New	Office Equipment: Monitors, Energy Star or Better	0.14599	60%	100%	4	\$0.01	\$0.02
Dry_Goods_Retail	Plug_Load	New	Office Equipment: Printers, Energy Star or Better	0.14599	62%	100%	4	\$0.02	\$0.01
Dry_Goods_Retail	Plug_Load	New	Vending Machines- High Efficiency	0.14599	85%	100%	14	\$0.02	\$0.02
Dry_Goods_Retail	Space_Heat	Existing	Automated Ventilation VFD Control (Occupancy Sensors / CO2 Sensors)	0.90868	95%	75%	15	\$0.28	\$0.10
Dry_Goods_Retail	Space_Heat	Existing	Convert Constant Volume Air System to VAV	0.90868	15%	85%	15	\$0.19	\$0.12
Dry_Goods_Retail	Space_Heat	Existing	Duct Insulation	0.90868	20%	65%	20	\$0.01	\$0.03
Dry_Goods_Retail	Space_Heat	Existing	Duct Repair and Sealing	0.90868	50%	65%	20	\$0.01	\$0.01
Dry_Goods_Retail	Space_Heat	Existing	Insulation - Floor	0.90868	95%	60%	20	\$0.47	\$0.05
Dry_Goods_Retail	Space_Heat	Existing	Insulation - Roof / Ceiling	0.90868	90%	75%	20	\$0.47	\$0.10
Dry_Goods_Retail	Space_Heat	Existing	Programmable Thermostat	0.90868	48%	100%	10	\$0.15	\$0.20
Dry_Goods_Retail	Space_Heat	Existing	Retro-Commissioning	0.90868	85%	92%	3	\$0.27	\$0.15
Dry_Goods_Retail	Space_Heat	Existing	Windows-High Efficiency	0.90868	85%	80%	30	\$0.23	\$0.10
Dry_Goods_Retail	Space_Heat	New	Automated Ventilation VFD Control (Occupancy Sensors / CO2 Sensors)	0.90868	95%	75%	15	\$0.28	\$0.10

Building Type	End Use	Vintage	Measure Name	Base Usage	Incomplete Factor	Technical Feasibility	Measure Life	Per Unit Cost	Energy Savings
Dry_Goods_Retail	Space_Heat	New	Green Roof	0.90868	100%	25%	40	\$15.00	\$0.13
Dry_Goods_Retail	Space_Heat	New	Leak Proof Duct Fittings	0.90868	100%	49%	30	\$0.07	\$0.21
Dry_Goods_Retail	Space_Heat	New	Retro-Commissioning	0.90868	85%	92%	3	\$1.00	\$0.15
Dry_Goods_Retail	Space_Heat	New	Windows-High Efficiency	0.90868	85%	80%	30	\$0.08	\$0.10
Dry_Goods_Retail	Water_Heat	Existing	Commercial Washers	0.16921	95%	90%	8	\$1.45	\$0.35
Dry_Goods_Retail	Water_Heat	Existing	Demand controlled Circulating Systems	0.16921	98%	60%	15	\$1.56	\$0.05
Dry_Goods_Retail	Water_Heat	Existing	Faucet Aerators	0.16921	20%	100%	10	\$0.00	\$0.02
Dry_Goods_Retail	Water_Heat	Existing	Hot Water (SHW) Pipe Insulation	0.16921	95%	85%	15	\$0.02	\$0.05
Dry_Goods_Retail	Water_Heat	Existing	Low-Flow Showerheads	0.16921	25%	100%	10	\$0.01	\$0.01
Dry_Goods_Retail	Water_Heat	Existing	Solar Water Heater	0.16921	95%	45%	15	\$1.89	\$0.40
Dry_Goods_Retail	Water_Heat	Existing	Water Heater Temperature Setback	0.16921	50%	100%	10	\$0.01	\$0.15
Dry_Goods_Retail	Water_Heat	New	Commercial Washers	0.16921	95%	90%	8	\$1.45	\$0.35
Dry_Goods_Retail	Water_Heat	New	Demand controlled Circulating Systems	0.16921	98%	60%	15	\$1.56	\$0.05
Dry_Goods_Retail	Water_Heat	New	Faucet Aerators	0.16921	20%	100%	10	\$0.00	\$0.02
Dry_Goods_Retail	Water_Heat	New	Hot Water (SHW) Pipe Insulation	0.16921	95%	85%	15	\$0.02	\$0.05
Dry_Goods_Retail	Water_Heat	New	Low-Flow Showerheads	0.16921	25%	100%	10	\$0.01	\$0.01
Dry_Goods_Retail	Water_Heat	New	Solar Water Heater	0.16921	95%	45%	15	\$1.89	\$0.40
Grocery	Cooling_Chillers	Existing	Automated Ventilation VFD Control (Occupancy Sensors / CO2 Sensors)	6.39459	95%	25%	10	\$0.32	\$0.05
Grocery	Cooling_Chillers	Existing	Chilled Water / Condenser Water Settings-Optimization	6.39459	45%	95%	10	\$0.17	\$0.05
Grocery	Cooling_Chillers	Existing	Chilled Water Piping Loop w/ VSD Control	6.39459	75%	90%	15	\$0.49	\$0.12
Grocery	Cooling_Chillers	Existing	Chiller Tune-Up / Diagnostics	6.39459	65%	98%	3	\$0.12	\$0.10
Grocery	Cooling_Chillers	Existing	Chiller-Centrifugal, VSD Control, 300 tons	6.39459			20	\$0.65	\$0.25
Grocery	Cooling_Chillers	Existing	Chiller-Water Side Economizer	6.39459	95%	45%	20	\$0.59	\$0.10
Grocery	Cooling_Chillers	Existing	Cooling Tower-Decrease Approach Temperature	6.39459	98%	70%	15	\$0.11	\$0.08
Grocery	Cooling_Chillers	Existing	Cooling Tower-Two-Speed Fan Motor	6.39459	75%	95%	15	\$0.04	\$0.14
Grocery	Cooling_Chillers	Existing	Cooling Tower-VSD Fan Control	6.39459	90%	95%	15	\$0.08	\$0.04
Grocery	Cooling_Chillers	Existing	Direct Digital Control System-Installation	6.39459	20%	60%	10	\$0.20	\$0.10
Grocery	Cooling_Chillers	Existing	Direct Digital Control System-Optimization	6.39459	99%	100%	5	\$0.12	\$0.01
Grocery	Cooling_Chillers	Existing	High Efficiency Centrifugal Chiller, 300 ton	6.39459			20	\$0.20	\$0.20
Grocery	Cooling_Chillers	Existing	Insulation - Floor	6.39459	50%	60%	20	\$0.48	\$0.02
Grocery	Cooling_Chillers	Existing	Insulation - Roof / Ceiling	6.39459	15%	75%	20	\$0.48	\$0.03
Grocery	Cooling_Chillers	Existing	Pipe Insulation	6.39459	50%	65%	20	\$0.01	\$0.01
Grocery	Cooling_Chillers	Existing	Retro-Commissioning	6.39459	85%	92%	3	\$0.27	\$0.15
Grocery	Cooling_Chillers	Existing	Windows-High Efficiency	6.39459	90%	80%	30	\$0.21	\$0.05
Grocery	Cooling_Chillers	New	Automated Ventilation VFD Control (Occupancy Sensors / CO2 Sensors)	6.73115	95%	25%	10	\$0.32	\$0.05
Grocery	Cooling_Chillers	New	Chilled Water / Condenser Water Settings-Optimization	6.73115	45%	95%	10	\$0.17	\$0.05
Grocery	Cooling_Chillers	New	Chilled Water Piping Loop w/ VSD Control	6.73115	75%	90%	15	\$0.49	\$0.12
Grocery	Cooling_Chillers	New	Chiller-Centrifugal, VSD Control, 300 tons	6.73115			20	\$0.65	\$0.25
Grocery	Cooling_Chillers	New	Cooling Tower-Two-Speed Fan Motor	6.73115	10%	95%	15	\$0.04	\$0.14
Grocery	Cooling_Chillers	New	Cooling Tower-VSD Fan Control	6.73115	80%	95%	15	\$0.08	\$0.04
Grocery	Cooling_Chillers	New	Direct Digital Control System-Optimization	6.73115	99%	100%	5	\$0.12	\$0.01
Grocery	Cooling_Chillers	New	Green Roof	6.73115	100%	25%	40	\$15.00	\$0.13
Grocery	Cooling_Chillers	New	High Efficiency Centrifugal Chiller, 300 ton	6.73115			20	\$0.20	\$0.20
Grocery	Cooling_Chillers	New	Leak Proof Duct Fittings	6.73115	100%	49%	30	\$0.07	\$0.21
Grocery	Cooling_Chillers	New	Pipe Insulation	6.73115	50%	100%	20	\$0.01	\$0.01
Grocery	Cooling_Chillers	New	Retro-Commissioning	6.73115	85%	92%	3	\$1.00	\$0.15
Grocery	Cooling_Chillers	New	Windows-High Efficiency	6.73115	90%	80%	30	\$0.07	\$0.05
Grocery	Cooling_DX	Existing	Automated Ventilation VFD Control (Occupancy Sensors / CO2 Sensors)	10.86217	95%	25%	10	\$0.44	\$0.05
Grocery	Cooling_DX	Existing	DX Package-Air Side Economizer	10.86217	95%	10%	10	\$0.29	\$0.15
Grocery	Cooling_DX	Existing	DX Tune-Up / Diagnostics	10.86217	85%	98%	3	\$0.25	\$0.10
Grocery	Cooling_DX	Existing	Direct / Indirect Evaporative Cooling, Pre-Cooling	10.86217	90%	50%	10	\$0.94	\$0.10
Grocery	Cooling_DX	Existing	Duct Insulation	10.86217	20%	65%	20	\$0.01	\$0.03
Grocery	Cooling_DX	Existing	Duct Repair and Sealing	10.86217	50%	65%	20	\$0.04	\$0.01
Grocery	Cooling_DX	Existing	High Efficiency DX Package	10.86217			20	\$0.50	\$0.09
Grocery	Cooling_DX	Existing	Insulation - Floor	10.86217	50%	60%	20	\$0.48	\$0.02
Grocery	Cooling_DX	Existing	Insulation - Roof / Ceiling	10.86217	15%	75%	20	\$0.48	\$0.03
Grocery	Cooling_DX	Existing	Premium Efficiency DX Package	10.86217			20	\$0.81	\$0.16
Grocery	Cooling_DX	Existing	Programmable Thermostat	10.86217	45%	100%	10	\$0.07	\$0.10

Building Type	End Use	Vintage	Measure Name	Base Usage	Incomplete Factor	Technical Feasibility	Measure Life	Per Unit Cost	Energy Savings
Grocery	Cooling_DX	Existing	Retro-Commissioning	10.86217	85%	92%	3	\$0.27	\$0.15
Grocery	Cooling_DX	Existing	Windows-High Efficiency	10.86217	90%	80%	30	\$0.21	\$0.05
Grocery	Cooling_DX	New	Automated Ventilation VFD Control (Occupancy Sensors / CO2 Sensors)	11.65420	95%	25%	10	\$0.32	\$0.05
Grocery	Cooling_DX	New	Direct / Indirect Evaporative Cooling, Pre-Cooling	11.65420	90%	50%	10	\$0.94	\$0.10
Grocery	Cooling_DX	New	Green Roof	11.65420	100%	25%	40	\$15.00	\$0.13
Grocery	Cooling_DX	New	High Efficiency DX Package	11.65420			20	\$0.50	\$0.09
Grocery	Cooling_DX	New	Leak Proof Duct Fittings	11.65420	100%	49%	30	\$0.07	\$0.21
Grocery	Cooling_DX	New	Premium Efficiency DX Package	11.65420			20	\$0.81	\$0.16
Grocery	Cooling_DX	New	Retro-Commissioning	11.65420	85%	92%	3	\$1.00	\$0.15
Grocery	Cooling_DX	New	Windows-High Efficiency	11.65420	90%	80%	30	\$0.07	\$0.05
Grocery	Cooling_HeatPump	Existing	Automated Ventilation VFD Control (Occupancy Sensors / CO2 Sensors)	11.08877	95%	25%	10	\$0.32	\$0.05
Grocery	Cooling_HeatPump	Existing	Direct / Indirect Evaporative Cooling, Pre-Cooling	11.08877	90%	50%	10	\$0.94	\$0.10
Grocery	Cooling_HeatPump	Existing	Duct Insulation	11.08877	20%	65%	20	\$0.01	\$0.03
Grocery	Cooling_HeatPump	Existing	Duct Repair and Sealing	11.08877	50%	65%	20	\$0.04	\$0.01
Grocery	Cooling_HeatPump	Existing	Insulation - Floor	11.08877	50%	60%	20	\$0.48	\$0.02
Grocery	Cooling_HeatPump	Existing	Insulation - Roof / Ceiling	11.08877	15%	75%	20	\$0.48	\$0.03
Grocery	Cooling_HeatPump	Existing	Programmable Thermostat	11.08877	45%	100%	10	\$0.07	\$0.10
Grocery	Cooling_HeatPump	Existing	Retro-Commissioning	11.08877	85%	92%	3	\$0.27	\$0.15
Grocery	Cooling_HeatPump	Existing	Windows-High Efficiency	11.08877	90%	80%	30	\$0.21	\$0.05
Grocery	Cooling_HeatPump	New	Automated Ventilation VFD Control (Occupancy Sensors / CO2 Sensors)	11.37309	95%	25%	10	\$0.32	\$0.05
Grocery	Cooling_HeatPump	New	Direct / Indirect Evaporative Cooling, Pre-Cooling	11.37309	90%	50%	10	\$0.94	\$0.10
Grocery	Cooling_HeatPump	New	Green Roof	11.37309	100%	25%	40	\$15.00	\$0.13
Grocery	Cooling_HeatPump	New	Leak Proof Duct Fittings	11.37309	100%	49%	30	\$0.07	\$0.21
Grocery	Cooling_HeatPump	New	Retro-Commissioning	11.37309	85%	92%	3	\$1.00	\$0.15
Grocery	Cooling_HeatPump	New	Windows-High Efficiency	11.37309	90%	80%	30	\$0.07	\$0.05
Grocery	Lighting	Existing	Advanced High Intensity Discharge (HID) Light Sources	9.99595	100%	6%	4	\$0.14	\$0.09
Grocery	Lighting	Existing	Bi-Level Control, Stairwell Lighting	9.99595	98%	95%	7	\$0.10	\$0.02
Grocery	Lighting	Existing	Continuous Dimming, Fluorescent Fixtures	9.99595	90%	2%	8	\$0.39	\$0.15
Grocery	Lighting	Existing	Induction Lighting	9.99595	99%	25%	25	\$0.63	\$0.01
Grocery	Lighting	Existing	LED Exit Signs	9.99595	98%	100%	25	\$0.09	\$0.01
Grocery	Lighting	Existing	LED Refrigeration Case Lights	9.99595	85%	100%	12	\$0.02	\$0.18
Grocery	Lighting	Existing	LED Solid State White Lighting	9.99595	100%	7%	6	\$3.63	\$0.01
Grocery	Lighting	Existing	Low Wattage Ceramic Metal Halide Lamps	9.99595	100%	6%	7	\$2.78	\$0.13
Grocery	Lighting	Existing	Occupancy Sensor Control, Fluorescent	9.99595	95%	85%	7	\$0.52	\$0.02
Grocery	Lighting	Existing	Reduce Interior Lighting Power Density 15% Reduction (W/sqft)	9.99595	75%	98%	7	\$0.26	\$0.15
Grocery	Lighting	Existing	Reduce Interior Lighting Power Density 25% Reduction (W/sqft)	9.99595	90%	85%	7	\$0.48	\$0.25
Grocery	Lighting	Existing	Stepped Dimming Fluorescent Fixtures	9.99595	85%	60%	8	\$0.62	\$0.11
Grocery	Lighting	New	Advanced High Intensity Discharge (HID) Light Sources	9.39438	100%	6%	4	\$0.14	\$0.09
Grocery	Lighting	New	Bi-Level Control, Stairwell Lighting	9.39438	98%	95%	7	\$0.10	\$0.03
Grocery	Lighting	New	Continuous Dimming, Fluorescent Fixtures	9.39438	90%	2%	8	\$0.20	\$0.15
Grocery	Lighting	New	Induction Lighting	9.39438	99%	25%	25	\$0.63	\$0.01
Grocery	Lighting	New	LED Exit Signs	9.39438	98%	100%	25	\$0.03	\$0.01
Grocery	Lighting	New	LED Refrigeration Case Lights	9.39438	85%	100%	12	\$0.02	\$0.18
Grocery	Lighting	New	LED Solid State White Lighting	9.39438	100%	7%	6	\$3.63	\$0.01
Grocery	Lighting	New	Low Wattage Ceramic Metal Halide Lamps	9.39438	100%	6%	7	\$2.78	\$0.13
Grocery	Lighting	New	Occupancy Sensor Control, Fluorescent	9.39438	95%	85%	7	\$0.52	\$0.02
Grocery	Lighting	New	Reduce Interior Lighting Power Density 15% Reduction (W/sqft)	9.39438	75%	98%	7	\$0.12	\$0.15
Grocery	Lighting	New	Reduce Interior Lighting Power Density 25% Reduction (W/sqft)	9.39438	90%	85%	7	\$0.22	\$0.25
Grocery	Lighting	New	Stepped Dimming Fluorescent Fixtures	9.39438	85%	60%	8	\$0.31	\$0.11
Grocery	Plug_Load	Existing	Office Computer Network Energy Management	0.40243	33%	100%	4	\$0.00	\$0.07
Grocery	Plug_Load	Existing	Office Equipment: Copiers, Energy Star or Better	0.40243	65%	100%	4	\$0.01	\$0.01
Grocery	Plug_Load	Existing	Office Equipment: Monitors, Energy Star or Better	0.40243	60%	100%	4	\$0.01	\$0.02
Grocery	Plug_Load	Existing	Office Equipment: Printers, Energy Star or Better	0.40243	62%	100%	4	\$0.01	\$0.01
Grocery	Plug_Load	Existing	Vending Machines- Controls	0.40243	75%	95%	3	\$0.01	\$0.01
Grocery	Plug_Load	Existing	Vending Machines- High Efficiency	0.40243	85%	100%	14	\$0.02	\$0.02
Grocery	Plug_Load	New	Office Computer Network Energy Management	0.40243	33%	100%	4	\$0.00	\$0.07
Grocery	Plug_Load	New	Office Equipment: Copiers, Energy Star or Better	0.40243	65%	100%	4	\$0.01	\$0.01
Grocery	Plug_Load	New	Office Equipment: Monitors, Energy Star or Better	0.40243	60%	100%	4	\$0.01	\$0.02

Building Type	End Use	Vintage	Measure Name	Base Usage	Incomplete Factor	Technical Feasibility	Measure Life	Per Unit Cost	Energy Savings
Grocery	Plug_Load	New	Office Equipment: Printers, Energy Star or Better	0.40243	62%	100%	4	\$0.01	\$0.01
Grocery	Plug_Load	New	Vending Machines- High Efficiency	0.40243	85%	100%	14	\$0.02	\$0.02
Grocery	Refrigeration	Existing	Anti-Sweat (Humidistat) Controls	22.84253	45%	100%	12	\$0.02	\$0.05
Grocery	Refrigeration	Existing	Compressor VSD retrofit	22.84253	90%	60%	10	\$0.41	\$0.06
Grocery	Refrigeration	Existing	Efficient Fan Motor Options for Commercial Refrigeration	22.84253	100%	40%	9	\$1.16	\$0.14
Grocery	Refrigeration	Existing	High Efficiency Case Fans	22.84253	92%	100%	16	\$1.16	\$0.02
Grocery	Refrigeration	Existing	Installation of Floating Condenser Head Pressure Controls	22.84253	38%	100%	14	\$0.12	\$0.07
Grocery	Refrigeration	Existing	Night Covers for Display Cases	22.84253	90%	100%	5	\$0.01	\$0.06
Grocery	Refrigeration	Existing	Strip Curtains for Walk-Ins	22.84253	25%	100%	4	\$0.05	\$0.04
Grocery	Refrigeration	New	Anti-Sweat (Humidistat) Controls	22.84253	45%	100%	12	\$0.02	\$0.05
Grocery	Refrigeration	New	Efficient Fan Motor Options for Commercial Refrigeration	22.84253	100%	40%	9	\$1.16	\$0.14
Grocery	Refrigeration	New	High Efficiency Case Fans	22.84253	92%	100%	16	\$1.16	\$0.02
Grocery	Refrigeration	New	Installation of Floating Condenser Head Pressure Controls	22.84253	38%	100%	14	\$0.12	\$0.07
Grocery	Refrigeration	New	Night Covers for Display Cases	22.84253	90%	100%	5	\$0.01	\$0.06
Grocery	Refrigeration	New	Reduced Speed or Cycling of Evaporator Fans	22.84253	75%	100%	5	\$0.09	\$0.01
Grocery	Refrigeration	New	Strip Curtains for Walk-Ins	22.84253	25%	100%	4	\$0.05	\$0.04
Grocery	Space_Heat	Existing	Automated Ventilation VFD Control (Occupancy Sensors / CO2 Sensors)	1.33587	95%	25%	15	\$0.28	\$0.10
Grocery	Space_Heat	Existing	Duct Insulation	1.33587	20%	65%	20	\$0.01	\$0.03
Grocery	Space_Heat	Existing	Duct Repair and Sealing	1.33587	50%	65%	20	\$0.01	\$0.01
Grocery	Space_Heat	Existing	Insulation - Floor	1.33587	50%	60%	20	\$0.48	\$0.05
Grocery	Space_Heat	Existing	Insulation - Roof / Ceiling	1.33587	15%	75%	20	\$0.48	\$0.10
Grocery	Space_Heat	Existing	Programmable Thermostat	1.33587	45%	100%	10	\$0.15	\$0.20
Grocery	Space_Heat	Existing	Retro-Commissioning	1.33587	85%	92%	3	\$0.27	\$0.15
Grocery	Space_Heat	Existing	Windows-High Efficiency	1.33587	90%	80%	30	\$0.21	\$0.06
Grocery	Space_Heat	New	Automated Ventilation VFD Control (Occupancy Sensors / CO2 Sensors)	1.33587	95%	25%	15	\$0.28	\$0.10
Grocery	Space_Heat	New	Green Roof	1.33587	100%	25%	40	\$15.00	\$0.13
Grocery	Space_Heat	New	Leak Proof Duct Fittings	1.33587	100%	49%	30	\$0.07	\$0.21
Grocery	Space_Heat	New	Retro-Commissioning	1.33587	85%	92%	3	\$1.00	\$0.15
Grocery	Space_Heat	New	Windows-High Efficiency	1.33587	90%	80%	30	\$0.07	\$0.06
Grocery	Water_Heat	Existing	Demand controlled Circulating Systems	1.69795	98%	60%	15	\$1.16	\$0.05
Grocery	Water_Heat	Existing	Faucet Aerators	1.69795	20%	100%	10	\$0.00	\$0.02
Grocery	Water_Heat	Existing	Hot Water (SHW) Pipe Insulation	1.69795	95%	85%	15	\$0.01	\$0.05
Grocery	Water_Heat	Existing	Low Flow Spray Heads	1.69795	45%	100%	5	\$0.01	\$0.01
Grocery	Water_Heat	Existing	Low-Flow Showerheads	1.69795	25%	100%	10	\$0.01	\$0.01
Grocery	Water_Heat	Existing	Solar Water Heater	1.69795	95%	45%	15	\$0.95	\$0.40
Grocery	Water_Heat	Existing	Water Cooled Refrigeration with Heat Recovery	1.69795	95%	85%	8	\$0.09	\$0.03
Grocery	Water_Heat	Existing	Water Heater Temperature Setback	1.69795	55%	100%	10	\$0.01	\$0.15
Grocery	Water_Heat	New	Demand controlled Circulating Systems	1.69795	98%	60%	15	\$1.16	\$0.05
Grocery	Water_Heat	New	Faucet Aerators	1.69795	20%	100%	10	\$0.00	\$0.02
Grocery	Water_Heat	New	Hot Water (SHW) Pipe Insulation	1.69795	95%	85%	15	\$0.01	\$0.05
Grocery	Water_Heat	New	Low Flow Spray Heads	1.69795	45%	100%	5	\$0.01	\$0.01
Grocery	Water_Heat	New	Low-Flow Showerheads	1.69795	25%	100%	10	\$0.01	\$0.01
Grocery	Water_Heat	New	Solar Water Heater	1.69795	95%	45%	15	\$0.95	\$0.40
Grocery	Water_Heat	New	Water Cooled Refrigeration with Heat Recovery	1.69795	95%	85%	8	\$0.09	\$0.03
Hospital	Cooling_Chillers	Existing	Active Window Insulation	8.55084	100%	20%	15	\$1.45	\$0.21
Hospital	Cooling_Chillers	Existing	Automated Ventilation VFD Control (Occupancy Sensors / CO2 Sensors)	8.55084	95%	5%	10	\$0.44	\$0.05
Hospital	Cooling_Chillers	Existing	Chilled Water / Condenser Water Settings-Optimization	8.55084	45%	95%	10	\$0.10	\$0.05
Hospital	Cooling_Chillers	Existing	Chilled Water Piping Loop w/ VSD Control	8.55084	75%	90%	15	\$0.68	\$0.12
Hospital	Cooling_Chillers	Existing	Chiller Tune-Up / Diagnostics	8.55084	65%	98%	3	\$0.17	\$0.10
Hospital	Cooling_Chillers	Existing	Chiller-Centrifugal, VSD Control, 300 tons	8.55084			20	\$0.90	\$0.25
Hospital	Cooling_Chillers	Existing	Chiller-Water Side Economizer	8.55084	95%	45%	20	\$0.59	\$0.10
Hospital	Cooling_Chillers	Existing	Convert Constant Volume Air System to VAV	8.55084	15%	85%	15	\$0.35	\$0.12
Hospital	Cooling_Chillers	Existing	Cooling Tower-Decrease Approach Temperature	8.55084	98%	70%	15	\$0.16	\$0.08
Hospital	Cooling_Chillers	Existing	Cooling Tower-Two-Speed Fan Motor	8.55084	75%	95%	15	\$0.04	\$0.14
Hospital	Cooling_Chillers	Existing	Cooling Tower-VSD Fan Control	8.55084	90%	95%	15	\$0.11	\$0.04
Hospital	Cooling_Chillers	Existing	Direct Digital Control System-Installation	8.55084	20%	60%	10	\$0.27	\$0.10
Hospital	Cooling_Chillers	Existing	Direct Digital Control System-Optimization	8.55084	90%	100%	5	\$0.12	\$0.01
Hospital	Cooling_Chillers	Existing	High Efficiency Centrifugal Chiller, 300 ton	8.55084			20	\$0.27	\$0.20

Building Type	End Use	Vintage	Measure Name	Base Usage	Incomplete Factor	Technical Feasibility	Measure Life	Per Unit Cost	Energy Savings
Hospital	Cooling_Chillers	Existing	Insulation - Floor	8.55084	40%	60%	20	\$0.43	\$0.02
Hospital	Cooling_Chillers	Existing	Insulation - Roof / Ceiling	8.55084	17%	75%	20	\$0.43	\$0.03
Hospital	Cooling_Chillers	Existing	Pipe Insulation	8.55084	50%	65%	20	\$0.01	\$0.01
Hospital	Cooling_Chillers	Existing	Retro-Commissioning	8.55084	85%	92%	3	\$0.27	\$0.15
Hospital	Cooling_Chillers	Existing	Windows-High Efficiency	8.55084	65%	80%	30	\$0.10	\$0.01
Hospital	Cooling_Chillers	Existing	Wireless Performance Monitoring, Diagnostics and Control	8.55084	100%	30%	10	\$0.50	\$0.10
Hospital	Cooling_Chillers	New	Active Window Insulation	8.78378	100%	20%	15	\$1.45	\$0.21
Hospital	Cooling_Chillers	New	Automated Ventilation VFD Control (Occupancy Sensors / CO2 Sensors)	8.78378	95%	5%	10	\$0.44	\$0.05
Hospital	Cooling_Chillers	New	Chilled Water / Condenser Water Settings-Optimization	8.78378	45%	95%	10	\$0.10	\$0.05
Hospital	Cooling_Chillers	New	Chilled Water Piping Loop w/ VSD Control	8.78378	75%	90%	15	\$0.68	\$0.12
Hospital	Cooling_Chillers	New	Chiller-Centrifugal, VSD Control, 300 tons	9.00088			20	\$0.90	\$0.25
Hospital	Cooling_Chillers	New	Cooling Tower-Two-Speed Fan Motor	8.78378	10%	95%	15	\$0.04	\$0.14
Hospital	Cooling_Chillers	New	Cooling Tower-VSD Fan Control	8.78378	80%	95%	15	\$0.11	\$0.04
Hospital	Cooling_Chillers	New	Direct Digital Control System-Optimization	8.78378	90%	100%	5	\$0.12	\$0.01
Hospital	Cooling_Chillers	New	Green Roof	8.78378	100%	25%	40	\$15.00	\$0.13
Hospital	Cooling_Chillers	New	High Efficiency Centrifugal Chiller, 300 ton	9.00088			20	\$0.27	\$0.20
Hospital	Cooling_Chillers	New	Leak Proof Duct Fittings	8.78378	100%	49%	30	\$0.07	\$0.21
Hospital	Cooling_Chillers	New	Pipe Insulation	8.78378	50%	100%	20	\$0.01	\$0.01
Hospital	Cooling_Chillers	New	Retro-Commissioning	8.78378	85%	92%	3	\$1.00	\$0.15
Hospital	Cooling_Chillers	New	Windows-High Efficiency	8.78378	65%	80%	30	\$0.03	\$0.01
Hospital	Cooling_Chillers	New	Wireless Performance Monitoring, Diagnostics and Control	8.78378	100%	30%	10	\$0.50	\$0.10
Hospital	Cooling_DX	Existing	Active Window Insulation	14.69131	100%	20%	15	\$0.44	\$0.21
Hospital	Cooling_DX	Existing	Automated Ventilation VFD Control (Occupancy Sensors / CO2 Sensors)	14.69131	95%	5%	10	\$0.09	\$0.05
Hospital	Cooling_DX	Existing	Convert Constant Volume Air System to VAV	14.69131	15%	85%	15	\$0.35	\$0.12
Hospital	Cooling_DX	Existing	DX Package-Air Side Economizer	14.69131	35%	10%	10	\$0.17	\$0.15
Hospital	Cooling_DX	Existing	DX Tune-Up / Diagnostics	14.69131	85%	98%	3	\$0.35	\$0.10
Hospital	Cooling_DX	Existing	Direct / Indirect Evaporative Cooling, Pre-Cooling	14.69131	90%	50%	10	\$1.31	\$0.10
Hospital	Cooling_DX	Existing	Duct Insulation	14.69131	20%	65%	20	\$0.01	\$0.03
Hospital	Cooling_DX	Existing	Duct Repair and Sealing	14.69131	50%	65%	20	\$0.04	\$0.01
Hospital	Cooling_DX	Existing	High Efficiency DX Package	14.52487			20	\$0.50	\$0.09
Hospital	Cooling_DX	Existing	Insulation - Floor	14.69131	40%	60%	20	\$0.43	\$0.02
Hospital	Cooling_DX	Existing	Insulation - Roof / Ceiling	14.69131	17%	75%	20	\$0.43	\$0.03
Hospital	Cooling_DX	Existing	Premium Efficiency DX Package	14.52487			20	\$0.90	\$0.16
Hospital	Cooling_DX	Existing	Programmable Thermostat	14.69131	55%	100%	10	\$0.09	\$0.10
Hospital	Cooling_DX	Existing	Retro-Commissioning	14.69131	85%	92%	3	\$0.27	\$0.15
Hospital	Cooling_DX	Existing	Windows-High Efficiency	14.69131	65%	80%	30	\$0.10	\$0.05
Hospital	Cooling_DX	New	Active Window Insulation	15.20808	100%	20%	15	\$1.45	\$0.21
Hospital	Cooling_DX	New	Automated Ventilation VFD Control (Occupancy Sensors / CO2 Sensors)	15.20808	95%	5%	10	\$0.44	\$0.05
Hospital	Cooling_DX	New	Direct / Indirect Evaporative Cooling, Pre-Cooling	15.20808	90%	50%	10	\$1.31	\$0.10
Hospital	Cooling_DX	New	Green Roof	15.20808	100%	25%	40	\$15.00	\$0.13
Hospital	Cooling_DX	New	High Efficiency DX Package	15.58398			20	\$0.50	\$0.09
Hospital	Cooling_DX	New	Leak Proof Duct Fittings	15.20808	100%	49%	30	\$0.07	\$0.21
Hospital	Cooling_DX	New	Premium Efficiency DX Package	15.58398			20	\$0.90	\$0.16
Hospital	Cooling_DX	New	Retro-Commissioning	15.20808	85%	92%	3	\$1.00	\$0.15
Hospital	Cooling_DX	New	Windows-High Efficiency	15.20808	65%	80%	30	\$0.03	\$0.05
Hospital	Cooling_HeatPump	Existing	Active Window Insulation	14.82788	100%	20%	15	\$1.45	\$0.21
Hospital	Cooling_HeatPump	Existing	Automated Ventilation VFD Control (Occupancy Sensors / CO2 Sensors)	14.82788	95%	5%	10	\$0.44	\$0.05
Hospital	Cooling_HeatPump	Existing	Direct / Indirect Evaporative Cooling, Pre-Cooling	14.82788	90%	50%	10	\$1.31	\$0.10
Hospital	Cooling_HeatPump	Existing	Duct Insulation	14.82788	20%	65%	20	\$0.01	\$0.03
Hospital	Cooling_HeatPump	Existing	Duct Repair and Sealing	14.82788	50%	65%	20	\$0.04	\$0.01
Hospital	Cooling_HeatPump	Existing	Insulation - Floor	14.82788	40%	60%	20	\$0.43	\$0.02
Hospital	Cooling_HeatPump	Existing	Insulation - Roof / Ceiling	14.82788	17%	75%	20	\$0.43	\$0.03
Hospital	Cooling_HeatPump	Existing	Programmable Thermostat	14.82788	55%	100%	10	\$0.09	\$0.10
Hospital	Cooling_HeatPump	Existing	Retro-Commissioning	14.82788	85%	92%	3	\$0.27	\$0.15
Hospital	Cooling_HeatPump	Existing	Windows-High Efficiency	14.82788	65%	80%	30	\$0.10	\$0.05
Hospital	Cooling_HeatPump	New	Active Window Insulation	15.20808	100%	20%	15	\$1.45	\$0.21
Hospital	Cooling_HeatPump	New	Automated Ventilation VFD Control (Occupancy Sensors / CO2 Sensors)	15.20808	95%	5%	10	\$0.44	\$0.05
Hospital	Cooling_HeatPump	New	Direct / Indirect Evaporative Cooling, Pre-Cooling	15.20808	90%	50%	10	\$1.31	\$0.10



Building Type	End Use	Vintage	Measure Name	Base Usage	Incomplete Factor	Technical Feasibility	Measure Life	Per Unit Cost	Energy Savings
Hospital	Cooling_HeatPump	New	Green Roof	15.20808	100%	25%	40	\$15.00	\$0.13
Hospital	Cooling_HeatPump	New	Leak Proof Duct Fittings	15.20808	100%	49%	30	\$0.07	\$0.21
Hospital	Cooling_HeatPump	New	Retro-Commissioning	15.20808	85%	92%	3	\$1.00	\$0.15
Hospital	Cooling_HeatPump	New	Windows-High Efficiency	15.20808	65%	80%	30	\$0.03	\$0.05
Hospital	HVAC_Aux	New	Optimized Variable Volume Lab Hood Design	2.59698	98%	95%	10	\$0.01	\$0.02
Hospital	Lighting	Existing	Advanced High Intensity Discharge (HID) Light Sources	8.76044	100%	6%	4	\$0.12	\$0.02
Hospital	Lighting	Existing	Advanced/Integrated Daylighting controls (ADCs)	8.76044	100%	66%	20	\$2.50	\$0.08
Hospital	Lighting	Existing	Bi-Level Control, Stairwell Lighting	8.76044	98%	95%	7	\$0.10	\$0.03
Hospital	Lighting	Existing	Continuous Dimming, Fluorescent Fixtures	8.76044	90%	20%	8	\$0.38	\$0.13
Hospital	Lighting	Existing	Induction Lighting	8.76044	99%	25%	25	\$0.15	\$0.01
Hospital	Lighting	Existing	LED Exit Signs	8.76044	98%	100%	25	\$0.05	\$0.01
Hospital	Lighting	Existing	LED Solid State White Lighting	8.76044	100%	7%	6	\$3.17	\$0.10
Hospital	Lighting	Existing	Low Wattage Ceramic Metal Halide Lamps	8.76044	100%	6%	7	\$2.43	\$0.03
Hospital	Lighting	Existing	Occupancy Sensor Control, Fluorescent	8.76044	95%	85%	7	\$0.51	\$0.04
Hospital	Lighting	Existing	Reduce Interior Lighting Power Density 15% Reduction (W/sqft)	8.76044	75%	98%	7	\$0.26	\$0.15
Hospital	Lighting	Existing	Reduce Interior Lighting Power Density 25% Reduction (W/sqft)	8.76044	90%	85%	7	\$0.48	\$0.25
Hospital	Lighting	Existing	Scotopic (High CCT) Lighting	8.76044	100%	13%	15	\$0.55	\$0.19
Hospital	Lighting	Existing	Stepped Dimming Fluorescent Fixtures	8.76044	85%	60%	8	\$0.61	\$0.10
Hospital	Lighting	New	Advanced High Intensity Discharge (HID) Light Sources	8.34295	100%	6%	4	\$0.12	\$0.02
Hospital	Lighting	New	Advanced/Integrated Daylighting controls (ADCs)	8.34295	100%	66%	20	\$2.50	\$0.10
Hospital	Lighting	New	Bi-Level Control, Stairwell Lighting	8.34295	98%	95%	7	\$0.10	\$0.03
Hospital	Lighting	New	Continuous Dimming, Fluorescent Fixtures	8.34295	90%	20%	8	\$0.19	\$0.13
Hospital	Lighting	New	Induction Lighting	8.34295	99%	25%	25	\$0.15	\$0.01
Hospital	Lighting	New	LED Exit Signs	8.34295	98%	100%	25	\$0.02	\$0.01
Hospital	Lighting	New	LED Solid State White Lighting	8.34295	100%	7%	6	\$3.17	\$0.10
Hospital	Lighting	New	Low Wattage Ceramic Metal Halide Lamps	8.34295	100%	6%	7	\$2.43	\$0.03
Hospital	Lighting	New	Occupancy Sensor Control, Fluorescent	8.34295	95%	85%	7	\$0.51	\$0.04
Hospital	Lighting	New	Reduce Interior Lighting Power Density 15% Reduction (W/sqft)	8.34295	75%	98%	7	\$0.12	\$0.15
Hospital	Lighting	New	Reduce Interior Lighting Power Density 25% Reduction (W/sqft)	8.34295	90%	85%	7	\$0.22	\$0.25
Hospital	Lighting	New	Scotopic (High CCT) Lighting	8.34295	100%	13%	15	\$0.55	\$0.19
Hospital	Lighting	New	Stepped Dimming Fluorescent Fixtures	8.34295	85%	60%	8	\$0.31	\$0.10
Hospital	Plug_Load	Existing	Office Computer Network Energy Management	0.51066	33%	100%	4	\$0.00	\$0.06
Hospital	Plug_Load	Existing	Office Equipment: Copiers, Energy Star or Better	0.51066	65%	100%	4	\$0.04	\$0.01
Hospital	Plug_Load	Existing	Office Equipment: Monitors, Energy Star or Better	0.51066	60%	100%	4	\$0.06	\$0.02
Hospital	Plug_Load	Existing	Office Equipment: Printers, Energy Star or Better	0.51066	62%	100%	4	\$0.11	\$0.01
Hospital	Plug_Load	Existing	Vending Machines- Controls	0.51066	80%	95%	3	\$0.01	\$0.01
Hospital	Plug_Load	Existing	Vending Machines- High Efficiency	0.51066	85%	100%	14	\$0.02	\$0.02
Hospital	Plug_Load	New	Office Computer Network Energy Management	0.51066	33%	100%	4	\$0.00	\$0.06
Hospital	Plug_Load	New	Office Equipment: Copiers, Energy Star or Better	0.51066	65%	100%	4	\$0.04	\$0.01
Hospital	Plug_Load	New	Office Equipment: Monitors, Energy Star or Better	0.51066	60%	100%	4	\$0.06	\$0.02
Hospital	Plug_Load	New	Office Equipment: Printers, Energy Star or Better	0.51066	62%	100%	4	\$0.11	\$0.01
Hospital	Plug_Load	New	Vending Machines- High Efficiency	0.51066	85%	100%	14	\$0.02	\$0.02
Hospital	Space_Heat	Existing	Automated Ventilation VFD Control (Occupancy Sensors / CO2 Sensors)	4.47640	95%	5%	15	\$0.28	\$0.10
Hospital	Space_Heat	Existing	Convert Constant Volume Air System to VAV	4.47640	15%	85%	15	\$0.35	\$0.12
Hospital	Space_Heat	Existing	Duct Insulation	4.47640	20%	65%	20	\$0.01	\$0.03
Hospital	Space_Heat	Existing	Duct Repair and Sealing	4.47640	50%	65%	20	\$0.00	\$0.01
Hospital	Space_Heat	Existing	Exhaust Air to Ventilation Air Heat Recovery	4.47640	95%	5%	20	\$1.00	\$0.20
Hospital	Space_Heat	Existing	Insulation - Floor	4.47640	40%	60%	20	\$0.43	\$0.05
Hospital	Space_Heat	Existing	Insulation - Roof / Ceiling	4.47640	17%	75%	20	\$0.43	\$0.10
Hospital	Space_Heat	Existing	Programmable Thermostat	4.47640	55%	100%	10	\$0.15	\$0.20
Hospital	Space_Heat	Existing	Retro-Commissioning	4.47640	85%	92%	3	\$0.27	\$0.15
Hospital	Space_Heat	Existing	Windows-High Efficiency	4.47640	65%	80%	30	\$0.10	\$0.06
Hospital	Space_Heat	Existing	Wireless Performance Monitoring, Diagnostics and Control	4.47640	100%	30%	10	\$0.50	\$0.10
Hospital	Space_Heat	New	Automated Ventilation VFD Control (Occupancy Sensors / CO2 Sensors)	4.47640	95%	5%	15	\$0.28	\$0.10
Hospital	Space_Heat	New	Exhaust Air to Ventilation Air Heat Recovery	4.47640	95%	5%	20	\$0.93	\$0.15
Hospital	Space_Heat	New	Green Roof	4.47640	100%	25%	40	\$15.00	\$0.13
Hospital	Space_Heat	New	Leak Proof Duct Fittings	4.47640	100%	49%	30	\$0.07	\$0.21
Hospital	Space_Heat	New	Retro-Commissioning	4.47640	85%	92%	3	\$1.00	\$0.15

Building Type	End Use	Vintage	Measure Name	Base Usage	Incomplete Factor	Technical Feasibility	Measure Life	Per Unit Cost	Energy Savings
Hospital	Space_Heat	New	Windows-High Efficiency	4.47640	65%	80%	30	\$0.03	\$0.06
Hospital	Space_Heat	New	Wireless Performance Monitoring, Diagnostics and Control	4.47640	100%	30%	10	\$0.50	\$0.10
Hospital	Water_Heat	Existing	Chemical Dishwashing System	2.09602	90%	80%	10	\$0.03	\$0.04
Hospital	Water_Heat	Existing	Commercial Washers	2.09602	95%	90%	8	\$0.22	\$0.10
Hospital	Water_Heat	Existing	Demand controlled Circulating Systems	2.09602	85%	60%	15	\$0.68	\$0.05
Hospital	Water_Heat	Existing	Faucet Aerators	2.09602	20%	100%	10	\$0.01	\$0.02
Hospital	Water_Heat	Existing	Hot Water (SHW) Pipe Insulation	2.09602	75%	85%	15	\$0.01	\$0.05
Hospital	Water_Heat	Existing	Low-Flow Showerheads	2.09602	25%	100%	10	\$0.03	\$0.04
Hospital	Water_Heat	Existing	Solar Water Heater	2.09602	95%	45%	15	\$3.01	\$0.40
Hospital	Water_Heat	Existing	Water Heater Temperature Setback	2.09602	85%	100%	10	\$0.00	\$0.15
Hospital	Water_Heat	New	Chemical Dishwashing System	2.09602	90%	80%	10	\$0.03	\$0.04
Hospital	Water_Heat	New	Commercial Washers	2.09602	95%	90%	8	\$0.22	\$0.10
Hospital	Water_Heat	New	Demand controlled Circulating Systems	2.09602	85%	60%	15	\$0.68	\$0.05
Hospital	Water_Heat	New	Faucet Aerators	2.09602	20%	100%	10	\$0.01	\$0.02
Hospital	Water_Heat	New	Hot Water (SHW) Pipe Insulation	2.09602	75%	85%	15	\$0.01	\$0.05
Hospital	Water_Heat	New	Low-Flow Showerheads	2.09602	25%	100%	10	\$0.03	\$0.04
Hospital	Water_Heat	New	Solar Water Heater	2.09602	95%	45%	15	\$3.01	\$0.40
Hotel_Motel	Cooling_Chillers	Existing	Active Window Insulation	1.43044	100%	20%	15	\$1.45	\$0.21
Hotel_Motel	Cooling_Chillers	Existing	Automated Ventilation VFD Control (Occupancy Sensors / CO2 Sensors)	1.43044	95%	10%	10	\$0.46	\$0.05
Hotel_Motel	Cooling_Chillers	Existing	Chilled Water / Condenser Water Settings-Optimization	1.43044	45%	95%	10	\$0.12	\$0.05
Hotel_Motel	Cooling_Chillers	Existing	Chilled Water Piping Loop w/ VSD Control	1.43044	75%	90%	15	\$0.71	\$0.12
Hotel_Motel	Cooling_Chillers	Existing	Chiller Tune-Up / Diagnostics	1.43044	65%	98%	3	\$0.18	\$0.10
Hotel_Motel	Cooling_Chillers	Existing	Chiller-Centrifugal, VSD Control, 300 tons	1.42821			20	\$0.95	\$0.25
Hotel_Motel	Cooling_Chillers	Existing	Chiller-Water Side Economizer	1.43044	35%	45%	20	\$0.59	\$0.10
Hotel_Motel	Cooling_Chillers	Existing	Cooling Tower-Decrease Approach Temperature	1.43044	98%	70%	15	\$0.17	\$0.08
Hotel_Motel	Cooling_Chillers	Existing	Cooling Tower-Two-Speed Fan Motor	1.43044	75%	95%	15	\$0.40	\$0.14
Hotel_Motel	Cooling_Chillers	Existing	Cooling Tower-VSD Fan Control	1.43044	90%	95%	15	\$0.11	\$0.04
Hotel_Motel	Cooling_Chillers	Existing	Direct Digital Control System-Installation	1.43044	20%	60%	10	\$0.29	\$0.10
Hotel_Motel	Cooling_Chillers	Existing	Direct Digital Control System-Optimization	1.43044	85%	100%	5	\$0.12	\$0.01
Hotel_Motel	Cooling_Chillers	Existing	High Efficiency Centrifugal Chiller, 300 ton	1.42821			20	\$0.29	\$0.20
Hotel_Motel	Cooling_Chillers	Existing	Hotel Key Card Room Energy Control System	1.43044	100%	90%	15	\$0.33	\$0.25
Hotel_Motel	Cooling_Chillers	Existing	Insulation - Floor	1.43044	50%	60%	20	\$0.21	\$0.02
Hotel_Motel	Cooling_Chillers	Existing	Insulation - Roof / Ceiling	1.43044	30%	75%	20	\$0.21	\$0.03
Hotel_Motel	Cooling_Chillers	Existing	Pipe Insulation	1.43044	50%	65%	20	\$0.03	\$0.01
Hotel_Motel	Cooling_Chillers	Existing	Retro-Commissioning	1.43044	85%	92%	3	\$0.27	\$0.15
Hotel_Motel	Cooling_Chillers	Existing	Windows-High Efficiency	1.43044	55%	80%	30	\$0.48	\$0.07
Hotel_Motel	Cooling_Chillers	Existing	Wireless Performance Monitoring, Diagnostics and Control	1.43044	100%	30%	10	\$0.50	\$0.10
Hotel_Motel	Cooling_Chillers	New	Active Window Insulation	1.46712	100%	20%	15	\$1.45	\$0.21
Hotel_Motel	Cooling_Chillers	New	Chilled Water / Condenser Water Settings-Optimization	1.46712	45%	95%	10	\$0.12	\$0.05
Hotel_Motel	Cooling_Chillers	New	Chilled Water Piping Loop w/ VSD Control	1.46712	75%	90%	15	\$0.71	\$0.12
Hotel_Motel	Cooling_Chillers	New	Chiller-Centrifugal, VSD Control, 300 tons	1.50338			20	\$0.95	\$0.25
Hotel_Motel	Cooling_Chillers	New	Cooling Tower-Two-Speed Fan Motor	1.46712	10%	95%	15	\$0.04	\$0.14
Hotel_Motel	Cooling_Chillers	New	Cooling Tower-VSD Fan Control	1.46712	80%	95%	15	\$0.11	\$0.04
Hotel_Motel	Cooling_Chillers	New	Direct Digital Control System-Optimization	1.46712	85%	100%	5	\$0.12	\$0.01
Hotel_Motel	Cooling_Chillers	New	Green Roof	1.46712	100%	25%	40	\$15.00	\$0.13
Hotel_Motel	Cooling_Chillers	New	High Efficiency Centrifugal Chiller, 300 ton	1.50338			20	\$0.29	\$0.20
Hotel_Motel	Cooling_Chillers	New	Hotel Key Card Room Energy Control System	1.46712	100%	90%	15	\$0.33	\$0.25
Hotel_Motel	Cooling_Chillers	New	Leak Proof Duct Fittings	1.46712	100%	49%	30	\$0.07	\$0.21
Hotel_Motel	Cooling_Chillers	New	Pipe Insulation	1.46712	50%	100%	20	\$0.03	\$0.01
Hotel_Motel	Cooling_Chillers	New	Retro-Commissioning	1.46712	85%	92%	3	\$1.00	\$0.15
Hotel_Motel	Cooling_Chillers	New	Windows-High Efficiency	1.46712	55%	80%	30	\$0.16	\$0.07
Hotel_Motel	Cooling_Chillers	New	Wireless Performance Monitoring, Diagnostics and Control	1.46712	100%	30%	10	\$0.50	\$0.10
Hotel_Motel	Cooling_DX	Existing	Active Window Insulation	2.45383	100%	20%	15	\$0.23	\$0.21
Hotel_Motel	Cooling_DX	Existing	Automated Ventilation VFD Control (Occupancy Sensors / CO2 Sensors)	2.45383	95%	10%	10	\$0.12	\$0.05
Hotel_Motel	Cooling_DX	Existing	DX Package-Air Side Economizer	2.45383	35%	10%	10	\$0.20	\$0.15
Hotel_Motel	Cooling_DX	Existing	DX Tune-Up / Diagnostics	2.45383	85%	98%	3	\$0.37	\$0.10
Hotel_Motel	Cooling_DX	Existing	Direct / Indirect Evaporative Cooling, Pre-Cooling	2.45383	90%	50%	10	\$1.38	\$0.10
Hotel_Motel	Cooling_DX	Existing	Duct Insulation	2.45383	20%	65%	20	\$0.01	\$0.03

Building Type	End Use	Vintage	Measure Name	Base Usage	Incomplete Factor	Technical Feasibility	Measure Life	Per Unit Cost	Energy Savings
Hotel_Motel	Cooling_DX	Existing	Duct Repair and Sealing	2.45383	50%	65%	20	\$0.04	\$0.01
Hotel_Motel	Cooling_DX	Existing	High Efficiency DX Package	2.42603			20	\$0.50	\$0.09
Hotel_Motel	Cooling_DX	Existing	Hotel Key Card Room Energy Control System	2.45383	100%	90%	15	\$0.33	\$0.25
Hotel_Motel	Cooling_DX	Existing	Insulation - Floor	2.45383	50%	60%	20	\$0.21	\$0.02
Hotel_Motel	Cooling_DX	Existing	Insulation - Roof / Ceiling	2.45383	30%	75%	20	\$0.21	\$0.03
Hotel_Motel	Cooling_DX	Existing	Premium Efficiency DX Package	2.42603			20	\$0.92	\$0.16
Hotel_Motel	Cooling_DX	Existing	Programmable Thermostat	2.45383	45%	100%	10	\$0.10	\$0.10
Hotel_Motel	Cooling_DX	Existing	Retro-Commissioning	2.45383	85%	92%	3	\$0.27	\$0.15
Hotel_Motel	Cooling_DX	Existing	Terminal HVAC units-Occupancy Sensor Control	2.45383	90%	75%	15	\$0.30	\$0.35
Hotel_Motel	Cooling_DX	Existing	Windows-High Efficiency	2.45383	55%	80%	30	\$0.48	\$0.05
Hotel_Motel	Cooling_DX	New	Active Window Insulation	2.54015	100%	20%	15	\$1.45	\$0.21
Hotel_Motel	Cooling_DX	New	Direct / Indirect Evaporative Cooling, Pre-Cooling	2.54015	90%	50%	10	\$1.38	\$0.10
Hotel_Motel	Cooling_DX	New	Green Roof	2.54015	100%	25%	40	\$15.00	\$0.13
Hotel_Motel	Cooling_DX	New	High Efficiency DX Package	2.60293			20	\$0.50	\$0.09
Hotel_Motel	Cooling_DX	New	Hotel Key Card Room Energy Control System	2.54015	100%	90%	15	\$0.33	\$0.25
Hotel_Motel	Cooling_DX	New	Leak Proof Duct Fittings	2.54015	100%	49%	30	\$0.07	\$0.21
Hotel_Motel	Cooling_DX	New	Premium Efficiency DX Package	2.60293			20	\$0.92	\$0.16
Hotel_Motel	Cooling_DX	New	Retro-Commissioning	2.54015	85%	92%	3	\$1.00	\$0.15
Hotel_Motel	Cooling_DX	New	Terminal HVAC units-Occupancy Sensor Control	2.54015	80%	75%	15	\$0.30	\$0.35
Hotel_Motel	Cooling_DX	New	Windows-High Efficiency	2.54015	55%	80%	30	\$0.16	\$0.05
Hotel_Motel	Cooling_HeatPump	Existing	Active Window Insulation	2.47664	100%	20%	15	\$1.45	\$0.21
Hotel_Motel	Cooling_HeatPump	Existing	Automated Ventilation VFD Control (Occupancy Sensors / CO2 Sensors)	2.47664	95%	10%	10	\$0.46	\$0.05
Hotel_Motel	Cooling_HeatPump	Existing	Direct / Indirect Evaporative Cooling, Pre-Cooling	2.47664	90%	50%	10	\$1.38	\$0.10
Hotel_Motel	Cooling_HeatPump	Existing	Duct Insulation	2.47664	20%	65%	20	\$0.01	\$0.03
Hotel_Motel	Cooling_HeatPump	Existing	Duct Repair and Sealing	2.47664	50%	65%	20	\$0.04	\$0.01
Hotel_Motel	Cooling_HeatPump	Existing	Hotel Key Card Room Energy Control System	2.47664	100%	90%	15	\$0.33	\$0.25
Hotel_Motel	Cooling_HeatPump	Existing	Insulation - Floor	2.47664	50%	60%	20	\$0.21	\$0.02
Hotel_Motel	Cooling_HeatPump	Existing	Insulation - Roof / Ceiling	2.47664	30%	75%	20	\$0.21	\$0.03
Hotel_Motel	Cooling_HeatPump	Existing	Programmable Thermostat	2.47664	45%	100%	10	\$0.10	\$0.10
Hotel_Motel	Cooling_HeatPump	Existing	Retro-Commissioning	2.47664	85%	92%	3	\$0.27	\$0.15
Hotel_Motel	Cooling_HeatPump	Existing	Windows-High Efficiency	2.47664	55%	80%	30	\$0.48	\$0.05
Hotel_Motel	Cooling_HeatPump	New	Active Window Insulation	2.54015	100%	20%	15	\$1.45	\$0.21
Hotel_Motel	Cooling_HeatPump	New	Direct / Indirect Evaporative Cooling, Pre-Cooling	2.54015	90%	50%	10	\$1.38	\$0.10
Hotel_Motel	Cooling_HeatPump	New	Green Roof	2.54015	100%	25%	40	\$15.00	\$0.13
Hotel_Motel	Cooling_HeatPump	New	Hotel Key Card Room Energy Control System	2.54015	100%	90%	15	\$0.33	\$0.25
Hotel_Motel	Cooling_HeatPump	New	Leak Proof Duct Fittings	2.54015	100%	49%	30	\$0.07	\$0.21
Hotel_Motel	Cooling_HeatPump	New	Retro-Commissioning	2.54015	85%	92%	3	\$1.00	\$0.15
Hotel_Motel	Cooling_HeatPump	New	Windows-High Efficiency	2.54015	55%	80%	30	\$0.16	\$0.05
Hotel_Motel	Lighting	Existing	Advanced High Intensity Discharge (HID) Light Sources	2.77856	100%	6%	4	\$0.04	\$0.19
Hotel_Motel	Lighting	Existing	Bi-Level Control, Stairwell Lighting	2.77856	98%	95%	7	\$0.10	\$0.03
Hotel_Motel	Lighting	Existing	Continuous Dimming, Fluorescent Fixtures	2.77856	90%	2%	19	\$0.19	\$0.02
Hotel_Motel	Lighting	Existing	Hospitality Bathroom Lighting	2.77856	100%	2%	10	\$0.18	\$0.02
Hotel_Motel	Lighting	Existing	Induction Lighting	2.77856	99%	25%	25	\$0.33	\$0.01
Hotel_Motel	Lighting	Existing	LED Exit Signs	2.77856	98%	100%	25	\$0.06	\$0.01
Hotel_Motel	Lighting	Existing	LED Solid State White Lighting	2.77856	100%	7%	6	\$0.93	\$0.15
Hotel_Motel	Lighting	Existing	Low Wattage Ceramic Metal Halide Lamps	2.77856	100%	6%	7	\$0.71	\$0.26
Hotel_Motel	Lighting	Existing	Occupancy Sensor Control, Fluorescent	2.77856	90%	85%	15	\$0.26	\$0.01
Hotel_Motel	Lighting	Existing	Reduce Interior Lighting Power Density 15% Reduction (W/sqft)	2.77856	75%	98%	7	\$0.26	\$0.15
Hotel_Motel	Lighting	Existing	Reduce Interior Lighting Power Density 25% Reduction (W/sqft)	2.77856	90%	85%	7	\$0.48	\$0.25
Hotel_Motel	Lighting	Existing	Scotopic (High CCT) Lighting	2.77856	100%	13%	15	\$0.55	\$0.02
Hotel_Motel	Lighting	Existing	Stepped Dimming Fluorescent Fixtures	2.77856	85%	60%	19	\$0.31	\$0.01
Hotel_Motel	Lighting	New	Advanced High Intensity Discharge (HID) Light Sources	2.75607	100%	6%	4	\$0.04	\$0.19
Hotel_Motel	Lighting	New	Bi-Level Control, Stairwell Lighting	2.75607	98%	95%	7	\$0.10	\$0.03
Hotel_Motel	Lighting	New	Continuous Dimming, Fluorescent Fixtures	2.75607	90%	2%	19	\$0.10	\$0.02
Hotel_Motel	Lighting	New	Hospitality Bathroom Lighting	2.75607	100%	2%	10	\$0.18	\$0.02
Hotel_Motel	Lighting	New	Induction Lighting	2.75607	99%	25%	25	\$0.33	\$0.01
Hotel_Motel	Lighting	New	LED Exit Signs	2.75607	98%	100%	25	\$0.02	\$0.01
Hotel_Motel	Lighting	New	LED Solid State White Lighting	2.75607	100%	7%	6	\$0.93	\$0.15

Building Type	End Use	Vintage	Measure Name	Base Usage	Incomplete Factor	Technical Feasibility	Measure Life	Per Unit Cost	Energy Savings
Hotel_Motel	Lighting	New	Low Wattage Ceramic Metal Halide Lamps	2.75607	100%	6%	7	\$0.71	\$0.26
Hotel_Motel	Lighting	New	Occupancy Sensor Control, Fluorescent	2.75607	90%	85%	15	\$0.26	\$0.01
Hotel_Motel	Lighting	New	Reduce Interior Lighting Power Density 15% Reduction (W/sqft)	2.75607	75%	98%	7	\$0.12	\$0.15
Hotel_Motel	Lighting	New	Reduce Interior Lighting Power Density 25% Reduction (W/sqft)	2.75607	90%	85%	7	\$0.22	\$0.25
Hotel_Motel	Lighting	New	Scotopic (High CCT) Lighting	2.75607	100%	13%	15	\$0.55	\$0.02
Hotel_Motel	Lighting	New	Stepped Dimming Fluorescent Fixtures	2.75607	85%	60%	19	\$0.15	\$0.01
Hotel_Motel	Plug_Load	Existing	Office Computer Network Energy Management	0.09942	33%	100%	4	\$0.00	\$0.05
Hotel_Motel	Plug_Load	Existing	Office Equipment: Copiers, Energy Star or Better	0.09942	65%	100%	4	\$0.00	\$0.01
Hotel_Motel	Plug_Load	Existing	Office Equipment: Monitors, Energy Star or Better	0.09942	60%	100%	4	\$0.00	\$0.02
Hotel_Motel	Plug_Load	Existing	Office Equipment: Printers, Energy Star or Better	0.09942	62%	100%	4	\$0.01	\$0.01
Hotel_Motel	Plug_Load	Existing	Vending Machines- Controls	0.09942	75%	95%	3	\$0.01	\$0.01
Hotel_Motel	Plug_Load	Existing	Vending Machines- High Efficiency	0.09942	85%	100%	14	\$0.02	\$0.02
Hotel_Motel	Plug_Load	New	Office Computer Network Energy Management	0.09942	33%	100%	4	\$0.00	\$0.05
Hotel_Motel	Plug_Load	New	Office Equipment: Copiers, Energy Star or Better	0.09942	65%	100%	4	\$0.00	\$0.01
Hotel_Motel	Plug_Load	New	Office Equipment: Monitors, Energy Star or Better	0.09942	60%	100%	4	\$0.00	\$0.02
Hotel_Motel	Plug_Load	New	Office Equipment: Printers, Energy Star or Better	0.09942	62%	100%	4	\$0.01	\$0.01
Hotel_Motel	Plug_Load	New	Vending Machines- High Efficiency	0.09942	85%	100%	14	\$0.02	\$0.02
Hotel_Motel	Space_Heat	Existing	Automated Ventilation VFD Control (Occupancy Sensors / CO2 Sensors)	4.73023	95%	10%	15	\$0.28	\$0.10
Hotel_Motel	Space_Heat	Existing	Duct Insulation	4.73023	20%	65%	20	\$0.01	\$0.03
Hotel_Motel	Space_Heat	Existing	Duct Repair and Sealing	4.73023	50%	65%	20	\$0.01	\$0.01
Hotel_Motel	Space_Heat	Existing	Exhaust Air to Ventilation Air Heat Recovery	4.73023	95%	5%	20	\$1.00	\$0.20
Hotel_Motel	Space_Heat	Existing	Hotel Key Card Room Energy Control System	4.73023	100%	90%	15	\$0.33	\$0.25
Hotel_Motel	Space_Heat	Existing	Insulation - Floor	4.73023	50%	60%	20	\$0.21	\$0.05
Hotel_Motel	Space_Heat	Existing	Insulation - Roof / Ceiling	4.73023	30%	75%	20	\$0.21	\$0.10
Hotel_Motel	Space_Heat	Existing	Programmable Thermostat	4.73023	45%	100%	10	\$0.15	\$0.20
Hotel_Motel	Space_Heat	Existing	Retro-Commissioning	4.73023	85%	92%	3	\$0.27	\$0.15
Hotel_Motel	Space_Heat	Existing	Terminal HVAC units-Occupancy Sensor Control	4.73023	90%	75%	15	\$0.20	\$0.35
Hotel_Motel	Space_Heat	Existing	Windows-High Efficiency	4.73023	55%	80%	30	\$0.48	\$0.06
Hotel_Motel	Space_Heat	Existing	Wireless Performance Monitoring, Diagnostics and Control	4.73023	100%	30%	10	\$0.50	\$0.10
Hotel_Motel	Space_Heat	New	Exhaust Air to Ventilation Air Heat Recovery	4.73023	95%	5%	20	\$0.93	\$0.15
Hotel_Motel	Space_Heat	New	Green Roof	4.73023	100%	25%	40	\$15.00	\$0.13
Hotel_Motel	Space_Heat	New	Hotel Key Card Room Energy Control System	4.73023	100%	90%	15	\$0.33	\$0.25
Hotel_Motel	Space_Heat	New	Leak Proof Duct Fittings	4.73023	100%	49%	30	\$0.07	\$0.21
Hotel_Motel	Space_Heat	New	Retro-Commissioning	4.73023	85%	92%	3	\$1.00	\$0.15
Hotel_Motel	Space_Heat	New	Terminal HVAC units-Occupancy Sensor Control	4.73023	80%	75%	15	\$0.20	\$0.35
Hotel_Motel	Space_Heat	New	Windows-High Efficiency	4.73023	55%	80%	30	\$0.16	\$0.06
Hotel_Motel	Space_Heat	New	Wireless Performance Monitoring, Diagnostics and Control	4.73023	100%	30%	10	\$0.50	\$0.10
Hotel_Motel	Water_Heat	Existing	Commercial Washers	3.80473	95%	90%	8	\$0.22	\$0.10
Hotel_Motel	Water_Heat	Existing	Demand controlled Circulating Systems	3.80473	98%	60%	15	\$0.78	\$0.05
Hotel_Motel	Water_Heat	Existing	Faucet Aerators	3.80473	20%	100%	10	\$0.01	\$0.02
Hotel_Motel	Water_Heat	Existing	Hot Water (SHW) Pipe Insulation	3.80473	95%	85%	15	\$0.03	\$0.05
Hotel_Motel	Water_Heat	Existing	Low Flow Spray Heads	3.80473	55%	100%	5	\$0.01	\$0.01
Hotel_Motel	Water_Heat	Existing	Low-Flow Showerheads	3.80473	25%	100%	10	\$0.05	\$0.05
Hotel_Motel	Water_Heat	Existing	Solar Water Heater	3.80473	95%	45%	15	\$2.64	\$0.40
Hotel_Motel	Water_Heat	Existing	Water Heater Temperature Setback	3.80473	10%	100%	10	\$0.01	\$0.15
Hotel_Motel	Water_Heat	New	Commercial Washers	3.80473	95%	90%	8	\$0.22	\$0.10
Hotel_Motel	Water_Heat	New	Demand controlled Circulating Systems	3.80473	98%	60%	15	\$0.78	\$0.05
Hotel_Motel	Water_Heat	New	Faucet Aerators	3.80473	20%	100%	10	\$0.01	\$0.02
Hotel_Motel	Water_Heat	New	Hot Water (SHW) Pipe Insulation	3.80473	95%	85%	15	\$0.03	\$0.05
Hotel_Motel	Water_Heat	New	Low Flow Spray Heads	3.80473	55%	100%	5	\$0.01	\$0.01
Hotel_Motel	Water_Heat	New	Low-Flow Showerheads	3.80473	25%	100%	10	\$0.05	\$0.05
Hotel_Motel	Water_Heat	New	Solar Water Heater	3.80473	95%	45%	15	\$2.64	\$0.40
Office	Cooling_Chillers	Existing	Active Window Insulation	3.58631	100%	20%	15	\$1.45	\$0.21
Office	Cooling_Chillers	Existing	Automated Ventilation VFD Control (Occupancy Sensors / CO2 Sensors)	3.58631	95%	75%	10	\$0.29	\$0.05
Office	Cooling_Chillers	Existing	Chilled Water / Condenser Water Settings-Optimization	3.58631	45%	95%	10	\$0.16	\$0.05
Office	Cooling_Chillers	Existing	Chilled Water Piping Loop w/ VSD Control	3.58631	75%	90%	15	\$0.45	\$0.12
Office	Cooling_Chillers	Existing	Chiller Tune-Up / Diagnostics	3.58631	65%	98%	3	\$0.11	\$0.10
Office	Cooling_Chillers	Existing	Chiller-Centrifugal, VSD Control, 300 tons	3.58072			20	\$0.60	\$0.25

Building Type	End Use	Vintage	Measure Name	Base Usage	Incomplete Factor	Technical Feasibility	Measure Life	Per Unit Cost	Energy Savings
Office	Cooling_Chillers	Existing	Chiller-Water Side Economizer	3.58631	50%	45%	20	\$0.59	\$0.10
Office	Cooling_Chillers	Existing	Convert Constant Volume Air System to VAV	3.58631	15%	85%	15	\$0.23	\$0.12
Office	Cooling_Chillers	Existing	Cooling Tower-Decrease Approach Temperature	3.58631	98%	70%	15	\$0.11	\$0.08
Office	Cooling_Chillers	Existing	Cooling Tower-Two-Speed Fan Motor	3.58631	75%	95%	15	\$0.04	\$0.14
Office	Cooling_Chillers	Existing	Cooling Tower-VSD Fan Control	3.58631	90%	95%	15	\$0.07	\$0.04
Office	Cooling_Chillers	Existing	Direct Digital Control System-Installation	3.58631	20%	60%	10	\$0.18	\$0.10
Office	Cooling_Chillers	Existing	Direct Digital Control System-Optimization	3.58631	85%	100%	5	\$0.12	\$0.01
Office	Cooling_Chillers	Existing	High Efficiency Centrifugal Chiller, 300 ton	3.58072			20	\$0.18	\$0.20
Office	Cooling_Chillers	Existing	Insulation - Floor	3.58631	20%	60%	20	\$0.33	\$0.02
Office	Cooling_Chillers	Existing	Insulation - Roof / Ceiling	3.58631	5%	75%	20	\$0.33	\$0.03
Office	Cooling_Chillers	Existing	Pipe Insulation	3.58631	50%	65%	20	\$0.00	\$0.01
Office	Cooling_Chillers	Existing	Retro-Commissioning	3.58631	85%	92%	3	\$0.27	\$0.15
Office	Cooling_Chillers	Existing	Windows-High Efficiency	3.58631	99%	80%	30	\$0.44	\$0.09
Office	Cooling_Chillers	New	Active Window Insulation	3.67826	100%	20%	15	\$1.45	\$0.21
Office	Cooling_Chillers	New	Automated Ventilation VFD Control (Occupancy Sensors / CO2 Sensors)	3.67826	95%	75%	10	\$0.29	\$0.05
Office	Cooling_Chillers	New	Chilled Water / Condenser Water Settings-Optimization	3.67826	45%	95%	10	\$0.16	\$0.05
Office	Cooling_Chillers	New	Chilled Water Piping Loop w/ VSD Control	3.67826	75%	90%	15	\$0.45	\$0.12
Office	Cooling_Chillers	New	Chiller-Centrifugal, VSD Control, 300 tons	3.76918			20	\$0.60	\$0.25
Office	Cooling_Chillers	New	Cooling Tower-Two-Speed Fan Motor	3.67826	10%	95%	15	\$0.04	\$0.14
Office	Cooling_Chillers	New	Cooling Tower-VSD Fan Control	3.67826	80%	95%	15	\$0.07	\$0.04
Office	Cooling_Chillers	New	Direct Digital Control System-Optimization	3.67826	85%	100%	5	\$0.12	\$0.01
Office	Cooling_Chillers	New	Green Roof	3.67826	100%	25%	40	\$15.00	\$0.13
Office	Cooling_Chillers	New	High Efficiency Centrifugal Chiller, 300 ton	3.76918			20	\$0.18	\$0.20
Office	Cooling_Chillers	New	Leak Proof Duct Fittings	3.67826	100%	49%	30	\$0.07	\$0.21
Office	Cooling_Chillers	New	Pipe Insulation	3.67826	50%	100%	20	\$0.00	\$0.01
Office	Cooling_Chillers	New	Retro-Commissioning	3.67826	85%	92%	3	\$1.00	\$0.15
Office	Cooling_Chillers	New	Windows-High Efficiency	3.67826	99%	80%	30	\$0.15	\$0.09
Office	Cooling_DX	Existing	Active Window Insulation	6.15208	100%	20%	15	\$0.14	\$0.21
Office	Cooling_DX	Existing	Automated Ventilation VFD Control (Occupancy Sensors / CO2 Sensors)	6.15208	95%	75%	10	\$0.10	\$0.05
Office	Cooling_DX	Existing	Convert Constant Volume Air System to VAV	6.15208	15%	85%	15	\$0.10	\$0.12
Office	Cooling_DX	Existing	DX Package-Air Side Economizer	6.15208	25%	10%	10	\$0.26	\$0.15
Office	Cooling_DX	Existing	DX Tune-Up / Diagnostics	6.15208	85%	98%	3	\$0.23	\$0.10
Office	Cooling_DX	Existing	Direct / Indirect Evaporative Cooling, Pre-Cooling	6.15208	90%	50%	10	\$0.87	\$0.10
Office	Cooling_DX	Existing	Duct Insulation	6.15208	20%	65%	20	\$0.02	\$0.03
Office	Cooling_DX	Existing	Duct Repair and Sealing	6.15208	50%	65%	20	\$0.04	\$0.01
Office	Cooling_DX	Existing	High Efficiency DX Package	6.08238			20	\$0.50	\$0.09
Office	Cooling_DX	Existing	Insulation - Floor	6.15208	20%	60%	20	\$0.33	\$0.02
Office	Cooling_DX	Existing	Insulation - Roof / Ceiling	6.15208	5%	75%	20	\$0.33	\$0.03
Office	Cooling_DX	Existing	Premium Efficiency DX Package	6.08238			20	\$0.79	\$0.16
Office	Cooling_DX	Existing	Programmable Thermostat	6.15208	52%	100%	10	\$0.06	\$0.10
Office	Cooling_DX	Existing	Retro-Commissioning	6.15208	85%	92%	3	\$0.27	\$0.15
Office	Cooling_DX	Existing	Windows-High Efficiency	6.15208	99%	80%	30	\$0.44	\$0.05
Office	Cooling_DX	New	Active Window Insulation	6.36848	100%	20%	15	\$1.45	\$0.21
Office	Cooling_DX	New	Automated Ventilation VFD Control (Occupancy Sensors / CO2 Sensors)	6.36848	95%	75%	10	\$0.29	\$0.05
Office	Cooling_DX	New	Direct / Indirect Evaporative Cooling, Pre-Cooling	6.36848	90%	50%	10	\$0.87	\$0.10
Office	Cooling_DX	New	Green Roof	6.36848	100%	25%	40	\$15.00	\$0.13
Office	Cooling_DX	New	High Efficiency DX Package	6.52589			20	\$0.50	\$0.09
Office	Cooling_DX	New	Leak Proof Duct Fittings	6.36848	100%	49%	30	\$0.07	\$0.21
Office	Cooling_DX	New	Premium Efficiency DX Package	6.52589			20	\$0.79	\$0.16
Office	Cooling_DX	New	Retro-Commissioning	6.36848	85%	92%	3	\$1.00	\$0.15
Office	Cooling_DX	New	Windows-High Efficiency	6.36848	99%	80%	30	\$0.15	\$0.05
Office	Cooling_HeatPump	Existing	Active Window Insulation	6.20927	100%	20%	15	\$1.45	\$0.21
Office	Cooling_HeatPump	Existing	Automated Ventilation VFD Control (Occupancy Sensors / CO2 Sensors)	6.20927	95%	75%	10	\$0.29	\$0.05
Office	Cooling_HeatPump	Existing	Direct / Indirect Evaporative Cooling, Pre-Cooling	6.20927	90%	50%	10	\$0.87	\$0.10
Office	Cooling_HeatPump	Existing	Duct Insulation	6.20927	20%	65%	20	\$0.02	\$0.03
Office	Cooling_HeatPump	Existing	Duct Repair and Sealing	6.20927	50%	65%	20	\$0.04	\$0.01
Office	Cooling_HeatPump	Existing	Insulation - Floor	6.20927	20%	60%	20	\$0.33	\$0.02
Office	Cooling_HeatPump	Existing	Insulation - Roof / Ceiling	6.20927	5%	75%	20	\$0.33	\$0.03

Building Type	End Use	Vintage	Measure Name	Base Usage	Incomplete Factor	Technical Feasibility	Measure Life	Per Unit Cost	Energy Savings
Office	Cooling_HeatPump	Existing	Programmable Thermostat	6.20927	52%	100%	10	\$0.06	\$0.10
Office	Cooling_HeatPump	Existing	Retro-Commissioning	6.20927	85%	92%	3	\$0.27	\$0.15
Office	Cooling_HeatPump	Existing	Windows-High Efficiency	6.20927	99%	80%	30	\$0.44	\$0.05
Office	Cooling_HeatPump	New	Active Window Insulation	6.36848	100%	20%	15	\$1.45	\$0.21
Office	Cooling_HeatPump	New	Automated Ventilation VFD Control (Occupancy Sensors / CO2 Sensors)	6.36848	95%	75%	10	\$0.29	\$0.05
Office	Cooling_HeatPump	New	Direct / Indirect Evaporative Cooling, Pre-Cooling	6.36848	90%	50%	10	\$0.87	\$0.10
Office	Cooling_HeatPump	New	Green Roof	6.36848	100%	25%	40	\$15.00	\$0.13
Office	Cooling_HeatPump	New	Leak Proof Duct Fittings	6.36848	100%	49%	30	\$0.07	\$0.21
Office	Cooling_HeatPump	New	Retro-Commissioning	6.36848	85%	92%	3	\$1.00	\$0.15
Office	Cooling_HeatPump	New	Windows-High Efficiency	6.36848	99%	80%	30	\$0.15	\$0.05
Office	HVAC_Aux	New	Under floor Ventilation with Low Static Pressure	2.19566	100%	22%	15	\$0.70	\$0.20
Office	Lighting	Existing	Advanced High Intensity Discharge (HID) Light Sources	4.12969	100%	6%	4	\$0.06	\$0.05
Office	Lighting	Existing	Advanced/Integrated Daylighting controls (ADCs)	4.12969	100%	66%	20	\$2.50	\$0.08
Office	Lighting	Existing	Bi-Level Control, Stairwell Lighting	4.12969	98%	95%	7	\$0.10	\$0.02
Office	Lighting	Existing	Continuous Dimming, Fluorescent Fixtures	4.12969	90%	60%	11	\$0.39	\$0.16
Office	Lighting	Existing	Cost Effective Load Shed Ballast and Controller	4.12969	100%	80%	15	\$1.57	\$0.01
Office	Lighting	Existing	Hybrid Solar Lighting	4.12969	100%	22%	15	\$7.19	\$0.52
Office	Lighting	Existing	Induction Lighting	4.12969	99%	25%	25	\$0.18	\$0.01
Office	Lighting	Existing	LED Exit Signs	4.12969	98%	100%	25	\$0.08	\$0.01
Office	Lighting	Existing	LED Solid State White Lighting	4.12969	100%	7%	6	\$1.54	\$0.02
Office	Lighting	Existing	Low Wattage Ceramic Metal Halide Lamps	4.12969	100%	6%	7	\$1.18	\$0.07
Office	Lighting	Existing	Occupancy Sensor Control, Fluorescent	4.12969	90%	85%	9	\$0.52	\$0.08
Office	Lighting	Existing	Reduce Interior Lighting Power Density 15% Reduction (W/sqft)	4.12969	75%	98%	7	\$0.26	\$0.15
Office	Lighting	Existing	Reduce Interior Lighting Power Density 35% Reduction (W/sqft)	4.12969	90%	85%	7	\$0.48	\$0.25
Office	Lighting	Existing	Scotopic (High CCT) Lighting	4.12969	100%	13%	15	\$0.55	\$0.24
Office	Lighting	Existing	Stepped Dimming Fluorescent Fixtures	4.12969	85%	60%	11	\$0.63	\$0.12
Office	Lighting	New	Advanced High Intensity Discharge (HID) Light Sources	3.86134	100%	6%	4	\$0.06	\$0.05
Office	Lighting	New	Advanced/Integrated Daylighting controls (ADCs)	3.86134	100%	66%	20	\$2.50	\$0.01
Office	Lighting	New	Bi-Level Control, Stairwell Lighting	3.86134	98%	95%	7	\$0.10	\$0.03
Office	Lighting	New	Continuous Dimming, Fluorescent Fixtures	3.86134	90%	60%	11	\$0.20	\$0.16
Office	Lighting	New	Cost Effective Load Shed Ballast and Controller	3.86134	100%	80%	15	\$1.57	\$0.01
Office	Lighting	New	Hybrid Solar Lighting	3.86134	100%	22%	15	\$7.19	\$0.52
Office	Lighting	New	Induction Lighting	3.86134	99%	25%	25	\$0.18	\$0.01
Office	Lighting	New	LED Exit Signs	3.86134	98%	100%	25	\$0.03	\$0.01
Office	Lighting	New	LED Solid State White Lighting	3.86134	100%	7%	6	\$1.54	\$0.02
Office	Lighting	New	Low Wattage Ceramic Metal Halide Lamps	3.86134	100%	6%	7	\$1.18	\$0.07
Office	Lighting	New	Occupancy Sensor Control, Fluorescent	3.86134	90%	85%	9	\$0.52	\$0.04
Office	Lighting	New	Reduce Interior Lighting Power Density 15% Reduction (W/sqft)	3.86134	75%	98%	7	\$0.12	\$0.15
Office	Lighting	New	Reduce Interior Lighting Power Density 25% Reduction (W/sqft)	3.86134	90%	85%	7	\$0.22	\$0.35
Office	Lighting	New	Scotopic (High CCT) Lighting	3.86134	100%	13%	15	\$0.55	\$0.24
Office	Lighting	New	Stepped Dimming Fluorescent Fixtures	3.86134	85%	60%	11	\$0.31	\$0.12
Office	Plug_Load	Existing	Office Computer Network Energy Management	1.55216	33%	100%	4	\$0.01	\$0.09
Office	Plug_Load	Existing	Office Equipment: Copiers, Energy Star or Better	1.55216	65%	100%	4	\$0.03	\$0.01
Office	Plug_Load	Existing	Office Equipment: Monitors, Energy Star or Better	1.55216	60%	100%	4	\$0.09	\$0.02
Office	Plug_Load	Existing	Office Equipment: Printers, Energy Star or Better	1.55216	62%	100%	4	\$0.10	\$0.01
Office	Plug_Load	Existing	Vending Machines- Controls	1.55216	85%	95%	3	\$0.01	\$0.00
Office	Plug_Load	Existing	Vending Machines- High Efficiency	1.55216	85%	100%	14	\$0.01	\$0.00
Office	Plug_Load	New	Office Computer Network Energy Management	1.55216	33%	100%	4	\$0.01	\$0.09
Office	Plug_Load	New	Office Equipment: Copiers, Energy Star or Better	1.55216	65%	100%	4	\$0.03	\$0.01
Office	Plug_Load	New	Office Equipment: Monitors, Energy Star or Better	1.55216	60%	100%	4	\$0.09	\$0.02
Office	Plug_Load	New	Office Equipment: Printers, Energy Star or Better	1.55216	62%	100%	4	\$0.10	\$0.01
Office	Plug_Load	New	Vending Machines- High Efficiency	1.55216	85%	100%	14	\$0.01	\$0.00
Office	Space_Heat	Existing	Automated Ventilation VFD Control (Occupancy Sensors / CO2 Sensors)	4.50000	95%	75%	15	\$0.28	\$0.10
Office	Space_Heat	Existing	Convert Constant Volume Air System to VAV	4.50000	15%	85%	15	\$0.23	\$0.12
Office	Space_Heat	Existing	Duct Insulation	4.50000	20%	65%	20	\$0.02	\$0.03
Office	Space_Heat	Existing	Duct Repair and Sealing	4.50000	50%	65%	20	\$0.01	\$0.01
Office	Space_Heat	Existing	Exhaust Air to Ventilation Air Heat Recovery	4.50000	95%	5%	20	\$1.00	\$0.20
Office	Space_Heat	Existing	Insulation - Floor	4.50000	20%	60%	20	\$0.33	\$0.05

Building Type	End Use	Vintage	Measure Name	Base Usage	Incomplete Factor	Technical Feasibility	Measure Life	Per Unit Cost	Energy Savings
Office	Space_Heat	Existing	Insulation - Roof / Ceiling	4.50000	5%	75%	20	\$0.33	\$0.10
Office	Space_Heat	Existing	Programmable Thermostat	4.50000	52%	100%	10	\$0.15	\$0.20
Office	Space_Heat	Existing	Retro-Commissioning	4.50000	85%	92%	3	\$0.27	\$0.15
Office	Space_Heat	Existing	Windows-High Efficiency	4.50000	99%	80%	30	\$0.44	\$0.20
Office	Space_Heat	New	Automated Ventilation VFD Control (Occupancy Sensors / CO2 Sensors)	4.50000	95%	75%	15	\$0.28	\$0.10
Office	Space_Heat	New	Exhaust Air to Ventilation Air Heat Recovery	4.50000	95%	5%	20	\$0.93	\$0.15
Office	Space_Heat	New	Green Roof	4.50000	100%	25%	40	\$15.00	\$0.13
Office	Space_Heat	New	Leak Proof Duct Fittings	4.50000	100%	49%	30	\$0.07	\$0.21
Office	Space_Heat	New	Retro-Commissioning	4.50000	85%	92%	3	\$1.00	\$0.15
Office	Space_Heat	New	Windows-High Efficiency	4.50000	99%	80%	30	\$0.15	\$0.20
Office	Water_Heat	Existing	Demand controlled Circulating Systems	0.30125	85%	60%	15	\$1.05	\$0.05
Office	Water_Heat	Existing	Faucet Aerators	0.30125	20%	100%	10	\$0.00	\$0.02
Office	Water_Heat	Existing	Hot Water (SHW) Pipe Insulation	0.30125	35%	85%	15	\$0.00	\$0.05
Office	Water_Heat	Existing	Low-Flow Showerheads	0.30125	25%	100%	10	\$0.00	\$0.01
Office	Water_Heat	Existing	Solar Water Heater	0.30125	95%	45%	15	\$1.54	\$0.40
Office	Water_Heat	Existing	Water Heater Temperature Setback	0.30125	45%	100%	10	\$0.01	\$0.15
Office	Water_Heat	New	Demand controlled Circulating Systems	0.30125	85%	60%	15	\$1.05	\$0.05
Office	Water_Heat	New	Faucet Aerators	0.30125	20%	100%	10	\$0.00	\$0.02
Office	Water_Heat	New	Hot Water (SHW) Pipe Insulation	0.30125	35%	85%	15	\$0.00	\$0.05
Office	Water_Heat	New	Low-Flow Showerheads	0.30125	25%	100%	10	\$0.01	\$0.01
Office	Water_Heat	New	Solar Water Heater	0.30125	95%	45%	15	\$1.54	\$0.40
Other	Cooling_Chillers	Existing	Active Window Insulation	2.42207	100%	20%	15	\$1.45	\$0.21
Other	Cooling_Chillers	Existing	Automated Ventilation VFD Control (Occupancy Sensors / CO2 Sensors)	2.42207	95%	50%	10	\$0.19	\$0.05
Other	Cooling_Chillers	Existing	Chilled Water / Condenser Water Settings-Optimization	2.42207	45%	95%	10	\$0.14	\$0.05
Other	Cooling_Chillers	Existing	Chilled Water Piping Loop w/ VSD Control	2.42207	75%	90%	15	\$0.30	\$0.12
Other	Cooling_Chillers	Existing	Chiller Tune-Up / Diagnostics	2.42207	65%	98%	3	\$0.08	\$0.10
Other	Cooling_Chillers	Existing	Chiller-Centrifugal, VSD Control, 300 tons	2.42207			20	\$0.40	\$0.25
Other	Cooling_Chillers	Existing	Chiller-Water Side Economizer	2.42207	90%	45%	20	\$0.59	\$0.10
Other	Cooling_Chillers	Existing	Convert Constant Volume Air System to VAV	2.42207	15%	85%	15	\$0.16	\$0.12
Other	Cooling_Chillers	Existing	Cooling Tower-Decrease Approach Temperature	2.42207	98%	70%	15	\$0.07	\$0.08
Other	Cooling_Chillers	Existing	Cooling Tower-Two-Speed Fan Motor	2.42207	75%	95%	15	\$0.04	\$0.14
Other	Cooling_Chillers	Existing	Cooling Tower-VSD Fan Control	2.42207	90%	95%	15	\$0.05	\$0.04
Other	Cooling_Chillers	Existing	Direct Digital Control System-Installation	2.42207	20%	60%	10	\$0.12	\$0.10
Other	Cooling_Chillers	Existing	Direct Digital Control System-Optimization	2.42207	98%	100%	5	\$0.12	\$0.01
Other	Cooling_Chillers	Existing	High Efficiency Centrifugal Chiller, 300 ton	2.42207			20	\$0.12	\$0.20
Other	Cooling_Chillers	Existing	Insulation - Floor	2.42207	55%	60%	20	\$0.44	\$0.02
Other	Cooling_Chillers	Existing	Insulation - Roof / Ceiling	2.42207	35%	75%	20	\$0.44	\$0.03
Other	Cooling_Chillers	Existing	Pipe Insulation	2.42207	50%	65%	20	\$0.01	\$0.01
Other	Cooling_Chillers	Existing	Retro-Commissioning	2.42207	85%	92%	3	\$0.27	\$0.15
Other	Cooling_Chillers	Existing	Windows-High Efficiency	2.42207	75%	80%	30	\$0.14	\$0.02
Other	Cooling_Chillers	New	Active Window Insulation	2.48805	100%	20%	15	\$1.45	\$0.21
Other	Cooling_Chillers	New	Automated Ventilation VFD Control (Occupancy Sensors / CO2 Sensors)	2.48805	95%	50%	10	\$0.19	\$0.05
Other	Cooling_Chillers	New	Chilled Water / Condenser Water Settings-Optimization	2.48805	45%	95%	10	\$0.14	\$0.05
Other	Cooling_Chillers	New	Chilled Water Piping Loop w/ VSD Control	2.48805	75%	90%	15	\$0.30	\$0.12
Other	Cooling_Chillers	New	Chiller-Centrifugal, VSD Control, 300 tons	2.48805			20	\$0.40	\$0.25
Other	Cooling_Chillers	New	Cooling Tower-Two-Speed Fan Motor	2.48805	10%	95%	15	\$0.04	\$0.14
Other	Cooling_Chillers	New	Cooling Tower-VSD Fan Control	2.48805	80%	95%	15	\$0.05	\$0.04
Other	Cooling_Chillers	New	Direct Digital Control System-Optimization	2.48805	98%	100%	5	\$0.12	\$0.01
Other	Cooling_Chillers	New	Green Roof	2.48805	100%	25%	40	\$15.00	\$0.13
Other	Cooling_Chillers	New	High Efficiency Centrifugal Chiller, 300 ton	2.48805			20	\$0.12	\$0.20
Other	Cooling_Chillers	New	Leak Proof Duct Fittings	2.48805	100%	49%	30	\$0.07	\$0.21
Other	Cooling_Chillers	New	Pipe Insulation	2.48805	50%	100%	20	\$0.01	\$0.01
Other	Cooling_Chillers	New	Retro-Commissioning	2.48805	85%	92%	3	\$1.00	\$0.15
Other	Cooling_Chillers	New	Windows-High Efficiency	2.48805	75%	80%	30	\$0.05	\$0.02
Other	Cooling_DX	Existing	Active Window Insulation	4.11425	100%	20%	15	\$0.32	\$0.21
Other	Cooling_DX	Existing	Automated Ventilation VFD Control (Occupancy Sensors / CO2 Sensors)	4.11425	95%	50%	10	\$0.32	\$0.05
Other	Cooling_DX	Existing	Convert Constant Volume Air System to VAV	4.11425	15%	85%	15	\$0.16	\$0.12
Other	Cooling_DX	Existing	DX Package-Air Side Economizer	4.11425	75%	10%	10	\$0.23	\$0.15

Building Type	End Use	Vintage	Measure Name	Base Usage	Incomplete Factor	Technical Feasibility	Measure Life	Per Unit Cost	Energy Savings
Other	Cooling_DX	Existing	DX Tune-Up / Diagnostics	4.11425	85%	98%	3	\$0.16	\$0.10
Other	Cooling_DX	Existing	Direct / Indirect Evaporative Cooling, Pre-Cooling	4.11425	90%	50%	10	\$0.58	\$0.10
Other	Cooling_DX	Existing	Duct Insulation	4.11425	20%	65%	20	\$0.01	\$0.03
Other	Cooling_DX	Existing	Duct Repair and Sealing	4.11425	50%	65%	20	\$0.04	\$0.01
Other	Cooling_DX	Existing	High Efficiency DX Package	4.11425			20	\$0.50	\$0.09
Other	Cooling_DX	Existing	Insulation - Floor	4.11425	55%	60%	20	\$0.44	\$0.02
Other	Cooling_DX	Existing	Insulation - Roof / Ceiling	4.11425	35%	75%	20	\$0.44	\$0.03
Other	Cooling_DX	Existing	Premium Efficiency DX Package	4.11425			20	\$0.71	\$0.16
Other	Cooling_DX	Existing	Programmable Thermostat	4.11425	32%	100%	10	\$0.04	\$0.10
Other	Cooling_DX	Existing	Retro-Commissioning	4.11425	85%	92%	3	\$0.27	\$0.15
Other	Cooling_DX	Existing	Windows-High Efficiency	4.11425	75%	80%	30	\$0.14	\$0.05
Other	Cooling_DX	New	Active Window Insulation	4.41425	100%	20%	15	\$1.45	\$0.21
Other	Cooling_DX	New	Automated Ventilation VFD Control (Occupancy Sensors / CO2 Sensors)	4.41425	95%	50%	10	\$0.19	\$0.05
Other	Cooling_DX	New	Direct / Indirect Evaporative Cooling, Pre-Cooling	4.41425	90%	50%	10	\$0.58	\$0.10
Other	Cooling_DX	New	Green Roof	4.41425	100%	25%	40	\$15.00	\$0.13
Other	Cooling_DX	New	High Efficiency DX Package	4.41425			20	\$0.50	\$0.09
Other	Cooling_DX	New	Leak Proof Duct Fittings	4.41425	100%	49%	30	\$0.07	\$0.21
Other	Cooling_DX	New	Premium Efficiency DX Package	4.41425			20	\$0.71	\$0.16
Other	Cooling_DX	New	Retro-Commissioning	4.41425	85%	92%	3	\$1.00	\$0.15
Other	Cooling_DX	New	Windows-High Efficiency	4.41425	75%	80%	30	\$0.05	\$0.05
Other	Cooling_HeatPump	Existing	Active Window Insulation	4.20008	100%	20%	15	\$1.45	\$0.21
Other	Cooling_HeatPump	Existing	Automated Ventilation VFD Control (Occupancy Sensors / CO2 Sensors)	4.20008	95%	50%	10	\$0.19	\$0.05
Other	Cooling_HeatPump	Existing	Direct / Indirect Evaporative Cooling, Pre-Cooling	4.20008	90%	50%	10	\$0.58	\$0.10
Other	Cooling_HeatPump	Existing	Duct Insulation	4.20008	20%	65%	20	\$0.01	\$0.03
Other	Cooling_HeatPump	Existing	Duct Repair and Sealing	4.20008	50%	65%	20	\$0.04	\$0.01
Other	Cooling_HeatPump	Existing	Insulation - Floor	4.20008	55%	60%	20	\$0.44	\$0.02
Other	Cooling_HeatPump	Existing	Insulation - Roof / Ceiling	4.20008	35%	75%	20	\$0.44	\$0.03
Other	Cooling_HeatPump	Existing	Programmable Thermostat	4.20008	32%	100%	10	\$0.04	\$0.10
Other	Cooling_HeatPump	Existing	Retro-Commissioning	4.20008	85%	92%	3	\$0.27	\$0.15
Other	Cooling_HeatPump	Existing	Windows-High Efficiency	4.20008	75%	80%	30	\$0.14	\$0.05
Other	Cooling_HeatPump	New	Active Window Insulation	4.30777	100%	20%	15	\$1.45	\$0.21
Other	Cooling_HeatPump	New	Automated Ventilation VFD Control (Occupancy Sensors / CO2 Sensors)	4.30777	95%	50%	10	\$0.19	\$0.05
Other	Cooling_HeatPump	New	Direct / Indirect Evaporative Cooling, Pre-Cooling	4.30777	90%	50%	10	\$0.58	\$0.10
Other	Cooling_HeatPump	New	Green Roof	4.30777	100%	25%	40	\$15.00	\$0.13
Other	Cooling_HeatPump	New	Leak Proof Duct Fittings	4.30777	100%	49%	30	\$0.07	\$0.21
Other	Cooling_HeatPump	New	Retro-Commissioning	4.30777	85%	92%	3	\$1.00	\$0.15
Other	Cooling_HeatPump	New	Windows-High Efficiency	4.30777	75%	80%	30	\$0.05	\$0.05
Other	HVAC_Aux	New	Optimized Variable Volume Lab Hood Design	1.84570	98%	95%	10	\$0.01	\$0.02
Other	Lighting	Existing	Advanced High Intensity Discharge (HID) Light Sources	1.72088	100%	6%	4	\$0.29	\$0.22
Other	Lighting	Existing	Advanced/Integrated Daylighting controls (ADCs)	1.72088	100%	66%	20	\$2.50	\$0.12
Other	Lighting	Existing	Bi-Level Control, Stairwell Lighting	1.72088	98%	95%	7	\$0.10	\$0.03
Other	Lighting	Existing	Continuous Dimming, Fluorescent Fixtures	1.72088	90%	60%	26	\$0.37	\$0.07
Other	Lighting	Existing	Induction Lighting	1.72088	99%	25%	25	\$0.28	\$0.01
Other	Lighting	Existing	LED Exit Signs	1.72088	98%	100%	25	\$0.07	\$0.01
Other	Lighting	Existing	LED Solid State White Lighting	1.72088	100%	7%	6	\$1.46	\$0.01
Other	Lighting	Existing	Low Wattage Ceramic Metal Halide Lamps	1.72088	100%	6%	7	\$1.42	\$0.31
Other	Lighting	Existing	Occupancy Sensor Control, Fluorescent	1.72088	80%	85%	21	\$0.49	\$0.06
Other	Lighting	Existing	Reduce Interior Lighting Power Density 15% Reduction (W/sqft)	1.72088	75%	98%	7	\$0.26	\$0.15
Other	Lighting	Existing	Reduce Interior Lighting Power Density 25% Reduction (W/sqft)	1.72088	90%	85%	7	\$0.48	\$0.25
Other	Lighting	Existing	Scotopic (High CCT) Lighting	1.72088	100%	13%	15	\$0.55	\$0.11
Other	Lighting	Existing	Stepped Dimming Fluorescent Fixtures	1.72088	85%	60%	26	\$0.59	\$0.05
Other	Lighting	New	Advanced High Intensity Discharge (HID) Light Sources	1.63596	100%	6%	4	\$0.07	\$0.22
Other	Lighting	New	Advanced/Integrated Daylighting controls (ADCs)	1.63596	100%	66%	20	\$2.50	\$0.05
Other	Lighting	New	Bi-Level Control, Stairwell Lighting	1.63596	98%	95%	7	\$0.10	\$0.03
Other	Lighting	New	Continuous Dimming, Fluorescent Fixtures	1.63596	90%	60%	26	\$0.18	\$0.07
Other	Lighting	New	Induction Lighting	1.63596	99%	25%	25	\$0.28	\$0.01
Other	Lighting	New	LED Exit Signs	1.63596	98%	100%	25	\$0.02	\$0.01
Other	Lighting	New	LED Solid State White Lighting	1.63596	100%	7%	6	\$1.86	\$0.01



Building Type	End Use	Vintage	Measure Name	Base Usage	Incomplete Factor	Technical Feasibility	Measure Life	Per Unit Cost	Energy Savings
Other	Lighting	New	Low Wattage Ceramic Metal Halide Lamps	1.63596	100%	6%	7	\$0.13	\$0.31
Other	Lighting	New	Occupancy Sensor Control, Fluorescent	1.63596	80%	85%	21	\$0.49	\$0.05
Other	Lighting	New	Reduce Interior Lighting Power Density 15% Reduction (W/sqft)	1.63596	75%	98%	7	\$0.12	\$0.15
Other	Lighting	New	Reduce Interior Lighting Power Density 25% Reduction (W/sqft)	1.63596	90%	85%	7	\$0.22	\$0.25
Other	Lighting	New	Scotopic (High CCT) Lighting	1.63596	100%	13%	15	\$0.55	\$0.11
Other	Lighting	New	Stepped Dimming Fluorescent Fixtures	1.63596	85%	60%	26	\$0.30	\$0.05
Other	Plug_Load	Existing	Office Computer Network Energy Management	0.08595	33%	100%	4	\$0.01	\$0.07
Other	Plug_Load	Existing	Office Equipment: Copiers, Energy Star or Better	0.08595	65%	100%	4	\$0.04	\$0.01
Other	Plug_Load	Existing	Office Equipment: Monitors, Energy Star or Better	0.08595	60%	100%	4	\$0.07	\$0.02
Other	Plug_Load	Existing	Office Equipment: Printers, Energy Star or Better	0.08595	62%	100%	4	\$0.11	\$0.01
Other	Plug_Load	Existing	Vending Machines- Controls	0.08595	85%	95%	3	\$0.01	\$0.01
Other	Plug_Load	Existing	Vending Machines- High Efficiency	0.08595	85%	100%	14	\$0.01	\$0.02
Other	Plug_Load	New	Office Computer Network Energy Management	0.08595	33%	100%	4	\$0.01	\$0.07
Other	Plug_Load	New	Office Equipment: Copiers, Energy Star or Better	0.08595	65%	100%	4	\$0.04	\$0.01
Other	Plug_Load	New	Office Equipment: Monitors, Energy Star or Better	0.08595	60%	100%	4	\$0.07	\$0.02
Other	Plug_Load	New	Office Equipment: Printers, Energy Star or Better	0.08595	62%	100%	4	\$0.11	\$0.01
Other	Plug_Load	New	Vending Machines- High Efficiency	0.08595	85%	100%	14	\$0.01	\$0.02
Other	Space_Heat	Existing	Automated Ventilation VFD Control (Occupancy Sensors / CO2 Sensors)	4.47640	95%	50%	15	\$0.28	\$0.10
Other	Space_Heat	Existing	Convert Constant Volume Air System to VAV	4.47640	15%	85%	15	\$0.16	\$0.12
Other	Space_Heat	Existing	Duct Insulation	4.47640	20%	65%	20	\$0.01	\$0.03
Other	Space_Heat	Existing	Duct Repair and Sealing	4.47640	50%	65%	20	\$0.01	\$0.01
Other	Space_Heat	Existing	Exhaust Air to Ventilation Air Heat Recovery	4.47640	95%	5%	20	\$1.00	\$0.20
Other	Space_Heat	Existing	Insulation - Floor	4.47640	55%	60%	20	\$0.44	\$0.05
Other	Space_Heat	Existing	Insulation - Roof / Ceiling	4.47640	35%	75%	20	\$0.44	\$0.10
Other	Space_Heat	Existing	Programmable Thermostat	4.47640	32%	100%	10	\$0.15	\$0.20
Other	Space_Heat	Existing	Retro-Commissioning	4.47640	85%	92%	3	\$0.27	\$0.15
Other	Space_Heat	Existing	Windows-High Efficiency	4.47640	75%	80%	30	\$0.14	\$0.06
Other	Space_Heat	New	Automated Ventilation VFD Control (Occupancy Sensors / CO2 Sensors)	4.47640	95%	50%	15	\$0.28	\$0.10
Other	Space_Heat	New	Exhaust Air to Ventilation Air Heat Recovery	4.47640	95%	5%	20	\$0.93	\$0.15
Other	Space_Heat	New	Green Roof	4.47640	100%	25%	40	\$15.00	\$0.13
Other	Space_Heat	New	Leak Proof Duct Fittings	4.47640	100%	49%	30	\$0.07	\$0.21
Other	Space_Heat	New	Retro-Commissioning	4.47640	85%	92%	3	\$1.00	\$0.15
Other	Space_Heat	New	Windows-High Efficiency	4.47640	75%	80%	30	\$0.05	\$0.06
Other	Water_Heat	Existing	Commercial Washers	0.30027	95%	90%	8	\$0.44	\$0.35
Other	Water_Heat	Existing	Demand controlled Circulating Systems	0.30027	98%	60%	15	\$0.93	\$0.05
Other	Water_Heat	Existing	Faucet Aerators	0.30027	20%	100%	10	\$0.00	\$0.02
Other	Water_Heat	Existing	Hot Water (SHW) Pipe Insulation	0.30027	95%	85%	15	\$0.01	\$0.05
Other	Water_Heat	Existing	Low-Flow Showerheads	0.30027	25%	100%	10	\$0.01	\$0.02
Other	Water_Heat	Existing	Solar Water Heater	0.30027	95%	45%	15	\$2.58	\$0.40
Other	Water_Heat	Existing	Water Heater Temperature Setback	0.30027	60%	100%	10	\$0.01	\$0.15
Other	Water_Heat	New	Commercial Washers	0.30027	95%	90%	8	\$0.44	\$0.35
Other	Water_Heat	New	Demand controlled Circulating Systems	0.30027	98%	60%	15	\$0.93	\$0.05
Other	Water_Heat	New	Faucet Aerators	0.30027	20%	100%	10	\$0.00	\$0.02
Other	Water_Heat	New	Hot Water (SHW) Pipe Insulation	0.30027	95%	85%	15	\$0.01	\$0.05
Other	Water_Heat	New	Low-Flow Showerheads	0.30027	25%	100%	10	\$0.01	\$0.02
Other	Water_Heat	New	Solar Water Heater	0.30027	95%	45%	15	\$2.58	\$0.40
Restaurant	Cooling_Chillers	Existing	Active Window Insulation	4.95063	100%	20%	15	\$1.45	\$0.21
Restaurant	Cooling_Chillers	Existing	Automated Ventilation VFD Control (Occupancy Sensors / CO2 Sensors)	4.95063	95%	5%	10	\$0.18	\$0.05
Restaurant	Cooling_Chillers	Existing	Chilled Water / Condenser Water Settings-Optimization	4.95063	45%	95%	10	\$0.32	\$0.05
Restaurant	Cooling_Chillers	Existing	Chilled Water Piping Loop w/ VSD Control	4.95063	75%	90%	15	\$0.29	\$0.12
Restaurant	Cooling_Chillers	Existing	Chiller Tune-Up / Diagnostics	4.95063	65%	98%	3	\$0.07	\$0.10
Restaurant	Cooling_Chillers	Existing	Chiller-Centrifugal, VSD Control, 300 tons	4.95063			20	\$0.38	\$0.25
Restaurant	Cooling_Chillers	Existing	Chiller-Water Side Economizer	4.95063	95%	45%	20	\$0.59	\$0.10
Restaurant	Cooling_Chillers	Existing	Cooling Tower-Decrease Approach Temperature	4.95063	98%	70%	15	\$0.07	\$0.08
Restaurant	Cooling_Chillers	Existing	Cooling Tower-Two-Speed Fan Motor	4.95063	75%	95%	15	\$0.04	\$0.14
Restaurant	Cooling_Chillers	Existing	Cooling Tower-VSD Fan Control	4.95063	90%	95%	15	\$0.05	\$0.04
Restaurant	Cooling_Chillers	Existing	Direct Digital Control System-Installation	4.95063	20%	60%	10	\$0.11	\$0.10
Restaurant	Cooling_Chillers	Existing	Direct Digital Control System-Optimization	4.95063	99%	100%	5	\$0.12	\$0.01

Building Type	End Use	Vintage	Measure Name	Base Usage	Incomplete Factor	Technical Feasibility	Measure Life	Per Unit Cost	Energy Savings
Restaurant	Cooling_Chillers	Existing	High Efficiency Centrifugal Chiller, 300 ton	4.95063			20	\$0.11	\$0.20
Restaurant	Cooling_Chillers	Existing	Insulation - Floor	4.95063	95%	60%	20	\$0.45	\$0.02
Restaurant	Cooling_Chillers	Existing	Insulation - Roof / Ceiling	4.95063	90%	75%	20	\$0.45	\$0.03
Restaurant	Cooling_Chillers	Existing	Pipe Insulation	4.95063	50%	65%	20	\$0.02	\$0.01
Restaurant	Cooling_Chillers	Existing	Retro-Commissioning	4.95063	85%	92%	3	\$0.27	\$0.15
Restaurant	Cooling_Chillers	Existing	Windows-High Efficiency	4.95063	85%	80%	30	\$0.14	\$0.05
Restaurant	Cooling_Chillers	New	Active Window Insulation	5.21119	100%	20%	15	\$1.45	\$0.21
Restaurant	Cooling_Chillers	New	Automated Ventilation VFD Control (Occupancy Sensors / CO2 Sensors)	5.21119	95%	5%	10	\$0.18	\$0.05
Restaurant	Cooling_Chillers	New	Chilled Water / Condenser Water Settings-Optimization	5.21119	45%	95%	10	\$0.32	\$0.05
Restaurant	Cooling_Chillers	New	Chilled Water Piping Loop w/ VSD Control	5.21119	75%	90%	15	\$0.29	\$0.12
Restaurant	Cooling_Chillers	New	Chiller-Centrifugal, VSD Control, 300 tons	5.21119			20	\$0.38	\$0.25
Restaurant	Cooling_Chillers	New	Cooling Tower-Two-Speed Fan Motor	5.21119	10%	95%	15	\$0.04	\$0.14
Restaurant	Cooling_Chillers	New	Cooling Tower-VSD Fan Control	5.21119	80%	95%	15	\$0.05	\$0.04
Restaurant	Cooling_Chillers	New	Direct Digital Control System-Optimization	5.21119	99%	100%	5	\$0.12	\$0.01
Restaurant	Cooling_Chillers	New	Green Roof	5.21119	100%	25%	40	\$15.00	\$0.13
Restaurant	Cooling_Chillers	New	High Efficiency Centrifugal Chiller, 300 ton	5.21119			20	\$0.11	\$0.20
Restaurant	Cooling_Chillers	New	Leak Proof Duct Fittings	5.21119	100%	49%	30	\$0.07	\$0.21
Restaurant	Cooling_Chillers	New	Pipe Insulation	5.21119	50%	100%	20	\$0.02	\$0.01
Restaurant	Cooling_Chillers	New	Retro-Commissioning	5.21119	85%	92%	3	\$1.00	\$0.15
Restaurant	Cooling_Chillers	New	Windows-High Efficiency	5.21119	85%	80%	30	\$0.05	\$0.05
Restaurant	Cooling_DX	Existing	Active Window Insulation	8.40938	100%	20%	15	\$0.21	\$0.21
Restaurant	Cooling_DX	Existing	Automated Ventilation VFD Control (Occupancy Sensors / CO2 Sensors)	8.40938	95%	5%	10	\$0.14	\$0.05
Restaurant	Cooling_DX	Existing	DX Package-Air Side Economizer	8.40938	55%	10%	10	\$0.53	\$0.15
Restaurant	Cooling_DX	Existing	DX Tune-Up / Diagnostics	8.40938	85%	98%	3	\$0.15	\$0.10
Restaurant	Cooling_DX	Existing	Direct / Indirect Evaporative Cooling, Pre-Cooling	8.40938	90%	50%	10	\$0.55	\$0.10
Restaurant	Cooling_DX	Existing	Duct Insulation	8.40938	20%	65%	20	\$0.01	\$0.03
Restaurant	Cooling_DX	Existing	Duct Repair and Sealing	8.40938	50%	65%	20	\$0.04	\$0.01
Restaurant	Cooling_DX	Existing	High Efficiency DX Package	8.40938			20	\$0.50	\$0.09
Restaurant	Cooling_DX	Existing	Insulation - Floor	8.40938	95%	60%	20	\$0.45	\$0.02
Restaurant	Cooling_DX	Existing	Insulation - Roof / Ceiling	8.40938	90%	75%	20	\$0.45	\$0.03
Restaurant	Cooling_DX	Existing	Premium Efficiency DX Package	8.40938			20	\$0.70	\$0.16
Restaurant	Cooling_DX	Existing	Programmable Thermostat	8.40938	45%	100%	10	\$0.04	\$0.10
Restaurant	Cooling_DX	Existing	Retro-Commissioning	8.40938	85%	92%	3	\$0.27	\$0.15
Restaurant	Cooling_DX	Existing	Windows-High Efficiency	8.40938	85%	80%	30	\$0.14	\$0.05
Restaurant	Cooling_DX	New	Active Window Insulation	9.02257	100%	20%	15	\$1.45	\$0.21
Restaurant	Cooling_DX	New	Automated Ventilation VFD Control (Occupancy Sensors / CO2 Sensors)	9.02257	95%	5%	10	\$0.18	\$0.05
Restaurant	Cooling_DX	New	Direct / Indirect Evaporative Cooling, Pre-Cooling	9.02257	90%	50%	10	\$0.55	\$0.10
Restaurant	Cooling_DX	New	Green Roof	9.02257	100%	25%	40	\$15.00	\$0.13
Restaurant	Cooling_DX	New	High Efficiency DX Package	9.02257			20	\$0.50	\$0.09
Restaurant	Cooling_DX	New	Leak Proof Duct Fittings	9.02257	100%	49%	30	\$0.07	\$0.21
Restaurant	Cooling_DX	New	Premium Efficiency DX Package	9.02257			20	\$0.70	\$0.16
Restaurant	Cooling_DX	New	Retro-Commissioning	9.02257	85%	92%	3	\$1.00	\$0.15
Restaurant	Cooling_DX	New	Windows-High Efficiency	9.02257	85%	80%	30	\$0.05	\$0.05
Restaurant	Cooling_HeatPump	Existing	Active Window Insulation	8.58481	100%	20%	15	\$1.45	\$0.21
Restaurant	Cooling_HeatPump	Existing	Automated Ventilation VFD Control (Occupancy Sensors / CO2 Sensors)	8.58481	95%	5%	10	\$0.18	\$0.05
Restaurant	Cooling_HeatPump	Existing	Direct / Indirect Evaporative Cooling, Pre-Cooling	8.58481	90%	50%	10	\$0.55	\$0.10
Restaurant	Cooling_HeatPump	Existing	Duct Insulation	8.58481	20%	65%	20	\$0.01	\$0.03
Restaurant	Cooling_HeatPump	Existing	Duct Repair and Sealing	8.58481	50%	65%	20	\$0.04	\$0.01
Restaurant	Cooling_HeatPump	Existing	Insulation - Floor	8.58481	95%	60%	20	\$0.45	\$0.02
Restaurant	Cooling_HeatPump	Existing	Insulation - Roof / Ceiling	8.58481	90%	75%	20	\$0.45	\$0.03
Restaurant	Cooling_HeatPump	Existing	Programmable Thermostat	8.58481	45%	100%	10	\$0.04	\$0.10
Restaurant	Cooling_HeatPump	Existing	Retro-Commissioning	8.58481	85%	92%	3	\$0.27	\$0.15
Restaurant	Cooling_HeatPump	Existing	Windows-High Efficiency	8.58481	85%	80%	30	\$0.14	\$0.05
Restaurant	Cooling_HeatPump	New	Active Window Insulation	8.80494	100%	20%	15	\$1.45	\$0.21
Restaurant	Cooling_HeatPump	New	Automated Ventilation VFD Control (Occupancy Sensors / CO2 Sensors)	8.80494	95%	5%	10	\$0.18	\$0.05
Restaurant	Cooling_HeatPump	New	Direct / Indirect Evaporative Cooling, Pre-Cooling	8.80494	90%	50%	10	\$0.55	\$0.10
Restaurant	Cooling_HeatPump	New	Green Roof	8.80494	100%	25%	40	\$15.00	\$0.13
Restaurant	Cooling_HeatPump	New	Leak Proof Duct Fittings	8.80494	100%	49%	30	\$0.07	\$0.21

Building Type	End Use	Vintage	Measure Name	Base Usage	Incomplete Factor	Technical Feasibility	Measure Life	Per Unit Cost	Energy Savings
Restaurant	Cooling_HeatPump	New	Retro-Commissioning	8.80494	85%	92%	3	\$1.00	\$0.15
Restaurant	Cooling_HeatPump	New	Windows-High Efficiency	8.80494	85%	80%	30	\$0.05	\$0.05
Restaurant	Lighting	Existing	Bi-Level Control, Stairwell Lighting	7.59584	98%	95%	7	\$0.10	\$0.02
Restaurant	Lighting	Existing	Continuous Dimming, Fluorescent Fixtures	7.59584	90%	2%	16	\$0.40	\$0.10
Restaurant	Lighting	Existing	Cost Effective Load Shed Ballast and Controller	7.59584	100%	80%	15	\$1.61	\$0.01
Restaurant	Lighting	Existing	Induction Lighting	7.59584	99%	25%	25	\$0.24	\$0.01
Restaurant	Lighting	Existing	LED Exit Signs	7.59584	98%	100%	25	\$0.16	\$0.01
Restaurant	Lighting	Existing	LED Refrigeration Case Lights	7.59584	85%	100%	12	\$0.02	\$0.07
Restaurant	Lighting	Existing	LED Solid State White Lighting	7.59584	100%	7%	6	\$2.70	\$0.16
Restaurant	Lighting	Existing	Occupancy Sensor Control, Fluorescent	7.59584	95%	85%	13	\$0.53	\$0.00
Restaurant	Lighting	Existing	Reduce Interior Lighting Power Density 15% Reduction (W/sqft)	7.59584	75%	98%	7	\$0.26	\$0.15
Restaurant	Lighting	Existing	Reduce Interior Lighting Power Density 25% Reduction (W/sqft)	7.59584	90%	85%	7	\$0.48	\$0.25
Restaurant	Lighting	Existing	Stepped Dimming Fluorescent Fixtures	7.59584	85%	60%	16	\$0.64	\$0.08
Restaurant	Lighting	New	Bi-Level Control, Stairwell Lighting	7.30932	98%	95%	7	\$0.10	\$0.03
Restaurant	Lighting	New	Continuous Dimming, Fluorescent Fixtures	7.30932	90%	2%	16	\$0.20	\$0.10
Restaurant	Lighting	New	Cost Effective Load Shed Ballast and Controller	7.30932	100%	80%	15	\$1.61	\$0.01
Restaurant	Lighting	New	Induction Lighting	7.30932	99%	25%	25	\$0.00	\$0.01
Restaurant	Lighting	New	LED Exit Signs	7.30932	98%	100%	25	\$0.05	\$0.01
Restaurant	Lighting	New	LED Refrigeration Case Lights	7.30932	85%	100%	12	\$0.02	\$0.07
Restaurant	Lighting	New	LED Solid State White Lighting	7.30932	100%	7%	6	\$2.70	\$0.16
Restaurant	Lighting	New	Occupancy Sensor Control, Fluorescent	7.30932	95%	85%	13	\$0.53	\$0.00
Restaurant	Lighting	New	Reduce Interior Lighting Power Density 15% Reduction (W/sqft)	7.30932	75%	98%	7	\$0.12	\$0.15
Restaurant	Lighting	New	Reduce Interior Lighting Power Density 25% Reduction (W/sqft)	7.30932	90%	85%	7	\$0.22	\$0.25
Restaurant	Lighting	New	Stepped Dimming Fluorescent Fixtures	7.30932	85%	60%	16	\$0.32	\$0.08
Restaurant	Plug_Load	Existing	Office Computer Network Energy Management	0.22583	33%	100%	4	\$0.00	\$0.07
Restaurant	Plug_Load	Existing	Office Equipment: Copiers, Energy Star or Better	0.22583	65%	100%	4	\$0.01	\$0.01
Restaurant	Plug_Load	Existing	Office Equipment: Monitors, Energy Star or Better	0.22583	60%	100%	4	\$0.02	\$0.02
Restaurant	Plug_Load	Existing	Office Equipment: Printers, Energy Star or Better	0.22583	62%	100%	4	\$0.04	\$0.01
Restaurant	Plug_Load	Existing	Vending Machines- Controls	0.22583	80%	95%	3	\$0.02	\$0.01
Restaurant	Plug_Load	Existing	Vending Machines- High Efficiency	0.22583	85%	100%	14	\$0.03	\$0.02
Restaurant	Plug_Load	New	Office Computer Network Energy Management	0.22583	33%	100%	4	\$0.00	\$0.07
Restaurant	Plug_Load	New	Office Equipment: Copiers, Energy Star or Better	0.22583	65%	100%	4	\$0.01	\$0.01
Restaurant	Plug_Load	New	Office Equipment: Monitors, Energy Star or Better	0.22583	60%	100%	4	\$0.02	\$0.02
Restaurant	Plug_Load	New	Office Equipment: Printers, Energy Star or Better	0.22583	62%	100%	4	\$0.04	\$0.01
Restaurant	Plug_Load	New	Vending Machines- High Efficiency	0.22583	85%	100%	14	\$0.03	\$0.02
Restaurant	Refrigeration	Existing	Anti-Sweat (Humidistat) Controls	5.48107	45%	100%	12	\$0.02	\$0.05
Restaurant	Refrigeration	Existing	Compressor VSD retrofit	5.48107	90%	60%	10	\$0.41	\$0.06
Restaurant	Refrigeration	Existing	Efficient Fan Motor Options for Commercial Refrigeration	5.48107	100%	40%	9	\$1.16	\$0.14
Restaurant	Refrigeration	Existing	High Efficiency Case Fans	5.48107	92%	100%	16	\$1.16	\$0.02
Restaurant	Refrigeration	Existing	Installation of Floating Condenser Head Pressure Controls	5.48107	38%	100%	14	\$0.12	\$0.07
Restaurant	Refrigeration	Existing	Night Covers for Display Cases	5.48107	90%	100%	5	\$0.01	\$0.06
Restaurant	Refrigeration	Existing	Strip Curtains for Walk-Ins	5.48107	25%	100%	4	\$0.05	\$0.04
Restaurant	Refrigeration	New	Anti-Sweat (Humidistat) Controls	5.48107	45%	100%	12	\$0.02	\$0.05
Restaurant	Refrigeration	New	Efficient Fan Motor Options for Commercial Refrigeration	5.48107	100%	40%	9	\$1.16	\$0.14
Restaurant	Refrigeration	New	High Efficiency Case Fans	5.48107	92%	100%	16	\$1.16	\$0.02
Restaurant	Refrigeration	New	Installation of Floating Condenser Head Pressure Controls	5.48107	38%	100%	14	\$0.12	\$0.07
Restaurant	Refrigeration	New	Night Covers for Display Cases	5.48107	90%	100%	5	\$0.01	\$0.06
Restaurant	Refrigeration	New	Reduced Speed or Cycling of Evaporator Fans	5.48107	75%	100%	5	\$0.09	\$0.01
Restaurant	Refrigeration	New	Strip Curtains for Walk-Ins	5.48107	25%	100%	4	\$0.05	\$0.04
Restaurant	Space_Heat	Existing	Automated Ventilation VFD Control (Occupancy Sensors / CO2 Sensors)	7.06793	95%	5%	15	\$0.28	\$0.10
Restaurant	Space_Heat	Existing	Duct Insulation	7.06793	20%	65%	20	\$0.03	\$0.03
Restaurant	Space_Heat	Existing	Duct Repair and Sealing	7.06793	50%	65%	20	\$0.01	\$0.01
Restaurant	Space_Heat	Existing	Insulation - Floor	7.06793	95%	60%	20	\$0.45	\$0.05
Restaurant	Space_Heat	Existing	Insulation - Roof / Ceiling	7.06793	90%	75%	20	\$0.45	\$0.10
Restaurant	Space_Heat	Existing	Programmable Thermostat	7.06793	45%	100%	10	\$0.15	\$0.20
Restaurant	Space_Heat	Existing	Retro-Commissioning	7.06793	85%	92%	3	\$0.27	\$0.15
Restaurant	Space_Heat	Existing	Windows-High Efficiency	7.06793	85%	80%	30	\$0.14	\$0.03
Restaurant	Space_Heat	New	Automated Ventilation VFD Control (Occupancy Sensors / CO2 Sensors)	7.06793	95%	5%	15	\$0.28	\$0.10

Building Type	End Use	Vintage	Measure Name	Base Usage	Incomplete Factor	Technical Feasibility	Measure Life	Per Unit Cost	Energy Savings
Restaurant	Space_Heat	New	Green Roof	7.06793	100%	25%	40	\$15.00	\$0.13
Restaurant	Space_Heat	New	Leak Proof Duct Fittings	7.06793	100%	49%	30	\$0.07	\$0.21
Restaurant	Space_Heat	New	Retro-Commissioning	7.06793	85%	92%	3	\$1.00	\$0.15
Restaurant	Space_Heat	New	Windows-High Efficiency	7.06793	85%	80%	30	\$0.05	\$0.03
Restaurant	Water_Heat	Existing	Chemical Dishwashing System	4.10206	90%	80%	10	\$0.20	\$0.07
Restaurant	Water_Heat	Existing	Demand controlled Circulating Systems	4.10206	98%	60%	15	\$2.13	\$0.05
Restaurant	Water_Heat	Existing	Faucet Aerators	4.10206	20%	100%	10	\$0.01	\$0.02
Restaurant	Water_Heat	Existing	Hot Water (SHW) Pipe Insulation	4.10206	95%	85%	15	\$0.02	\$0.05
Restaurant	Water_Heat	Existing	Low Flow Spray Heads	4.10206	30%	100%	5	\$0.02	\$0.05
Restaurant	Water_Heat	Existing	Low-Flow Showerheads	4.10206	25%	100%	10	\$0.00	\$0.00
Restaurant	Water_Heat	Existing	Solar Water Heater	4.10206	95%	45%	15	\$2.21	\$0.40
Restaurant	Water_Heat	Existing	Water Cooled Refrigeration with Heat Recovery	4.10206	95%	85%	8	\$0.09	\$0.03
Restaurant	Water_Heat	Existing	Water Heater Temperature Setback	4.10206	80%	100%	10	\$0.01	\$0.15
Restaurant	Water_Heat	New	Chemical Dishwashing System	4.10206	90%	80%	10	\$0.20	\$0.07
Restaurant	Water_Heat	New	Demand controlled Circulating Systems	4.10206	98%	60%	15	\$2.13	\$0.05
Restaurant	Water_Heat	New	Faucet Aerators	4.10206	20%	100%	10	\$0.01	\$0.02
Restaurant	Water_Heat	New	Hot Water (SHW) Pipe Insulation	4.10206	95%	85%	15	\$0.02	\$0.05
Restaurant	Water_Heat	New	Low Flow Spray Heads	4.10206	30%	100%	5	\$0.02	\$0.05
Restaurant	Water_Heat	New	Low-Flow Showerheads	4.10206	25%	100%	10	\$0.01	\$0.00
Restaurant	Water_Heat	New	Solar Water Heater	4.10206	95%	45%	15	\$2.21	\$0.40
Restaurant	Water_Heat	New	Water Cooled Refrigeration with Heat Recovery	4.10206	95%	85%	8	\$0.09	\$0.03
School	Cooling_Chillers	Existing	Active Window Insulation	0.28718	100%	20%	15	\$1.45	\$0.21
School	Cooling_Chillers	Existing	Automated Ventilation VFD Control (Occupancy Sensors / CO2 Sensors)	0.28718	95%	25%	10	\$0.22	\$0.05
School	Cooling_Chillers	Existing	Chilled Water / Condenser Water Settings-Optimization	0.28718	45%	95%	10	\$0.07	\$0.05
School	Cooling_Chillers	Existing	Chilled Water Piping Loop w/ VSD Control	0.28718	75%	90%	15	\$0.34	\$0.12
School	Cooling_Chillers	Existing	Chiller Tune-Up / Diagnostics	0.28718	65%	98%	3	\$0.08	\$0.10
School	Cooling_Chillers	Existing	Chiller-Centrifugal, VSD Control, 300 tons	0.28718			20	\$0.45	\$0.25
School	Cooling_Chillers	Existing	Chiller-Water Side Economizer	0.28718	70%	45%	20	\$0.59	\$0.10
School	Cooling_Chillers	Existing	Convert Constant Volume Air System to VAV	0.28718	15%	85%	15	\$0.17	\$0.12
School	Cooling_Chillers	Existing	Cooling Tower-Decrease Approach Temperature	0.28718	98%	70%	15	\$0.08	\$0.08
School	Cooling_Chillers	Existing	Cooling Tower-Two-Speed Fan Motor	0.28718	75%	95%	15	\$0.04	\$0.14
School	Cooling_Chillers	Existing	Cooling Tower-VSD Fan Control	0.28718	90%	95%	15	\$0.05	\$0.04
School	Cooling_Chillers	Existing	Direct Digital Control System-Installation	0.28718	20%	60%	10	\$0.14	\$0.10
School	Cooling_Chillers	Existing	Direct Digital Control System-Optimization	0.28718	92%	100%	5	\$0.12	\$0.01
School	Cooling_Chillers	Existing	High Efficiency Centrifugal Chiller, 300 ton	0.28718			20	\$0.14	\$0.20
School	Cooling_Chillers	Existing	Insulation - Floor	0.28718	40%	60%	20	\$0.47	\$0.02
School	Cooling_Chillers	Existing	Insulation - Roof / Ceiling	0.28718	20%	75%	20	\$0.47	\$0.03
School	Cooling_Chillers	Existing	Pipe Insulation	0.28718	50%	65%	20	\$0.02	\$0.01
School	Cooling_Chillers	Existing	Retro-Commissioning	0.28718	85%	92%	3	\$0.27	\$0.15
School	Cooling_Chillers	Existing	Windows-High Efficiency	0.28718	65%	80%	30	\$0.12	\$0.04
School	Cooling_Chillers	Existing	Wireless Performance Monitoring, Diagnostics and Control	0.28718	100%	30%	10	\$0.50	\$0.10
School	Cooling_Chillers	New	Active Window Insulation	0.30229	100%	20%	15	\$1.45	\$0.21
School	Cooling_Chillers	New	Automated Ventilation VFD Control (Occupancy Sensors / CO2 Sensors)	0.30229	95%	25%	10	\$0.22	\$0.05
School	Cooling_Chillers	New	Chilled Water / Condenser Water Settings-Optimization	0.30229	45%	95%	10	\$0.07	\$0.05
School	Cooling_Chillers	New	Chilled Water Piping Loop w/ VSD Control	0.30229	75%	90%	15	\$0.34	\$0.12
School	Cooling_Chillers	New	Chiller-Centrifugal, VSD Control, 300 tons	0.30229			20	\$0.45	\$0.25
School	Cooling_Chillers	New	Cooling Tower-Two-Speed Fan Motor	0.30229	10%	95%	15	\$0.04	\$0.14
School	Cooling_Chillers	New	Cooling Tower-VSD Fan Control	0.30229	80%	95%	15	\$0.05	\$0.04
School	Cooling_Chillers	New	Direct Digital Control System-Optimization	0.30229	92%	100%	5	\$0.12	\$0.01
School	Cooling_Chillers	New	Green Roof	0.30229	100%	25%	40	\$15.00	\$0.13
School	Cooling_Chillers	New	High Efficiency Centrifugal Chiller, 300 ton	0.30229			20	\$0.14	\$0.20
School	Cooling_Chillers	New	Leak Proof Duct Fittings	0.30229	100%	49%	30	\$0.07	\$0.21
School	Cooling_Chillers	New	Pipe Insulation	0.30229	50%	100%	20	\$0.02	\$0.01
School	Cooling_Chillers	New	Retro-Commissioning	0.30229	85%	92%	3	\$1.00	\$0.15
School	Cooling_Chillers	New	Windows-High Efficiency	0.30229	65%	80%	30	\$0.04	\$0.04
School	Cooling_Chillers	New	Wireless Performance Monitoring, Diagnostics and Control	0.30229	100%	30%	10	\$0.50	\$0.10
School	Cooling_DX	Existing	Active Window Insulation	0.48781	100%	20%	15	\$0.09	\$0.21
School	Cooling_DX	Existing	Automated Ventilation VFD Control (Occupancy Sensors / CO2 Sensors)	0.48781	95%	25%	10	\$0.14	\$0.05

Building Type	End Use	Vintage	Measure Name	Base Usage	Incomplete Factor	Technical Feasibility	Measure Life	Per Unit Cost	Energy Savings
School	Cooling_DX	Existing	Convert Constant Volume Air System to VAV	0.48781	15%	85%	15	\$0.17	\$0.12
School	Cooling_DX	Existing	DX Package-Air Side Economizer	0.48781	35%	10%	10	\$0.11	\$0.15
School	Cooling_DX	Existing	DX Tune-Up / Diagnostics	0.48781	85%	98%	3	\$0.18	\$0.10
School	Cooling_DX	Existing	Direct / Indirect Evaporative Cooling, Pre-Cooling	0.48781	90%	50%	10	\$0.65	\$0.10
School	Cooling_DX	Existing	Duct Insulation	0.48781	20%	65%	20	\$0.01	\$0.03
School	Cooling_DX	Existing	Duct Repair and Sealing	0.48781	50%	65%	20	\$0.04	\$0.01
School	Cooling_DX	Existing	High Efficiency DX Package	0.48781			20	\$0.50	\$0.09
School	Cooling_DX	Existing	Insulation - Floor	0.48781	40%	60%	20	\$0.47	\$0.02
School	Cooling_DX	Existing	Insulation - Roof / Ceiling	0.48781	20%	75%	20	\$0.47	\$0.03
School	Cooling_DX	Existing	Premium Efficiency DX Package	0.48781			20	\$0.73	\$0.16
School	Cooling_DX	Existing	Programmable Thermostat	0.48781	38%	100%	10	\$0.05	\$0.10
School	Cooling_DX	Existing	Retro-Commissioning	0.48781	85%	92%	3	\$0.27	\$0.15
School	Cooling_DX	Existing	Windows-High Efficiency	0.48781	65%	80%	30	\$0.12	\$0.05
School	Cooling_DX	New	Active Window Insulation	0.52338	100%	20%	15	\$1.45	\$0.21
School	Cooling_DX	New	Automated Ventilation VFD Control (Occupancy Sensors / CO2 Sensors)	0.52338	95%	25%	10	\$0.22	\$0.05
School	Cooling_DX	New	Direct / Indirect Evaporative Cooling, Pre-Cooling	0.52338	90%	50%	10	\$0.65	\$0.10
School	Cooling_DX	New	Green Roof	0.52338	100%	25%	40	\$15.00	\$0.13
School	Cooling_DX	New	High Efficiency DX Package	0.52338			20	\$0.50	\$0.09
School	Cooling_DX	New	Leak Proof Duct Fittings	0.52338	100%	49%	30	\$0.07	\$0.21
School	Cooling_DX	New	Premium Efficiency DX Package	0.52338			20	\$0.73	\$0.16
School	Cooling_DX	New	Retro-Commissioning	0.52338	85%	92%	3	\$1.00	\$0.15
School	Cooling_DX	New	Windows-High Efficiency	0.52338	65%	80%	30	\$0.04	\$0.05
School	Cooling_HeatPump	Existing	Active Window Insulation	0.49799	100%	20%	15	\$1.45	\$0.21
School	Cooling_HeatPump	Existing	Automated Ventilation VFD Control (Occupancy Sensors / CO2 Sensors)	0.49799	95%	25%	10	\$0.22	\$0.05
School	Cooling_HeatPump	Existing	Direct / Indirect Evaporative Cooling, Pre-Cooling	0.49799	90%	50%	10	\$0.65	\$0.10
School	Cooling_HeatPump	Existing	Duct Insulation	0.49799	20%	65%	20	\$0.01	\$0.03
School	Cooling_HeatPump	Existing	Duct Repair and Sealing	0.49799	50%	65%	20	\$0.04	\$0.01
School	Cooling_HeatPump	Existing	Insulation - Floor	0.49799	40%	60%	20	\$0.47	\$0.02
School	Cooling_HeatPump	Existing	Insulation - Roof / Ceiling	0.49799	20%	75%	20	\$0.47	\$0.03
School	Cooling_HeatPump	Existing	Programmable Thermostat	0.49799	38%	100%	10	\$0.05	\$0.10
School	Cooling_HeatPump	Existing	Retro-Commissioning	0.49799	85%	92%	3	\$0.27	\$0.15
School	Cooling_HeatPump	Existing	Windows-High Efficiency	0.49799	65%	80%	30	\$0.12	\$0.05
School	Cooling_HeatPump	New	Active Window Insulation	0.51076	100%	20%	15	\$1.45	\$0.21
School	Cooling_HeatPump	New	Automated Ventilation VFD Control (Occupancy Sensors / CO2 Sensors)	0.51076	95%	25%	10	\$0.22	\$0.05
School	Cooling_HeatPump	New	Direct / Indirect Evaporative Cooling, Pre-Cooling	0.51076	90%	50%	10	\$0.65	\$0.10
School	Cooling_HeatPump	New	Green Roof	0.51076	100%	25%	40	\$15.00	\$0.13
School	Cooling_HeatPump	New	Leak Proof Duct Fittings	0.51076	100%	49%	30	\$0.07	\$0.21
School	Cooling_HeatPump	New	Retro-Commissioning	0.51076	85%	92%	3	\$1.00	\$0.15
School	Cooling_HeatPump	New	Windows-High Efficiency	0.51076	65%	80%	30	\$0.04	\$0.05
School	HVAC_Aux	New	Optimized Variable Volume Lab Hood Design	0.73197	98%	95%	10	\$0.01	\$0.02
School	HVAC_Aux	New	Under floor Ventilation with Low Static Pressure	0.73197	100%	22%	15	\$0.70	\$0.20
School	Lighting	Existing	Advanced High Intensity Discharge (HID) Light Sources	1.96057	100%	6%	4	\$0.03	\$0.07
School	Lighting	Existing	Advanced/Integrated Daylighting controls (ADCs)	1.96057	100%	66%	20	\$2.50	\$0.12
School	Lighting	Existing	Bi-Level Control, Stairwell Lighting	1.96057	98%	95%	7	\$0.10	\$0.03
School	Lighting	Existing	Continuous Dimming, Fluorescent Fixtures	1.96057	90%	45%	24	\$0.35	\$0.16
School	Lighting	Existing	Cost Effective Load Shed Ballast and Controller	1.96057	100%	80%	15	\$1.41	\$0.01
School	Lighting	Existing	Hybrid Solar Lighting	1.96057	100%	22%	15	\$3.24	\$0.52
School	Lighting	Existing	Induction Lighting	1.96057	99%	25%	25	\$0.09	\$0.01
School	Lighting	Existing	Integrated Lighting, Classrooms	1.96057	98%	75%	8	\$0.94	\$0.25
School	Lighting	Existing	LED Exit Signs	1.96057	98%	100%	25	\$0.03	\$0.01
School	Lighting	Existing	LED Solid State White Lighting	1.96057	100%	7%	6	\$0.70	\$0.01
School	Lighting	Existing	Low Wattage Ceramic Metal Halide Lamps	1.96057	100%	6%	7	\$0.53	\$0.10
School	Lighting	Existing	Occupancy Sensor Control, Fluorescent	1.96057	75%	85%	20	\$0.42	\$0.04
School	Lighting	Existing	Reduce Interior Lighting Power Density 15% Reduction (W/sqft)	1.96057	75%	98%	7	\$0.26	\$0.15
School	Lighting	Existing	Reduce Interior Lighting Power Density 25% Reduction (W/sqft)	1.96057	90%	85%	7	\$0.48	\$0.25
School	Lighting	Existing	Scotopic (High CCT) Lighting	1.96057	100%	13%	15	\$0.55	\$0.24
School	Lighting	Existing	Stepped Dimming Fluorescent Fixtures	1.96057	85%	45%	24	\$0.56	\$0.12
School	Lighting	New	Advanced High Intensity Discharge (HID) Light Sources	1.89688	100%	6%	4	\$0.03	\$0.07

Building Type	End Use	Vintage	Measure Name	Base Usage	Incomplete Factor	Technical Feasibility	Measure Life	Per Unit Cost	Energy Savings
School	Lighting	New	Advanced/Integrated Daylighting controls (ADCs)	1.89688	100%	66%	20	\$2.50	\$0.05
School	Lighting	New	Bi-Level Control, Stairwell Lighting	1.89688	98%	95%	7	\$0.10	\$0.03
School	Lighting	New	Continuous Dimming, Fluorescent Fixtures	1.89688	90%	45%	24	\$0.18	\$0.16
School	Lighting	New	Cost Effective Load Shed Ballast and Controller	1.89688	100%	80%	15	\$1.41	\$0.01
School	Lighting	New	Hybrid Solar Lighting	1.89688	100%	22%	15	\$3.24	\$0.52
School	Lighting	New	Induction Lighting	1.89688	99%	25%	25	\$0.09	\$0.01
School	Lighting	New	Integrated Lighting, Classrooms	1.89688	98%	75%	8	\$0.94	\$0.25
School	Lighting	New	LED Exit Signs	1.89688	98%	100%	25	\$0.01	\$0.01
School	Lighting	New	LED Solid State White Lighting	1.89688	100%	7%	6	\$0.70	\$0.01
School	Lighting	New	Low Wattage Ceramic Metal Halide Lamps	1.89688	100%	6%	7	\$0.53	\$0.10
School	Lighting	New	Reduce Interior Lighting Power Density 15% Reduction (W/sqft)	1.89688	75%	98%	7	\$0.12	\$0.15
School	Lighting	New	Reduce Interior Lighting Power Density 25% Reduction (W/sqft)	1.89688	90%	85%	7	\$0.22	\$0.35
School	Lighting	New	Scotopic (High CCT) Lighting	1.89688	100%	13%	15	\$0.55	\$0.24
School	Lighting	New	Stepped Dimming Fluorescent Fixtures	1.89688	85%	45%	24	\$0.28	\$0.12
School	Plug_Load	Existing	Office Computer Network Energy Management	0.10981	33%	100%	4	\$0.00	\$0.07
School	Plug_Load	Existing	Office Equipment: Copiers, Energy Star or Better	0.10981	65%	100%	4	\$0.01	\$0.01
School	Plug_Load	Existing	Office Equipment: Monitors, Energy Star or Better	0.10981	60%	100%	4	\$0.06	\$0.02
School	Plug_Load	Existing	Office Equipment: Printers, Energy Star or Better	0.10981	62%	100%	4	\$0.06	\$0.01
School	Plug_Load	Existing	Vending Machines- Controls	0.10981	75%	95%	3	\$0.00	\$0.01
School	Plug_Load	Existing	Vending Machines- High Efficiency	0.10981	85%	100%	14	\$0.01	\$0.02
School	Plug_Load	New	Office Computer Network Energy Management	0.10981	33%	100%	4	\$0.00	\$0.07
School	Plug_Load	New	Office Equipment: Copiers, Energy Star or Better	0.10981	65%	100%	4	\$0.01	\$0.01
School	Plug_Load	New	Office Equipment: Monitors, Energy Star or Better	0.10981	60%	100%	4	\$0.06	\$0.02
School	Plug_Load	New	Office Equipment: Printers, Energy Star or Better	0.10981	62%	100%	4	\$0.06	\$0.01
School	Plug_Load	New	Vending Machines- High Efficiency	0.10981	85%	100%	14	\$0.01	\$0.02
School	Space_Heat	Existing	Automated Ventilation VFD Control (Occupancy Sensors / CO2 Sensors)	9.49571	95%	25%	15	\$0.28	\$0.10
School	Space_Heat	Existing	Convert Constant Volume Air System to VAV	9.49571	15%	85%	15	\$0.17	\$0.12
School	Space_Heat	Existing	Duct Insulation	9.49571	20%	65%	20	\$0.01	\$0.03
School	Space_Heat	Existing	Duct Repair and Sealing	9.49571	50%	65%	20	\$0.00	\$0.01
School	Space_Heat	Existing	Exhaust Air to Ventilation Air Heat Recovery	9.49571	95%	5%	20	\$1.10	\$0.20
School	Space_Heat	Existing	Insulation - Floor	9.49571	40%	60%	20	\$0.47	\$0.05
School	Space_Heat	Existing	Insulation - Roof / Ceiling	9.49571	20%	75%	20	\$0.47	\$0.10
School	Space_Heat	Existing	Programmable Thermostat	9.49571	38%	100%	10	\$0.15	\$0.20
School	Space_Heat	Existing	Retro-Commissioning	9.49571	85%	92%	3	\$0.27	\$0.15
School	Space_Heat	Existing	Windows-High Efficiency	9.49571	65%	80%	30	\$0.12	\$0.06
School	Space_Heat	Existing	Wireless Performance Monitoring, Diagnostics and Control	9.49571	100%	30%	10	\$0.50	\$0.10
School	Space_Heat	New	Automated Ventilation VFD Control (Occupancy Sensors / CO2 Sensors)	9.49571	95%	25%	15	\$0.28	\$0.10
School	Space_Heat	New	Exhaust Air to Ventilation Air Heat Recovery	9.49571	95%	5%	20	\$1.00	\$0.15
School	Space_Heat	New	Green Roof	9.49571	100%	25%	40	\$15.00	\$0.13
School	Space_Heat	New	Leak Proof Duct Fittings	9.49571	100%	49%	30	\$0.07	\$0.21
School	Space_Heat	New	Retro-Commissioning	9.49571	85%	92%	3	\$1.00	\$0.15
School	Space_Heat	New	Windows-High Efficiency	9.49571	65%	80%	30	\$0.04	\$0.06
School	Space_Heat	New	Wireless Performance Monitoring, Diagnostics and Control	9.49571	100%	30%	10	\$0.50	\$0.10
School	Water_Heat	Existing	Chemical Dishwashing System	0.66314	90%	80%	10	\$0.02	\$0.04
School	Water_Heat	Existing	Demand controlled Circulating Systems	0.66314	98%	60%	15	\$0.45	\$0.05
School	Water_Heat	Existing	Faucet Aerators	0.66314	20%	100%	10	\$0.01	\$0.02
School	Water_Heat	Existing	Hot Water (SHW) Pipe Insulation	0.66314	10%	85%	15	\$0.01	\$0.05
School	Water_Heat	Existing	Low Flow Spray Heads	0.66314	30%	100%	5	\$0.00	\$0.01
School	Water_Heat	Existing	Low-Flow Showerheads	0.66314	25%	100%	10	\$0.02	\$0.02
School	Water_Heat	Existing	Solar Water Heater	0.66314	95%	45%	15	\$1.93	\$0.40
School	Water_Heat	Existing	Water Heater Temperature Setback	0.66314	20%	100%	10	\$0.00	\$0.15
School	Water_Heat	New	Chemical Dishwashing System	0.66314	90%	80%	10	\$0.02	\$0.04
School	Water_Heat	New	Demand controlled Circulating Systems	0.66314	98%	60%	15	\$0.45	\$0.05
School	Water_Heat	New	Faucet Aerators	0.66314	20%	100%	10	\$0.01	\$0.02
School	Water_Heat	New	Hot Water (SHW) Pipe Insulation	0.66314	10%	85%	15	\$0.01	\$0.05
School	Water_Heat	New	Low Flow Spray Heads	0.66314	30%	100%	5	\$0.00	\$0.01
School	Water_Heat	New	Low-Flow Showerheads	0.66314	25%	100%	10	\$0.01	\$0.02
School	Water_Heat	New	Solar Water Heater	0.66314	95%	45%	15	\$1.93	\$0.40

Building Type	End Use	Vintage	Measure Name	Base Usage	Incomplete Factor	Technical Feasibility	Measure Life	Per Unit Cost	Energy Savings
University	Cooling_Chillers	Existing	Active Window Insulation	3.58072	100%	20%	15	\$1.45	\$0.21
University	Cooling_Chillers	Existing	Automated Ventilation VFD Control (Occupancy Sensors / CO2 Sensors)	3.58072	95%	25%	10	\$0.44	\$0.05
University	Cooling_Chillers	Existing	Chilled Water / Condenser Water Settings-Optimization	3.58072	45%	95%	10	\$0.05	\$0.05
University	Cooling_Chillers	Existing	Chilled Water Piping Loop w/ VSD Control	3.58072	75%	90%	15	\$0.68	\$0.12
University	Cooling_Chillers	Existing	Chiller Tune-Up / Diagnostics	3.58072	65%	98%	3	\$0.17	\$0.10
University	Cooling_Chillers	Existing	Chiller-Centrifugal, VSD Control, 300 tons	3.58072			20	\$0.90	\$0.25
University	Cooling_Chillers	Existing	Chiller-Water Side Economizer	3.58072	95%	45%	20	\$0.59	\$0.10
University	Cooling_Chillers	Existing	Convert Constant Volume Air System to VAV	3.58072	15%	85%	15	\$0.35	\$0.12
University	Cooling_Chillers	Existing	Cooling Tower-Decrease Approach Temperature	3.58072	98%	70%	15	\$0.16	\$0.08
University	Cooling_Chillers	Existing	Cooling Tower-Two-Speed Fan Motor	3.58072	75%	95%	15	\$0.04	\$0.14
University	Cooling_Chillers	Existing	Cooling Tower-VSD Fan Control	3.58072	90%	95%	15	\$0.11	\$0.04
University	Cooling_Chillers	Existing	Direct Digital Control System-Installation	3.58072	20%	60%	10	\$0.27	\$0.10
University	Cooling_Chillers	Existing	Direct Digital Control System-Optimization	3.58072	85%	100%	5	\$0.12	\$0.01
University	Cooling_Chillers	Existing	High Efficiency Centrifugal Chiller, 300 ton	3.58072			20	\$0.27	\$0.20
University	Cooling_Chillers	Existing	Insulation - Floor	3.58072	40%	60%	20	\$0.30	\$0.02
University	Cooling_Chillers	Existing	Insulation - Roof / Ceiling	3.58072	17%	75%	20	\$0.30	\$0.03
University	Cooling_Chillers	Existing	Pipe Insulation	3.58072	50%	65%	20	\$0.03	\$0.01
University	Cooling_Chillers	Existing	Retro-Commissioning	3.58072	85%	92%	3	\$0.27	\$0.15
University	Cooling_Chillers	Existing	Windows-High Efficiency	3.58072	65%	80%	30	\$0.32	\$0.04
University	Cooling_Chillers	Existing	Wireless Performance Monitoring, Diagnostics and Control	3.58072	100%	30%	10	\$0.50	\$0.10
University	Cooling_Chillers	New	Active Window Insulation	3.76918	100%	20%	15	\$1.45	\$0.21
University	Cooling_Chillers	New	Automated Ventilation VFD Control (Occupancy Sensors / CO2 Sensors)	3.76918	95%	25%	10	\$0.44	\$0.05
University	Cooling_Chillers	New	Chilled Water / Condenser Water Settings-Optimization	3.76918	45%	95%	10	\$0.05	\$0.05
University	Cooling_Chillers	New	Chilled Water Piping Loop w/ VSD Control	3.76918	75%	90%	15	\$0.68	\$0.12
University	Cooling_Chillers	New	Chiller-Centrifugal, VSD Control, 300 tons	3.76918			20	\$0.90	\$0.25
University	Cooling_Chillers	New	Cooling Tower-Two-Speed Fan Motor	3.76918	10%	95%	15	\$0.04	\$0.14
University	Cooling_Chillers	New	Cooling Tower-VSD Fan Control	3.76918	80%	95%	15	\$0.11	\$0.04
University	Cooling_Chillers	New	Direct Digital Control System-Optimization	3.76918	85%	100%	5	\$0.12	\$0.01
University	Cooling_Chillers	New	Green Roof	3.76918	100%	25%	40	\$15.00	\$0.13
University	Cooling_Chillers	New	High Efficiency Centrifugal Chiller, 300 ton	3.76918			20	\$0.27	\$0.20
University	Cooling_Chillers	New	Leak Proof Duct Fittings	3.76918	100%	49%	30	\$0.07	\$0.21
University	Cooling_Chillers	New	Pipe Insulation	3.76918	50%	100%	20	\$0.03	\$0.01
University	Cooling_Chillers	New	Retro-Commissioning	3.76918	85%	92%	3	\$1.00	\$0.15
University	Cooling_Chillers	New	Windows-High Efficiency	3.76918	65%	80%	30	\$0.11	\$0.04
University	Cooling_Chillers	New	Wireless Performance Monitoring, Diagnostics and Control	3.76918	100%	30%	10	\$0.50	\$0.10
University	Cooling_DX	Existing	Active Window Insulation	6.08238	100%	20%	15	\$0.12	\$0.21
University	Cooling_DX	Existing	Automated Ventilation VFD Control (Occupancy Sensors / CO2 Sensors)	6.08238	95%	25%	10	\$0.21	\$0.05
University	Cooling_DX	Existing	Convert Constant Volume Air System to VAV	6.08238	15%	85%	15	\$0.35	\$0.12
University	Cooling_DX	Existing	DX Package-Air Side Economizer	6.08238	98%	10%	10	\$0.08	\$0.15
University	Cooling_DX	Existing	DX Tune-Up / Diagnostics	6.08238	85%	98%	3	\$0.35	\$0.10
University	Cooling_DX	Existing	Direct / Indirect Evaporative Cooling, Pre-Cooling	6.08238	90%	50%	10	\$1.31	\$0.10
University	Cooling_DX	Existing	Duct Insulation	6.08238	20%	65%	20	\$0.01	\$0.03
University	Cooling_DX	Existing	Duct Repair and Sealing	6.08238	50%	65%	20	\$0.04	\$0.01
University	Cooling_DX	Existing	High Efficiency DX Package	6.08238			20	\$0.50	\$0.09
University	Cooling_DX	Existing	Insulation - Floor	6.08238	40%	60%	20	\$0.30	\$0.02
University	Cooling_DX	Existing	Insulation - Roof / Ceiling	6.08238	17%	75%	20	\$0.30	\$0.03
University	Cooling_DX	Existing	Premium Efficiency DX Package	6.08238			20	\$0.90	\$0.16
University	Cooling_DX	Existing	Programmable Thermostat	6.08238	28%	100%	10	\$0.09	\$0.10
University	Cooling_DX	Existing	Retro-Commissioning	6.08238	85%	92%	3	\$0.27	\$0.15
University	Cooling_DX	Existing	Windows-High Efficiency	6.08238	65%	80%	30	\$0.32	\$0.05
University	Cooling_DX	New	Active Window Insulation	6.52589	100%	20%	15	\$1.45	\$0.21
University	Cooling_DX	New	Automated Ventilation VFD Control (Occupancy Sensors / CO2 Sensors)	6.52589	95%	25%	10	\$0.44	\$0.05
University	Cooling_DX	New	Direct / Indirect Evaporative Cooling, Pre-Cooling	6.52589	90%	50%	10	\$1.31	\$0.10
University	Cooling_DX	New	Green Roof	6.52589	100%	25%	40	\$15.00	\$0.13
University	Cooling_DX	New	High Efficiency DX Package	6.52589			20	\$0.50	\$0.09
University	Cooling_DX	New	Leak Proof Duct Fittings	6.52589	100%	49%	30	\$0.07	\$0.21
University	Cooling_DX	New	Premium Efficiency DX Package	6.52589			20	\$0.90	\$0.16
University	Cooling_DX	New	Retro-Commissioning	6.52589	85%	92%	3	\$1.00	\$0.15

Building Type	End Use	Vintage	Measure Name	Base Usage	Incomplete Factor	Technical Feasibility	Measure Life	Per Unit Cost	Energy Savings
University	Cooling_DX	New	Windows-High Efficiency	6.52589	65%	80%	30	\$0.11	\$0.05
University	Cooling_HeatPump	Existing	Active Window Insulation	6.20927	100%	20%	15	\$1.45	\$0.21
University	Cooling_HeatPump	Existing	Automated Ventilation VFD Control (Occupancy Sensors / CO2 Sensors)	6.20927	95%	25%	10	\$0.44	\$0.05
University	Cooling_HeatPump	Existing	Direct / Indirect Evaporative Cooling, Pre-Cooling	6.20927	90%	50%	10	\$1.31	\$0.10
University	Cooling_HeatPump	Existing	Duct Insulation	6.20927	20%	65%	20	\$0.01	\$0.03
University	Cooling_HeatPump	Existing	Duct Repair and Sealing	6.20927	50%	65%	20	\$0.04	\$0.01
University	Cooling_HeatPump	Existing	Insulation - Floor	6.20927	40%	60%	20	\$0.30	\$0.02
University	Cooling_HeatPump	Existing	Insulation - Roof / Ceiling	6.20927	17%	75%	20	\$0.30	\$0.03
University	Cooling_HeatPump	Existing	Programmable Thermostat	6.20927	28%	100%	10	\$0.09	\$0.10
University	Cooling_HeatPump	Existing	Retro-Commissioning	6.20927	85%	92%	3	\$0.27	\$0.15
University	Cooling_HeatPump	Existing	Windows-High Efficiency	6.20927	65%	80%	30	\$0.32	\$0.05
University	Cooling_HeatPump	New	Active Window Insulation	6.36848	100%	20%	15	\$1.45	\$0.21
University	Cooling_HeatPump	New	Automated Ventilation VFD Control (Occupancy Sensors / CO2 Sensors)	6.36848	95%	25%	10	\$0.44	\$0.05
University	Cooling_HeatPump	New	Direct / Indirect Evaporative Cooling, Pre-Cooling	6.36848	90%	50%	10	\$1.31	\$0.10
University	Cooling_HeatPump	New	Green Roof	6.36848	100%	25%	40	\$15.00	\$0.13
University	Cooling_HeatPump	New	Leak Proof Duct Fittings	6.36848	100%	49%	30	\$0.07	\$0.21
University	Cooling_HeatPump	New	Retro-Commissioning	6.36848	85%	92%	3	\$1.00	\$0.15
University	Cooling_HeatPump	New	Windows-High Efficiency	6.36848	65%	80%	30	\$0.11	\$0.05
University	HVAC_Aux	New	Optimized Variable Volume Lab Hood Design	0.95098	95%	95%	10	\$0.02	\$0.04
University	HVAC_Aux	New	Under floor Ventilation with Low Static Pressure	0.95098	100%	15%	15	\$2.20	\$0.20
University	Lighting	Existing	Advanced High Intensity Discharge (HID) Light Sources	3.99065	100%	6%	4	\$0.05	\$0.05
University	Lighting	Existing	Advanced/Integrated Daylighting controls (ADCs)	3.99065	100%	66%	20	\$2.50	\$0.04
University	Lighting	Existing	Bi-Level Control, Stairwell Lighting	3.99065	98%	95%	7	\$0.10	\$0.03
University	Lighting	Existing	Continuous Dimming, Fluorescent Fixtures	3.99065	90%	60%	23	\$0.33	\$0.15
University	Lighting	Existing	Cost Effective Load Shed Ballast and Controller	3.99065	100%	80%	15	\$1.32	\$0.01
University	Lighting	Existing	Cost Effective Load Shed Ballast and Controller	3.99065	100%	80%	15	\$0.79	\$0.01
University	Lighting	Existing	Hybrid Solar Lighting	3.99065	100%	22%	15	\$6.49	\$0.52
University	Lighting	Existing	Induction Lighting	3.99065	99%	25%	25	\$0.13	\$0.01
University	Lighting	Existing	LED Exit Signs	3.99065	98%	100%	25	\$0.02	\$0.01
University	Lighting	Existing	LED Solid State White Lighting	3.99065	100%	7%	6	\$1.39	\$0.04
University	Lighting	Existing	Low Wattage Ceramic Metal Halide Lamps	3.99065	100%	6%	7	\$1.07	\$0.07
University	Lighting	Existing	Occupancy Sensor Control, Fluorescent	3.99065	75%	85%	19	\$0.44	\$0.06
University	Lighting	Existing	Reduce Interior Lighting Power Density 15% Reduction (W/sqft)	3.99065	75%	98%	7	\$0.26	\$0.15
University	Lighting	Existing	Reduce Interior Lighting Power Density 25% Reduction (W/sqft)	3.99065	90%	85%	7	\$0.48	\$0.25
University	Lighting	Existing	Scotopic (High CCT) Lighting	3.99065	100%	13%	15	\$0.55	\$0.23
University	Lighting	Existing	Stepped Dimming Fluorescent Fixtures	3.99065	85%	60%	23	\$0.53	\$0.11
University	Lighting	New	Advanced High Intensity Discharge (HID) Light Sources	3.89242	100%	6%	4	\$0.05	\$0.05
University	Lighting	New	Advanced/Integrated Daylighting controls (ADCs)	3.89242	100%	66%	20	\$2.50	\$0.12
University	Lighting	New	Bi-Level Control, Stairwell Lighting	3.89242	98%	95%	7	\$0.10	\$0.03
University	Lighting	New	Continuous Dimming, Fluorescent Fixtures	3.89242	90%	60%	23	\$0.17	\$0.15
University	Lighting	New	Cost Effective Load Shed Ballast and Controller	3.89242	100%	80%	15	\$1.48	\$0.01
University	Lighting	New	Cost Effective Load Shed Ballast and Controller	3.89242	100%	80%	15	\$1.32	\$0.01
University	Lighting	New	Hybrid Solar Lighting	3.89242	100%	22%	15	\$6.49	\$0.52
University	Lighting	New	Induction Lighting	3.89242	99%	25%	25	\$0.13	\$0.01
University	Lighting	New	LED Exit Signs	3.89242	98%	100%	25	\$0.01	\$0.01
University	Lighting	New	LED Solid State White Lighting	3.89242	100%	7%	6	\$1.39	\$0.04
University	Lighting	New	Low Wattage Ceramic Metal Halide Lamps	3.89242	100%	6%	7	\$1.07	\$0.07
University	Lighting	New	Reduce Interior Lighting Power Density 15% Reduction (W/sqft)	3.89242	75%	98%	7	\$0.12	\$0.15
University	Lighting	New	Reduce Interior Lighting Power Density 25% Reduction (W/sqft)	3.89242	90%	85%	7	\$0.22	\$0.25
University	Lighting	New	Scotopic (High CCT) Lighting	3.89242	100%	13%	15	\$0.55	\$0.23
University	Lighting	New	Stepped Dimming Fluorescent Fixtures	3.89242	85%	60%	23	\$0.26	\$0.11
University	Plug_Load	Existing	Office Computer Network Energy Management	0.30817	33%	100%	4	\$0.00	\$0.08
University	Plug_Load	Existing	Office Equipment: Copiers, Energy Star or Better	0.30817	65%	100%	4	\$0.00	\$0.01
University	Plug_Load	Existing	Office Equipment: Monitors, Energy Star or Better	0.30817	60%	100%	4	\$0.02	\$0.02
University	Plug_Load	Existing	Office Equipment: Printers, Energy Star or Better	0.30817	62%	100%	4	\$0.02	\$0.01
University	Plug_Load	Existing	Vending Machines- Controls	0.30817	75%	95%	3	\$0.00	\$0.01
University	Plug_Load	Existing	Vending Machines- High Efficiency	0.30817	85%	100%	14	\$0.01	\$0.02
University	Plug_Load	New	Office Computer Network Energy Management	0.30817	33%	100%	4	\$0.00	\$0.08



Building Type	End Use	Vintage	Measure Name	Base Usage	Incomplete Factor	Technical Feasibility	Measure Life	Per Unit Cost	Energy Savings
University	Plug_Load	New	Office Equipment: Copiers, Energy Star or Better	0.30817	65%	100%	4	\$0.00	\$0.01
University	Plug_Load	New	Office Equipment: Monitors, Energy Star or Better	0.30817	60%	100%	4	\$0.02	\$0.02
University	Plug_Load	New	Office Equipment: Printers, Energy Star or Better	0.30817	62%	100%	4	\$0.02	\$0.01
University	Plug_Load	New	Vending Machines- High Efficiency	0.30817	85%	100%	14	\$0.01	\$0.02
University	Space_Heat	Existing	Automated Ventilation VFD Control (Occupancy Sensors / CO2 Sensors)	4.00000	95%	25%	15	\$0.28	\$0.10
University	Space_Heat	Existing	Convert Constant Volume Air System to VAV	4.00000	15%	85%	15	\$0.35	\$0.12
University	Space_Heat	Existing	Duct Insulation	4.00000	20%	65%	20	\$0.01	\$0.03
University	Space_Heat	Existing	Duct Repair and Sealing	4.00000	50%	65%	20	\$0.00	\$0.01
University	Space_Heat	Existing	Exhaust Air to Ventilation Air Heat Recovery	4.00000	95%	5%	20	\$1.00	\$0.20
University	Space_Heat	Existing	Insulation - Floor	4.00000	40%	60%	20	\$0.30	\$0.05
University	Space_Heat	Existing	Insulation - Roof / Ceiling	4.00000	17%	75%	20	\$0.30	\$0.10
University	Space_Heat	Existing	Programmable Thermostat	4.00000	28%	100%	10	\$0.15	\$0.20
University	Space_Heat	Existing	Retro-Commissioning	4.00000	85%	92%	3	\$0.27	\$0.15
University	Space_Heat	Existing	Windows-High Efficiency	4.00000	65%	80%	30	\$0.32	\$0.06
University	Space_Heat	Existing	Wireless Performance Monitoring, Diagnostics and Control	4.00000	100%	30%	10	\$0.50	\$0.10
University	Space_Heat	New	Automated Ventilation VFD Control (Occupancy Sensors / CO2 Sensors)	4.00000	95%	25%	15	\$0.28	\$0.10
University	Space_Heat	New	Exhaust Air to Ventilation Air Heat Recovery	4.00000	95%	5%	20	\$0.93	\$0.15
University	Space_Heat	New	Green Roof	4.00000	100%	25%	40	\$15.00	\$0.13
University	Space_Heat	New	Leak Proof Duct Fittings	4.00000	100%	49%	30	\$0.07	\$0.21
University	Space_Heat	New	Retro-Commissioning	4.00000	85%	92%	3	\$1.00	\$0.15
University	Space_Heat	New	Windows-High Efficiency	4.00000	65%	80%	30	\$0.11	\$0.06
University	Space_Heat	New	Wireless Performance Monitoring, Diagnostics and Control	4.00000	100%	30%	10	\$0.50	\$0.10
University	Water_Heat	Existing	Chemical Dishwashing System	0.61619	90%	80%	10	\$0.01	\$0.04
University	Water_Heat	Existing	Demand controlled Circulating Systems	0.61619	98%	60%	15	\$0.31	\$0.05
University	Water_Heat	Existing	Faucet Aerators	0.61619	20%	100%	10	\$0.00	\$0.02
University	Water_Heat	Existing	Hot Water (SHW) Pipe Insulation	0.61619	75%	85%	15	\$0.02	\$0.05
University	Water_Heat	Existing	Low-Flow Showerheads	0.61619	25%	100%	10	\$0.01	\$0.02
University	Water_Heat	Existing	Solar Water Heater	0.61619	95%	45%	15	\$3.42	\$0.40
University	Water_Heat	Existing	Water Heater Temperature Setback	0.61619	20%	100%	10	\$0.00	\$0.15
University	Water_Heat	New	Chemical Dishwashing System	0.61619	90%	80%	10	\$0.01	\$0.04
University	Water_Heat	New	Demand controlled Circulating Systems	0.61619	98%	60%	15	\$0.31	\$0.05
University	Water_Heat	New	Faucet Aerators	0.61619	20%	100%	10	\$0.00	\$0.02
University	Water_Heat	New	Hot Water (SHW) Pipe Insulation	0.61619	75%	85%	15	\$0.02	\$0.05
University	Water_Heat	New	Low-Flow Showerheads	0.61619	25%	100%	10	\$0.01	\$0.02
University	Water_Heat	New	Solar Water Heater	0.61619	95%	45%	15	\$3.42	\$0.40
Warehouse	Cooling_Chillers	Existing	Automated Ventilation VFD Control (Occupancy Sensors / CO2 Sensors)	1.51207	95%	2%	10	\$0.09	\$0.05
Warehouse	Cooling_Chillers	Existing	Chilled Water / Condenser Water Settings-Optimization	1.51207	45%	95%	10	\$0.10	\$0.05
Warehouse	Cooling_Chillers	Existing	Chilled Water Piping Loop w/ VSD Control	1.51207	75%	90%	15	\$0.14	\$0.12
Warehouse	Cooling_Chillers	Existing	Chiller Tune-Up / Diagnostics	1.51207	65%	98%	3	\$0.03	\$0.10
Warehouse	Cooling_Chillers	Existing	Chiller-Centrifugal, VSD Control, 300 tons	1.51207			20	\$0.18	\$0.25
Warehouse	Cooling_Chillers	Existing	Chiller-Water Side Economizer	1.51207	95%	45%	20	\$0.59	\$0.10
Warehouse	Cooling_Chillers	Existing	Cooling Tower-Decrease Approach Temperature	1.51207	98%	70%	15	\$0.03	\$0.08
Warehouse	Cooling_Chillers	Existing	Cooling Tower-Two-Speed Fan Motor	1.51207	75%	95%	15	\$0.03	\$0.14
Warehouse	Cooling_Chillers	Existing	Cooling Tower-VSD Fan Control	1.51207	90%	95%	15	\$0.02	\$0.04
Warehouse	Cooling_Chillers	Existing	Direct Digital Control System-Installation	1.51207	20%	60%	10	\$0.05	\$0.10
Warehouse	Cooling_Chillers	Existing	Direct Digital Control System-Optimization	1.51207	92%	100%	5	\$0.12	\$0.01
Warehouse	Cooling_Chillers	Existing	High Efficiency Centrifugal Chiller, 300 ton	1.51207			20	\$0.05	\$0.20
Warehouse	Cooling_Chillers	Existing	Insulation - Floor	1.51207	50%	60%	20	\$0.45	\$0.02
Warehouse	Cooling_Chillers	Existing	Insulation - Roof / Ceiling	1.51207	15%	75%	20	\$0.45	\$0.03
Warehouse	Cooling_Chillers	Existing	Pipe Insulation	1.51207	50%	65%	20	\$0.00	\$0.01
Warehouse	Cooling_Chillers	Existing	Retro-Commissioning	1.51207	85%	92%	3	\$0.27	\$0.15
Warehouse	Cooling_Chillers	Existing	Windows-High Efficiency	1.51207	100%	80%	30	\$0.09	\$0.05
Warehouse	Cooling_Chillers	New	Automated Ventilation VFD Control (Occupancy Sensors / CO2 Sensors)	1.59165	95%	2%	10	\$0.09	\$0.05
Warehouse	Cooling_Chillers	New	Chilled Water / Condenser Water Settings-Optimization	1.59165	45%	95%	10	\$0.10	\$0.05
Warehouse	Cooling_Chillers	New	Chilled Water Piping Loop w/ VSD Control	1.59165	75%	90%	15	\$0.14	\$0.12
Warehouse	Cooling_Chillers	New	Chiller-Centrifugal, VSD Control, 300 tons	1.59165			20	\$0.18	\$0.25
Warehouse	Cooling_Chillers	New	Cooling Tower-Two-Speed Fan Motor	1.59165	10%	95%	15	\$0.03	\$0.14
Warehouse	Cooling_Chillers	New	Cooling Tower-VSD Fan Control	1.59165	80%	95%	15	\$0.02	\$0.04

Building Type	End Use	Vintage	Measure Name	Base Usage	Incomplete Factor	Technical Feasibility	Measure Life	Per Unit Cost	Energy Savings
Warehouse	Cooling_Chillers	New	Direct Digital Control System-Optimization	1.59165	92%	100%	5	\$0.12	\$0.01
Warehouse	Cooling_Chillers	New	Green Roof	1.59165	100%	25%	40	\$15.00	\$0.13
Warehouse	Cooling_Chillers	New	High Efficiency Centrifugal Chiller, 300 ton	1.59165			20	\$0.05	\$0.20
Warehouse	Cooling_Chillers	New	Leak Proof Duct Fittings	1.59165	100%	49%	30	\$0.07	\$0.21
Warehouse	Cooling_Chillers	New	Pipe Insulation	1.59165	50%	100%	20	\$0.00	\$0.01
Warehouse	Cooling_Chillers	New	Retro-Commissioning	1.59165	85%	92%	3	\$1.00	\$0.15
Warehouse	Cooling_Chillers	New	Windows-High Efficiency	1.59165	100%	80%	30	\$0.03	\$0.05
Warehouse	Cooling_DX	Existing	Automated Ventilation VFD Control (Occupancy Sensors / CO2 Sensors)	2.56848	95%	2%	10	\$0.23	\$0.05
Warehouse	Cooling_DX	Existing	DX Package-Air Side Economizer	2.56848	45%	10%	10	\$0.16	\$0.15
Warehouse	Cooling_DX	Existing	DX Tune-Up / Diagnostics	2.56848	85%	98%	3	\$0.07	\$0.10
Warehouse	Cooling_DX	Existing	Direct / Indirect Evaporative Cooling, Pre-Cooling	2.56848	90%	50%	10	\$0.26	\$0.10
Warehouse	Cooling_DX	Existing	Duct Insulation	2.56848	20%	65%	20	\$0.01	\$0.03
Warehouse	Cooling_DX	Existing	Duct Repair and Sealing	2.56848	50%	65%	20	\$0.04	\$0.01
Warehouse	Cooling_DX	Existing	High Efficiency DX Package	2.56848			20	\$0.50	\$0.09
Warehouse	Cooling_DX	Existing	Insulation - Floor	2.56848	50%	60%	20	\$0.45	\$0.02
Warehouse	Cooling_DX	Existing	Insulation - Roof / Ceiling	2.56848	15%	75%	20	\$0.45	\$0.03
Warehouse	Cooling_DX	Existing	Premium Efficiency DX Package	2.56848			20	\$0.62	\$0.16
Warehouse	Cooling_DX	Existing	Programmable Thermostat	2.56848	42%	100%	10	\$0.02	\$0.10
Warehouse	Cooling_DX	Existing	Retro-Commissioning	2.56848	85%	92%	3	\$0.27	\$0.15
Warehouse	Cooling_DX	Existing	Windows-High Efficiency	2.56848	100%	80%	30	\$0.09	\$0.05
Warehouse	Cooling_DX	New	Automated Ventilation VFD Control (Occupancy Sensors / CO2 Sensors)	2.75576	95%	2%	10	\$0.09	\$0.05
Warehouse	Cooling_DX	New	Direct / Indirect Evaporative Cooling, Pre-Cooling	2.75576	90%	50%	10	\$0.26	\$0.10
Warehouse	Cooling_DX	New	Green Roof	2.75576	100%	25%	40	\$15.00	\$0.13
Warehouse	Cooling_DX	New	High Efficiency DX Package	2.75576			20	\$0.50	\$0.09
Warehouse	Cooling_DX	New	Leak Proof Duct Fittings	2.75576	100%	49%	30	\$0.07	\$0.21
Warehouse	Cooling_DX	New	Premium Efficiency DX Package	2.75576			20	\$0.62	\$0.16
Warehouse	Cooling_DX	New	Retro-Commissioning	2.75576	85%	92%	3	\$1.00	\$0.15
Warehouse	Cooling_DX	New	Windows-High Efficiency	2.75576	100%	80%	30	\$0.03	\$0.05
Warehouse	Cooling_HeatPump	Existing	Automated Ventilation VFD Control (Occupancy Sensors / CO2 Sensors)	2.62206	95%	2%	10	\$0.09	\$0.05
Warehouse	Cooling_HeatPump	Existing	Direct / Indirect Evaporative Cooling, Pre-Cooling	2.62206	90%	50%	10	\$0.26	\$0.10
Warehouse	Cooling_HeatPump	Existing	Duct Insulation	2.62206	20%	65%	20	\$0.01	\$0.03
Warehouse	Cooling_HeatPump	Existing	Duct Repair and Sealing	2.62206	50%	65%	20	\$0.04	\$0.01
Warehouse	Cooling_HeatPump	Existing	Insulation - Floor	2.62206	50%	60%	20	\$0.45	\$0.02
Warehouse	Cooling_HeatPump	Existing	Insulation - Roof / Ceiling	2.62206	15%	75%	20	\$0.45	\$0.03
Warehouse	Cooling_HeatPump	Existing	Programmable Thermostat	2.62206	42%	100%	10	\$0.02	\$0.10
Warehouse	Cooling_HeatPump	Existing	Retro-Commissioning	2.62206	85%	92%	3	\$0.27	\$0.15
Warehouse	Cooling_HeatPump	Existing	Windows-High Efficiency	2.62206	100%	80%	30	\$0.09	\$0.05
Warehouse	Cooling_HeatPump	New	Automated Ventilation VFD Control (Occupancy Sensors / CO2 Sensors)	2.68929	95%	2%	10	\$0.09	\$0.05
Warehouse	Cooling_HeatPump	New	Direct / Indirect Evaporative Cooling, Pre-Cooling	2.68929	90%	50%	10	\$0.26	\$0.10
Warehouse	Cooling_HeatPump	New	Green Roof	2.68929	100%	25%	40	\$15.00	\$0.13
Warehouse	Cooling_HeatPump	New	Leak Proof Duct Fittings	2.68929	100%	49%	30	\$0.07	\$0.21
Warehouse	Cooling_HeatPump	New	Retro-Commissioning	2.68929	85%	92%	3	\$1.00	\$0.15
Warehouse	Cooling_HeatPump	New	Windows-High Efficiency	2.68929	100%	80%	30	\$0.03	\$0.05
Warehouse	Lighting	Existing	Advanced High Intensity Discharge (HID) Light Sources	2.47310	100%	6%	4	\$0.03	\$0.26
Warehouse	Lighting	Existing	Bi-Level Control, Stairwell Lighting	2.47310	98%	95%	7	\$0.10	\$0.02
Warehouse	Lighting	Existing	Continuous Dimming, Fluorescent Fixtures	2.47310	90%	2%	16	\$0.20	\$0.06
Warehouse	Lighting	Existing	Induction Lighting	2.47310	99%	25%	25	\$0.47	\$0.01
Warehouse	Lighting	Existing	LED Exit Signs	2.47310	98%	100%	25	\$0.05	\$0.01
Warehouse	Lighting	Existing	Low Wattage Ceramic Metal Halide Lamps	2.47310	100%	6%	7	\$0.68	\$0.37
Warehouse	Lighting	Existing	Occupancy Sensor Control, Fluorescent	2.47310	80%	85%	12	\$0.26	\$0.14
Warehouse	Lighting	Existing	Reduce Interior Lighting Power Density 15% Reduction (W/sqft)	2.47310	75%	98%	7	\$0.26	\$0.15
Warehouse	Lighting	Existing	Reduce Interior Lighting Power Density 25% Reduction (W/sqft)	2.47310	90%	85%	7	\$0.48	\$0.40
Warehouse	Lighting	Existing	Stepped Dimming Fluorescent Fixtures	2.47310	85%	60%	16	\$0.31	\$0.04
Warehouse	Lighting	New	Advanced High Intensity Discharge (HID) Light Sources	2.34303	100%	6%	4	\$0.03	\$0.26
Warehouse	Lighting	New	Bi-Level Control, Stairwell Lighting	2.34303	98%	95%	7	\$0.10	\$0.03
Warehouse	Lighting	New	Continuous Dimming, Fluorescent Fixtures	2.34303	90%	2%	16	\$0.10	\$0.06
Warehouse	Lighting	New	Induction Lighting	2.34303	99%	25%	25	\$0.47	\$0.01
Warehouse	Lighting	New	LED Exit Signs	2.34303	98%	100%	25	\$0.02	\$0.01

Building Type	End Use	Vintage	Measure Name	Base Usage	Incomplete Factor	Technical Feasibility	Measure Life	Per Unit Cost	Energy Savings
Warehouse	Lighting	New	Low Wattage Ceramic Metal Halide Lamps	2.34303	100%	6%	7	\$0.68	\$0.37
Warehouse	Lighting	New	Occupancy Sensor Control, Fluorescent	2.34303	80%	85%	12	\$0.26	\$0.14
Warehouse	Lighting	New	Reduce Interior Lighting Power Density 15% Reduction (W/sqft)	2.34303	75%	98%	7	\$0.12	\$0.15
Warehouse	Lighting	New	Reduce Interior Lighting Power Density 25% Reduction (W/sqft)	2.34303	90%	85%	7	\$0.22	\$0.40
Warehouse	Lighting	New	Stepped Dimming Fluorescent Fixtures	2.34303	85%	60%	16	\$0.16	\$0.04
Warehouse	Plug_Load	Existing	Office Computer Network Energy Management	0.14216	33%	100%	4	\$0.00	\$0.08
Warehouse	Plug_Load	Existing	Office Equipment: Copiers, Energy Star or Better	0.14216	65%	100%	4	\$0.02	\$0.01
Warehouse	Plug_Load	Existing	Office Equipment: Monitors, Energy Star or Better	0.14216	60%	100%	4	\$0.05	\$0.02
Warehouse	Plug_Load	Existing	Office Equipment: Printers, Energy Star or Better	0.14216	62%	100%	4	\$0.06	\$0.01
Warehouse	Plug_Load	Existing	Vending Machines- Controls	0.14216	85%	95%	3	\$0.01	\$0.00
Warehouse	Plug_Load	Existing	Vending Machines- High Efficiency	0.14216	85%	100%	14	\$0.02	\$0.01
Warehouse	Plug_Load	New	Office Computer Network Energy Management	0.14216	33%	100%	4	\$0.00	\$0.08
Warehouse	Plug_Load	New	Office Equipment: Copiers, Energy Star or Better	0.14216	65%	100%	4	\$0.02	\$0.01
Warehouse	Plug_Load	New	Office Equipment: Monitors, Energy Star or Better	0.14216	60%	100%	4	\$0.05	\$0.02
Warehouse	Plug_Load	New	Office Equipment: Printers, Energy Star or Better	0.14216	62%	100%	4	\$0.06	\$0.01
Warehouse	Plug_Load	New	Vending Machines- High Efficiency	0.14216	85%	100%	14	\$0.02	\$0.01
Warehouse	Space_Heat	Existing	Automated Ventilation VFD Control (Occupancy Sensors / CO2 Sensors)	0.77186	95%	2%	15	\$0.28	\$0.10
Warehouse	Space_Heat	Existing	Duct Insulation	0.77186	20%	65%	20	\$0.01	\$0.03
Warehouse	Space_Heat	Existing	Duct Repair and Sealing	0.77186	50%	65%	20	\$0.00	\$0.01
Warehouse	Space_Heat	Existing	Insulation - Floor	0.77186	50%	60%	20	\$0.45	\$0.05
Warehouse	Space_Heat	Existing	Insulation - Roof / Ceiling	0.77186	15%	75%	20	\$0.45	\$0.10
Warehouse	Space_Heat	Existing	Programmable Thermostat	0.77186	42%	100%	10	\$0.15	\$0.20
Warehouse	Space_Heat	Existing	Retro-Commissioning	0.77186	85%	92%	3	\$0.27	\$0.15
Warehouse	Space_Heat	Existing	Windows-High Efficiency	0.77186	100%	80%	30	\$0.09	\$0.01
Warehouse	Space_Heat	New	Automated Ventilation VFD Control (Occupancy Sensors / CO2 Sensors)	0.77186	95%	2%	15	\$0.28	\$0.10
Warehouse	Space_Heat	New	Green Roof	0.77186	100%	25%	40	\$15.00	\$0.13
Warehouse	Space_Heat	New	Leak Proof Duct Fittings	0.77186	100%	49%	30	\$0.07	\$0.21
Warehouse	Space_Heat	New	Retro-Commissioning	0.77186	85%	92%	3	\$1.00	\$0.15
Warehouse	Space_Heat	New	Windows-High Efficiency	0.77186	100%	80%	30	\$0.03	\$0.01
Warehouse	Water_Heat	Existing	Demand controlled Circulating Systems	0.02543	98%	60%	15	\$0.65	\$0.05
Warehouse	Water_Heat	Existing	Faucet Aerators	0.02543	20%	100%	10	\$0.00	\$0.02
Warehouse	Water_Heat	Existing	Hot Water (SHW) Pipe Insulation	0.02543	92%	85%	15	\$0.00	\$0.05
Warehouse	Water_Heat	Existing	Low-Flow Showerheads	0.02543	25%	100%	10	\$0.00	\$0.03
Warehouse	Water_Heat	Existing	Solar Water Heater	0.02543	95%	45%	15	\$0.60	\$0.40
Warehouse	Water_Heat	Existing	Water Heater Temperature Setback	0.02543	50%	100%	10	\$0.00	\$0.15
Warehouse	Water_Heat	New	Demand controlled Circulating Systems	0.02543	98%	60%	15	\$0.65	\$0.05
Warehouse	Water_Heat	New	Faucet Aerators	0.02543	20%	100%	10	\$0.00	\$0.02
Warehouse	Water_Heat	New	Hot Water (SHW) Pipe Insulation	0.02543	92%	85%	15	\$0.00	\$0.05
Warehouse	Water_Heat	New	Low-Flow Showerheads	0.02543	25%	100%	10	\$0.01	\$0.03
Warehouse	Water_Heat	New	Solar Water Heater	0.02543	95%	45%	15	\$0.60	\$0.40

**Table A-4. Commercial Gas Measures**

Building Type	End Use	Vintage	Measure Name	Base Usage	Incomplete Factor	Technical Feasibility	Measure Life	Per Unit Cost	Energy Savings
Dry_Goods_Retail	Space_Heat	Existing	Automated Ventilation VFD Control (Occupancy Sensors / CO2 Sensors)	0.12	95%	90%	15	\$0.28	10%
Dry_Goods_Retail	Space_Heat	Existing	Boiler Economizer	0.12	95%	40%	20	\$0.59	10%
Dry_Goods_Retail	Space_Heat	Existing	Convert Constant Volume Air System to VAV	0.12	15%	80%	15	\$0.19	12%
Dry_Goods_Retail	Space_Heat	Existing	Duct Insulation	0.12	20%	65%	20	\$0.01	2%
Dry_Goods_Retail	Space_Heat	Existing	Duct Repair and Sealing	0.12	50%	65%	20	\$0.04	2%
Dry_Goods_Retail	Space_Heat	Existing	High Efficiency Gas Furnace /Boiler	0.12			20	\$0.10	12%
Dry_Goods_Retail	Space_Heat	Existing	Insulation - Floor	0.12	95%	60%	20	\$0.47	5%
Dry_Goods_Retail	Space_Heat	Existing	Insulation - Roof / Ceiling	0.12	90%	75%	20	\$0.47	10%
Dry_Goods_Retail	Space_Heat	Existing	Programmable Thermostat	0.12	48%	100%	10	\$0.01	2%
Dry_Goods_Retail	Space_Heat	Existing	Retro-Commissioning	0.12	85%	92%	3	\$0.27	15%
Dry_Goods_Retail	Space_Heat	Existing	Windows-High Efficiency	0.12	75%	75%	30	\$0.23	7%
Dry_Goods_Retail	Space_Heat	New	Automated Ventilation VFD Control (Occupancy Sensors / CO2 Sensors)	0.12	95%	90%	15	\$0.28	10%
Dry_Goods_Retail	Space_Heat	New	Boiler Economizer	0.12	95%	40%	20	\$0.59	10%
Dry_Goods_Retail	Space_Heat	New	Green Roof	0.12	100%	10%	40	\$15.00	13%
Dry_Goods_Retail	Space_Heat	New	High Efficiency Gas Furnace /Boiler	0.12			20	\$0.10	12%
Dry_Goods_Retail	Space_Heat	New	Leak Proof Duct Fittings	0.12	100%	40%	30	\$0.09	15%
Dry_Goods_Retail	Space_Heat	New	Retro-Commissioning	0.12	85%	92%	3	\$1.00	15%
Dry_Goods_Retail	Space_Heat	New	Windows-High Efficiency	0.12	75%	75%	30	\$0.08	7%
Dry_Goods_Retail	Water_Heat	Existing	Commercial Washers	0.03	80%	5%	8	\$0.22	35%
Dry_Goods_Retail	Water_Heat	Existing	Condensing Water Heater	0.03	95%	45%	13	\$0.08	34%
Dry_Goods_Retail	Water_Heat	Existing	Demand controlled Circulating Systems	0.03	98%	60%	15	\$1.56	5%
Dry_Goods_Retail	Water_Heat	Existing	Faucet Aerators	0.03	20%	100%	10	\$0.00	3%
Dry_Goods_Retail	Water_Heat	Existing	High-Efficiency Water Heater	0.03			13	\$0.03	8%
Dry_Goods_Retail	Water_Heat	Existing	Hot Water (SHW) Pipe Insulation	0.03	95%	85%	15	\$0.02	2%
Dry_Goods_Retail	Water_Heat	Existing	Low-Flow Showerheads	0.03	25%	100%	10	\$0.01	1%
Dry_Goods_Retail	Water_Heat	Existing	Premium Efficiency Storage Water Heater	0.03			13	\$0.05	16%
Dry_Goods_Retail	Water_Heat	Existing	Solar Water Heater	0.03	95%	45%	15	\$1.89	40%
Dry_Goods_Retail	Water_Heat	Existing	Tankless Water Heater	0.03	95%	25%	15	\$0.12	27%
Dry_Goods_Retail	Water_Heat	Existing	Water Heater Temperature Setback	0.03	25%	100%	10	\$0.02	5%
Dry_Goods_Retail	Water_Heat	New	Commercial Washers	0.03	80%	5%	8	\$0.22	35%
Dry_Goods_Retail	Water_Heat	New	Condensing Water Heater	0.03	95%	45%	13	\$0.06	34%
Dry_Goods_Retail	Water_Heat	New	Demand controlled Circulating Systems	0.03	98%	60%	15	\$1.56	5%
Dry_Goods_Retail	Water_Heat	New	Faucet Aerators	0.03	20%	100%	10	\$0.00	3%
Dry_Goods_Retail	Water_Heat	New	High-Efficiency Water Heater	0.03			13	\$0.03	8%
Dry_Goods_Retail	Water_Heat	New	Hot Water (SHW) Pipe Insulation	0.03	95%	85%	15	\$0.02	2%
Dry_Goods_Retail	Water_Heat	New	Low-Flow Showerheads	0.03	25%	100%	10	\$0.01	1%
Dry_Goods_Retail	Water_Heat	New	Premium Efficiency Storage Water Heater	0.03			13	\$0.05	16%
Dry_Goods_Retail	Water_Heat	New	Solar Water Heater	0.03	95%	45%	15	\$1.89	40%
Dry_Goods_Retail	Water_Heat	New	Tankless Water Heater	0.03	95%	55%	15	\$0.12	27%
Grocery	Cooking	Existing	Power Burner Fryer	0.36	90%	100%	15	\$0.21	4%
Grocery	Cooking	Existing	Power Burner Oven	0.36	90%	100%	15	\$0.53	4%
Grocery	Cooking	New	Power Burner Fryer	0.36	90%	100%	15	\$0.21	2%
Grocery	Cooking	New	Power Burner Oven	0.36	90%	100%	15	\$0.53	2%
Grocery	Space_Heat	Existing	Automated Ventilation VFD Control (Occupancy Sensors / CO2 Sensors)	0.20	95%	90%	15	\$0.28	10%
Grocery	Space_Heat	Existing	Boiler Economizer	0.20	95%	40%	20	\$0.59	10%
Grocery	Space_Heat	Existing	Duct Insulation	0.20	20%	65%	20	\$0.01	2%
Grocery	Space_Heat	Existing	Duct Repair and Sealing	0.20	50%	65%	20	\$0.06	2%
Grocery	Space_Heat	Existing	High Efficiency Gas Furnace /Boiler	0.20			20	\$0.11	12%
Grocery	Space_Heat	Existing	Insulation - Floor	0.20	50%	60%	20	\$0.48	5%
Grocery	Space_Heat	Existing	Insulation - Roof / Ceiling	0.20	15%	75%	20	\$0.48	10%
Grocery	Space_Heat	Existing	Programmable Thermostat	0.20	70%	100%	10	\$0.02	2%
Grocery	Space_Heat	Existing	Retro-Commissioning	0.20	85%	92%	3	\$0.27	15%
Grocery	Space_Heat	Existing	Windows-High Efficiency	0.20	75%	75%	30	\$0.21	5%

Building Type	End Use	Vintage	Measure Name	Base Usage	Incomplete Factor	Technical Feasibility	Measure Life	Per Unit Cost	Energy Savings
Grocery	Space_Heat	New	Automated Ventilation VFD Control (Occupancy Sensors / CO2 Sensors)	0.20	95%	90%	15	\$0.28	10%
Grocery	Space_Heat	New	Boiler Economizer	0.20	95%	40%	20	\$0.59	10%
Grocery	Space_Heat	New	Green Roof	0.20	100%	10%	40	\$15.00	13%
Grocery	Space_Heat	New	High Efficiency Gas Furnace /Boiler	0.20			20	\$0.11	12%
Grocery	Space_Heat	New	Leak Proof Duct Fittings	0.20	100%	40%	30	\$0.11	15%
Grocery	Space_Heat	New	Retro-Commissioning	0.20	85%	92%	3	\$1.00	15%
Grocery	Space_Heat	New	Windows-High Efficiency	0.20	75%	75%	30	\$0.07	5%
Grocery	Water_Heat	Existing	Condensing Water Heater	0.30	95%	45%	13	\$1.14	34%
Grocery	Water_Heat	Existing	Demand controlled Circulating Systems	0.30	98%	60%	15	\$1.16	5%
Grocery	Water_Heat	Existing	Faucet Aerators	0.30	20%	100%	10	\$0.00	3%
Grocery	Water_Heat	Existing	High-Efficiency Water Heater	0.30			13	\$0.02	8%
Grocery	Water_Heat	Existing	Hot Water (SHW) Pipe Insulation	0.30	95%	85%	15	\$0.01	2%
Grocery	Water_Heat	Existing	Low Flow Spray Heads	0.30	45%	100%	5	\$0.01	1%
Grocery	Water_Heat	Existing	Low-Flow Showerheads	0.30	25%	100%	10	\$0.01	1%
Grocery	Water_Heat	Existing	Premium Efficiency Storage Water Heater	0.30			13	\$0.03	16%
Grocery	Water_Heat	Existing	Solar Water Heater	0.30	95%	45%	15	\$0.95	40%
Grocery	Water_Heat	Existing	Tankless Water Heater	0.30	95%	25%	15	\$0.43	27%
Grocery	Water_Heat	Existing	Water Heater Temperature Setback	0.30	40%	100%	10	\$0.01	5%
Grocery	Water_Heat	New	Condensing Water Heater	0.30	95%	45%	13	\$0.83	34%
Grocery	Water_Heat	New	Demand controlled Circulating Systems	0.30	98%	60%	15	\$1.16	5%
Grocery	Water_Heat	New	Faucet Aerators	0.30	20%	100%	10	\$0.00	3%
Grocery	Water_Heat	New	High-Efficiency Water Heater	0.30			13	\$0.02	8%
Grocery	Water_Heat	New	Hot Water (SHW) Pipe Insulation	0.30	95%	85%	15	\$0.01	2%
Grocery	Water_Heat	New	Low Flow Spray Heads	0.30	45%	100%	5	\$0.01	1%
Grocery	Water_Heat	New	Low-Flow Showerheads	0.30	25%	100%	10	\$0.01	1%
Grocery	Water_Heat	New	Premium Efficiency Storage Water Heater	0.30			13	\$0.03	16%
Grocery	Water_Heat	New	Solar Water Heater	0.30	95%	45%	15	\$0.95	40%
Grocery	Water_Heat	New	Tankless Water Heater	0.30	95%	55%	15	\$0.43	27%
Hospital	Cooking	Existing	Power Burner Fryer	0.05	90%	100%	15	\$0.04	4%
Hospital	Cooking	Existing	Power Burner Oven	0.05	90%	100%	15	\$0.09	4%
Hospital	Cooking	New	Power Burner Fryer	0.05	90%	100%	15	\$0.04	4%
Hospital	Cooking	New	Power Burner Oven	0.05	90%	100%	15	\$0.09	4%
Hospital	Pool_Heat	Existing	Installation of Solar Pool/Spa Heating Systems	0.02	98%	95%	10	\$0.02	16%
Hospital	Pool_Heat	Existing	Installation of Swimming Pool / Spa Covers	0.02	25%	100%	5	\$0.00	35%
Hospital	Pool_Heat	New	Installation of Solar Pool/Spa Heating Systems	0.02	98%	95%	10	\$0.02	16%
Hospital	Pool_Heat	New	Installation of Swimming Pool / Spa Covers	0.02	25%	100%	5	\$0.00	35%
Hospital	Space_Heat	Existing	Automated Ventilation VFD Control (Occupancy Sensors / CO2 Sensors)	0.47	95%	40%	15	\$0.28	10%
Hospital	Space_Heat	Existing	Boiler Economizer	0.47	95%	40%	20	\$0.59	10%
Hospital	Space_Heat	Existing	Boiler Tune-Up	0.47	45%	90%	3	\$0.05	2%
Hospital	Space_Heat	Existing	Convert Constant Volume Air System to VAV	0.47	15%	80%	15	\$0.35	12%
Hospital	Space_Heat	Existing	Duct Insulation	0.47	20%	65%	20	\$0.03	2%
Hospital	Space_Heat	Existing	Duct Repair and Sealing	0.47	50%	65%	20	\$0.13	2%
Hospital	Space_Heat	Existing	Exhaust Air to Ventilation Air Heat Recovery	0.47	95%	10%	20	\$1.00	20%
Hospital	Space_Heat	Existing	High Efficiency Gas Furnace /Boiler	0.47			20	\$0.13	12%
Hospital	Space_Heat	Existing	Insulation - Floor	0.47	40%	60%	20	\$0.43	5%
Hospital	Space_Heat	Existing	Insulation - Roof / Ceiling	0.47	17%	75%	20	\$0.65	10%
Hospital	Space_Heat	Existing	Programmable Thermostat	0.47	55%	100%	10	\$0.06	2%
Hospital	Space_Heat	Existing	Retro-Commissioning	0.47	85%	92%	3	\$0.27	15%
Hospital	Space_Heat	Existing	Windows-High Efficiency	0.47	75%	75%	30	\$0.27	4%
Hospital	Space_Heat	Existing	Wireless Performance Monitoring, Diagnostics and Control	0.47	100%	30%	10	\$0.50	10%
Hospital	Space_Heat	New	Automated Ventilation VFD Control (Occupancy Sensors / CO2 Sensors)	0.47	95%	40%	15	\$0.28	10%
Hospital	Space_Heat	New	Boiler Economizer	0.47	95%	40%	20	\$0.59	10%
Hospital	Space_Heat	New	Exhaust Air to Ventilation Air Heat Recovery	0.47	85%	10%	20	\$0.93	15%
Hospital	Space_Heat	New	Green Roof	0.47	100%	10%	40	\$15.00	13%
Hospital	Space_Heat	New	High Efficiency Gas Furnace /Boiler	0.47			20	\$0.13	12%

Building Type	End Use	Vintage	Measure Name	Base Usage	Incomplete Factor	Technical Feasibility	Measure Life	Per Unit Cost	Energy Savings
Hospital	Space_Heat	New	Leak Proof Duct Fittings	0.47	100%	40%	30	\$0.24	15%
Hospital	Space_Heat	New	Retro-Commissioning	0.47	85%	92%	3	\$1.00	15%
Hospital	Space_Heat	New	Windows-High Efficiency	0.47	75%	75%	30	\$0.12	4%
Hospital	Space_Heat	New	Wireless Performance Monitoring, Diagnostics and Control	0.47	100%	30%	10	\$0.50	10%
Hospital	Water_Heat	Existing	Condensing Water Heater	0.39	95%	45%	13	\$0.39	34%
Hospital	Water_Heat	Existing	Demand controlled Circulating Systems	0.39	85%	60%	15	\$0.68	5%
Hospital	Water_Heat	Existing	Faucet Aerators	0.39	20%	100%	10	\$0.01	3%
Hospital	Water_Heat	Existing	High-Efficiency Water Heater	0.39			13	\$0.01	8%
Hospital	Water_Heat	Existing	Hot Water (SHW) Pipe Insulation	0.39	75%	85%	15	\$0.01	2%
Hospital	Water_Heat	Existing	Low-Flow Showerheads	0.39	25%	100%	10	\$0.03	4%
Hospital	Water_Heat	Existing	Premium Efficiency Storage Water Heater	0.39			13	\$0.11	16%
Hospital	Water_Heat	Existing	Solar Water Heater	0.39	95%	45%	15	\$3.01	40%
Hospital	Water_Heat	Existing	Tankless Water Heater	0.39	95%	10%	15	\$0.25	27%
Hospital	Water_Heat	Existing	Water Heater Temperature Setback	0.39	60%	100%	10	\$0.01	5%
Hospital	Water_Heat	New	Condensing Water Heater	0.39	95%	45%	13	\$0.28	34%
Hospital	Water_Heat	New	Demand controlled Circulating Systems	0.39	85%	60%	15	\$0.68	5%
Hospital	Water_Heat	New	Faucet Aerators	0.39	20%	100%	10	\$0.01	3%
Hospital	Water_Heat	New	High-Efficiency Water Heater	0.39			13	\$0.01	8%
Hospital	Water_Heat	New	Hot Water (SHW) Pipe Insulation	0.39	75%	85%	15	\$0.01	2%
Hospital	Water_Heat	New	Low-Flow Showerheads	0.39	25%	100%	10	\$0.03	4%
Hospital	Water_Heat	New	Premium Efficiency Storage Water Heater	0.39			13	\$0.11	16%
Hospital	Water_Heat	New	Solar Water Heater	0.39	95%	45%	15	\$3.01	40%
Hospital	Water_Heat	New	Tankless Water Heater	0.39	95%	25%	15	\$0.25	27%
Hotel_Motel	Cooking	Existing	Power Burner Fryer	0.06	90%	100%	15	\$0.04	4%
Hotel_Motel	Cooking	Existing	Power Burner Oven	0.06	90%	100%	15	\$0.11	4%
Hotel_Motel	Cooking	New	Power Burner Fryer	0.06	90%	100%	15	\$0.04	4%
Hotel_Motel	Cooking	New	Power Burner Oven	0.06	90%	100%	15	\$0.11	4%
Hotel_Motel	Pool_Heat	Existing	Installation of Solar Pool/Spa Heating Systems	0.09	98%	95%	10	\$0.07	16%
Hotel_Motel	Pool_Heat	Existing	Installation of Swimming Pool / Spa Covers	0.09	25%	100%	5	\$0.01	35%
Hotel_Motel	Pool_Heat	New	Installation of Solar Pool/Spa Heating Systems	0.06	98%	95%	10	\$0.07	16%
Hotel_Motel	Pool_Heat	New	Installation of Swimming Pool / Spa Covers	0.06	25%	100%	5	\$0.01	35%
Hotel_Motel	Space_Heat	Existing	Automated Ventilation VFD Control (Occupancy Sensors / CO2 Sensors)	0.08	95%	90%	15	\$0.28	10%
Hotel_Motel	Space_Heat	Existing	Boiler Economizer	0.08	35%	40%	20	\$0.59	10%
Hotel_Motel	Space_Heat	Existing	Boiler Tune-Up	0.08	45%	90%	3	\$0.06	2%
Hotel_Motel	Space_Heat	Existing	Duct Insulation	0.08	20%	65%	20	\$0.01	2%
Hotel_Motel	Space_Heat	Existing	Duct Repair and Sealing	0.08	50%	65%	20	\$0.03	2%
Hotel_Motel	Space_Heat	Existing	Exhaust Air to Ventilation Air Heat Recovery	0.08	95%	50%	20	\$1.00	20%
Hotel_Motel	Space_Heat	Existing	High Efficiency Gas Furnace /Boiler	0.08			20	\$0.10	12%
Hotel_Motel	Space_Heat	Existing	Insulation - Floor	0.08	50%	60%	20	\$0.21	5%
Hotel_Motel	Space_Heat	Existing	Insulation - Roof / Ceiling	0.08	30%	75%	20	\$0.21	10%
Hotel_Motel	Space_Heat	Existing	Programmable Thermostat	0.08	70%	100%	10	\$0.01	2%
Hotel_Motel	Space_Heat	Existing	Retro-Commissioning	0.08	85%	92%	3	\$0.27	15%
Hotel_Motel	Space_Heat	Existing	Windows-High Efficiency	0.08	75%	75%	30	\$0.48	4%
Hotel_Motel	Space_Heat	Existing	Wireless Performance Monitoring, Diagnostics and Control	0.08	100%	30%	10	\$0.50	10%
Hotel_Motel	Space_Heat	New	Boiler Economizer	0.08	35%	40%	20	\$0.59	10%
Hotel_Motel	Space_Heat	New	Exhaust Air to Ventilation Air Heat Recovery	0.08	85%	95%	20	\$0.93	15%
Hotel_Motel	Space_Heat	New	Green Roof	0.08	100%	10%	40	\$15.00	13%
Hotel_Motel	Space_Heat	New	High Efficiency Gas Furnace /Boiler	0.08			20	\$0.10	12%
Hotel_Motel	Space_Heat	New	Leak Proof Duct Fittings	0.08	100%	40%	30	\$0.07	15%
Hotel_Motel	Space_Heat	New	Retro-Commissioning	0.08	85%	92%	3	\$1.00	15%
Hotel_Motel	Space_Heat	New	Windows-High Efficiency	0.08	75%	75%	30	\$0.16	4%
Hotel_Motel	Space_Heat	New	Wireless Performance Monitoring, Diagnostics and Control	0.08	100%	30%	10	\$0.50	10%
Hotel_Motel	Water_Heat	Existing	Condensing Water Heater	0.65	95%	45%	13	\$0.51	34%
Hotel_Motel	Water_Heat	Existing	Demand controlled Circulating Systems	0.65	98%	60%	15	\$0.78	5%
Hotel_Motel	Water_Heat	Existing	Faucet Aerators	0.65	20%	100%	10	\$0.01	3%

Building Type	End Use	Vintage	Measure Name	Base Usage	Incomplete Factor	Technical Feasibility	Measure Life	Per Unit Cost	Energy Savings
Hotel_Motel	Water_Heat	Existing	High-Efficiency Water Heater	0.65			13	\$0.01	8%
Hotel_Motel	Water_Heat	Existing	Hot Water (SHW) Pipe Insulation	0.65	95%	85%	15	\$0.02	2%
Hotel_Motel	Water_Heat	Existing	Low Flow Spray Heads	0.65	55%	100%	5	\$0.01	1%
Hotel_Motel	Water_Heat	Existing	Low-Flow Showerheads	0.65	25%	100%	10	\$0.07	5%
Hotel_Motel	Water_Heat	Existing	Premium Efficiency Storage Water Heater	0.65			13	\$0.24	30%
Hotel_Motel	Water_Heat	Existing	Solar Water Heater	0.65	95%	45%	15	\$2.64	40%
Hotel_Motel	Water_Heat	Existing	Tankless Water Heater	0.65	95%	10%	15	\$0.89	27%
Hotel_Motel	Water_Heat	Existing	Water Heater Temperature Setback	0.65	5%	100%	10	\$0.01	5%
Hotel_Motel	Water_Heat	New	Condensing Water Heater	0.65	95%	45%	13	\$0.37	34%
Hotel_Motel	Water_Heat	New	Demand controlled Circulating Systems	0.65	98%	60%	15	\$0.78	5%
Hotel_Motel	Water_Heat	New	Faucet Aerators	0.65	20%	100%	10	\$0.01	3%
Hotel_Motel	Water_Heat	New	High-Efficiency Water Heater	0.65			13	\$0.01	8%
Hotel_Motel	Water_Heat	New	Hot Water (SHW) Pipe Insulation	0.65	95%	85%	15	\$0.02	2%
Hotel_Motel	Water_Heat	New	Low Flow Spray Heads	0.65	55%	100%	5	\$0.01	1%
Hotel_Motel	Water_Heat	New	Low-Flow Showerheads	0.65	25%	100%	10	\$0.07	5%
Hotel_Motel	Water_Heat	New	Premium Efficiency Storage Water Heater	0.65			13	\$0.24	30%
Hotel_Motel	Water_Heat	New	Solar Water Heater	0.65	95%	45%	15	\$2.64	40%
Hotel_Motel	Water_Heat	New	Tankless Water Heater	0.65	95%	25%	15	\$0.89	27%
Office	Space_Heat	Existing	Automated Ventilation VFD Control (Occupancy Sensors / CO2 Sensors)	0.19	95%	90%	15	\$0.28	10%
Office	Space_Heat	Existing	Boiler Economizer	0.19	50%	40%	20	\$0.59	10%
Office	Space_Heat	Existing	Boiler Tune-Up	0.19	45%	90%	3	\$0.08	2%
Office	Space_Heat	Existing	Convert Constant Volume Air System to VAV	0.19	15%	80%	15	\$0.23	12%
Office	Space_Heat	Existing	Duct Insulation	0.19	20%	65%	20	\$0.02	2%
Office	Space_Heat	Existing	Duct Repair and Sealing	0.19	50%	65%	20	\$0.04	2%
Office	Space_Heat	Existing	Exhaust Air to Ventilation Air Heat Recovery	0.19	95%	50%	20	\$1.00	20%
Office	Space_Heat	Existing	High Efficiency Gas Furnace /Boiler	0.19			20	\$0.10	12%
Office	Space_Heat	Existing	Insulation - Floor	0.19	20%	60%	20	\$0.33	5%
Office	Space_Heat	Existing	Insulation - Roof / Ceiling	0.19	5%	75%	20	\$0.33	10%
Office	Space_Heat	Existing	Programmable Thermostat	0.19	52%	100%	10	\$0.01	2%
Office	Space_Heat	Existing	Retro-Commissioning	0.19	85%	92%	3	\$0.27	15%
Office	Space_Heat	Existing	Windows-High Efficiency	0.19	75%	75%	30	\$0.44	10%
Office	Space_Heat	New	Automated Ventilation VFD Control (Occupancy Sensors / CO2 Sensors)	0.19	95%	90%	15	\$0.28	10%
Office	Space_Heat	New	Boiler Economizer	0.19	50%	40%	20	\$0.59	10%
Office	Space_Heat	New	Exhaust Air to Ventilation Air Heat Recovery	0.19	85%	95%	20	\$0.93	15%
Office	Space_Heat	New	Green Roof	0.19	100%	10%	40	\$15.00	13%
Office	Space_Heat	New	High Efficiency Gas Furnace /Boiler	0.19			20	\$0.10	12%
Office	Space_Heat	New	Leak Proof Duct Fittings	0.19	100%	40%	30	\$0.10	15%
Office	Space_Heat	New	Retro-Commissioning	0.19	85%	92%	3	\$1.00	15%
Office	Space_Heat	New	Windows-High Efficiency	0.19	75%	75%	30	\$0.15	10%
Office	Water_Heat	Existing	Condensing Water Heater	0.08	95%	45%	13	\$0.13	34%
Office	Water_Heat	Existing	Demand controlled Circulating Systems	0.08	85%	60%	15	\$1.05	5%
Office	Water_Heat	Existing	Faucet Aerators	0.08	20%	100%	10	\$0.00	3%
Office	Water_Heat	Existing	High-Efficiency Water Heater	0.08			13	\$0.02	8%
Office	Water_Heat	Existing	Hot Water (SHW) Pipe Insulation	0.08	35%	85%	15	\$0.00	2%
Office	Water_Heat	Existing	Low-Flow Showerheads	0.08	25%	100%	10	\$0.00	1%
Office	Water_Heat	Existing	Premium Efficiency Storage Water Heater	0.08			13	\$0.03	16%
Office	Water_Heat	Existing	Solar Water Heater	0.08	95%	45%	15	\$1.54	40%
Office	Water_Heat	Existing	Tankless Water Heater	0.08	95%	25%	15	\$0.04	27%
Office	Water_Heat	Existing	Water Heater Temperature Setback	0.08	35%	100%	10	\$0.01	5%
Office	Water_Heat	New	Condensing Water Heater	0.08	95%	45%	13	\$0.09	34%
Office	Water_Heat	New	Demand controlled Circulating Systems	0.08	85%	60%	15	\$1.05	5%
Office	Water_Heat	New	Faucet Aerators	0.08	20%	100%	10	\$0.00	3%
Office	Water_Heat	New	High-Efficiency Water Heater	0.08			13	\$0.02	8%
Office	Water_Heat	New	Hot Water (SHW) Pipe Insulation	0.08	35%	85%	15	\$0.00	2%
Office	Water_Heat	New	Low-Flow Showerheads	0.08	25%	100%	10	\$0.00	1%

Building Type	End Use	Vintage	Measure Name	Base Usage	Incomplete Factor	Technical Feasibility	Measure Life	Per Unit Cost	Energy Savings
Office	Water_Heat	New	Premium Efficiency Storage Water Heater	0.08			13	\$0.03	16%
Office	Water_Heat	New	Solar Water Heater	0.08	95%	45%	15	\$1.54	40%
Office	Water_Heat	New	Tankless Water Heater	0.08	95%	55%	15	\$0.04	27%
Other	Space_Heat	Existing	Automated Ventilation VFD Control (Occupancy Sensors / CO2 Sensors)	0.23	95%	40%	15	\$0.28	10%
Other	Space_Heat	Existing	Boiler Economizer	0.23	90%	40%	20	\$0.59	10%
Other	Space_Heat	Existing	Boiler Tune-Up	0.23	45%	90%	3	\$0.07	2%
Other	Space_Heat	Existing	Convert Constant Volume Air System to VAV	0.23	15%	80%	15	\$0.16	12%
Other	Space_Heat	Existing	Duct Insulation	0.23	20%	65%	20	\$0.01	2%
Other	Space_Heat	Existing	Duct Repair and Sealing	0.23	50%	65%	20	\$0.07	2%
Other	Space_Heat	Existing	Exhaust Air to Ventilation Air Heat Recovery	0.23	95%	50%	20	\$1.00	20%
Other	Space_Heat	Existing	High Efficiency Gas Furnace /Boiler	0.23			20	\$0.16	12%
Other	Space_Heat	Existing	Insulation - Floor	0.23	55%	60%	20	\$0.44	5%
Other	Space_Heat	Existing	Insulation - Roof / Ceiling	0.23	35%	75%	20	\$0.44	10%
Other	Space_Heat	Existing	Programmable Thermostat	0.23	32%	100%	10	\$0.04	2%
Other	Space_Heat	Existing	Retro-Commissioning	0.23	85%	92%	3	\$0.27	15%
Other	Space_Heat	Existing	Windows-High Efficiency	0.23	75%	75%	30	\$0.24	5%
Other	Space_Heat	New	Automated Ventilation VFD Control (Occupancy Sensors / CO2 Sensors)	0.23	95%	40%	15	\$0.28	10%
Other	Space_Heat	New	Boiler Economizer	0.23	90%	40%	20	\$0.59	10%
Other	Space_Heat	New	Exhaust Air to Ventilation Air Heat Recovery	0.23	85%	50%	20	\$0.93	15%
Other	Space_Heat	New	Green Roof	0.23	100%	10%	40	\$15.00	13%
Other	Space_Heat	New	High Efficiency Gas Furnace /Boiler	0.23			20	\$0.16	12%
Other	Space_Heat	New	Leak Proof Duct Fittings	0.23	100%	40%	30	\$0.09	15%
Other	Space_Heat	New	Retro-Commissioning	0.23	85%	92%	3	\$1.00	15%
Other	Space_Heat	New	Windows-High Efficiency	0.23	75%	75%	30	\$1.53	5%
Other	Water_Heat	Existing	Commercial Washers	0.19	80%	5%	8	\$0.55	35%
Other	Water_Heat	Existing	Condensing Water Heater	0.19	95%	45%	13	\$0.14	34%
Other	Water_Heat	Existing	Demand controlled Circulating Systems	0.19	98%	60%	15	\$0.93	5%
Other	Water_Heat	Existing	Faucet Aerators	0.19	40%	100%	10	\$0.00	3%
Other	Water_Heat	Existing	High-Efficiency Water Heater	0.19			13	\$0.02	8%
Other	Water_Heat	Existing	Hot Water (SHW) Pipe Insulation	0.19	95%	40%	15	\$0.01	2%
Other	Water_Heat	Existing	Low-Flow Showerheads	0.19	25%	100%	10	\$0.01	2%
Other	Water_Heat	Existing	Premium Efficiency Storage Water Heater	0.19			13	\$0.03	16%
Other	Water_Heat	Existing	Solar Water Heater	0.19	95%	45%	15	\$2.58	40%
Other	Water_Heat	Existing	Tankless Water Heater	0.19	95%	25%	15	\$0.22	27%
Other	Water_Heat	Existing	Water Heater Temperature Setback	0.19	40%	100%	10	\$0.01	5%
Other	Water_Heat	New	Commercial Washers	0.19	80%	5%	8	\$0.55	35%
Other	Water_Heat	New	Condensing Water Heater	0.19	95%	45%	13	\$0.10	34%
Other	Water_Heat	New	Demand controlled Circulating Systems	0.19	98%	60%	15	\$0.93	5%
Other	Water_Heat	New	Faucet Aerators	0.19	40%	100%	10	\$0.00	3%
Other	Water_Heat	New	High-Efficiency Water Heater	0.19			13	\$0.01	8%
Other	Water_Heat	New	Hot Water (SHW) Pipe Insulation	0.19	95%	40%	15	\$0.01	2%
Other	Water_Heat	New	Low-Flow Showerheads	0.19	25%	100%	10	\$0.01	2%
Other	Water_Heat	New	Premium Efficiency Storage Water Heater	0.19			13	\$0.02	16%
Other	Water_Heat	New	Solar Water Heater	0.19	95%	45%	15	\$2.58	40%
Other	Water_Heat	New	Tankless Water Heater	0.19	95%	55%	15	\$0.22	27%
Restaurant	Cooking	Existing	Power Burner Fryer	0.93	85%	100%	15	\$0.79	8%
Restaurant	Cooking	Existing	Power Burner Oven	0.93	85%	100%	15	\$1.97	8%
Restaurant	Cooking	New	Power Burner Fryer	0.93	85%	100%	15	\$0.79	4%
Restaurant	Cooking	New	Power Burner Oven	0.93	85%	100%	15	\$1.97	4%
Restaurant	Space_Heat	Existing	Automated Ventilation VFD Control (Occupancy Sensors / CO2 Sensors)	0.14	95%	90%	15	\$0.28	10%
Restaurant	Space_Heat	Existing	Boiler Economizer	0.14	95%	40%	20	\$0.59	10%
Restaurant	Space_Heat	Existing	Duct Insulation	0.14	20%	65%	20	\$0.03	2%
Restaurant	Space_Heat	Existing	Duct Repair and Sealing	0.14	50%	65%	20	\$0.02	2%
Restaurant	Space_Heat	Existing	High Efficiency Gas Furnace /Boiler	0.14			20	\$0.26	12%
Restaurant	Space_Heat	Existing	Insulation - Floor	0.14	95%	60%	20	\$0.45	5%



Building Type	End Use	Vintage	Measure Name	Base Usage	Incomplete Factor	Technical Feasibility	Measure Life	Per Unit Cost	Energy Savings
Restaurant	Space_Heat	Existing	Insulation - Roof / Ceiling	0.14	90%	75%	20	\$0.45	10%
Restaurant	Space_Heat	Existing	Programmable Thermostat	0.14	70%	100%	10	\$0.01	2%
Restaurant	Space_Heat	Existing	Retro-Commissioning	0.14	85%	92%	3	\$0.27	15%
Restaurant	Space_Heat	Existing	Windows-High Efficiency	0.14	75%	75%	30	\$0.14	3%
Restaurant	Space_Heat	New	Automated Ventilation VFD Control (Occupancy Sensors / CO2 Sensors)	0.14	95%	90%	15	\$0.28	10%
Restaurant	Space_Heat	New	Boiler Economizer	0.14	95%	40%	20	\$0.59	10%
Restaurant	Space_Heat	New	Green Roof	0.14	100%	10%	40	\$15.00	13%
Restaurant	Space_Heat	New	High Efficiency Gas Furnace /Boiler	0.14			20	\$0.26	12%
Restaurant	Space_Heat	New	Leak Proof Duct Fittings	0.14	100%	40%	30	\$0.15	15%
Restaurant	Space_Heat	New	Retro-Commissioning	0.14	85%	92%	3	\$1.00	15%
Restaurant	Space_Heat	New	Windows-High Efficiency	0.14	75%	75%	30	\$0.05	3%
Restaurant	Water_Heat	Existing	Chemical Dishwashing System	0.82	90%	100%	10	\$0.31	5%
Restaurant	Water_Heat	Existing	Condensing Water Heater	0.82	95%	45%	13	\$0.75	34%
Restaurant	Water_Heat	Existing	Demand controlled Circulating Systems	0.82	98%	60%	15	\$2.13	5%
Restaurant	Water_Heat	Existing	Faucet Aerators	0.82	20%	100%	10	\$0.02	3%
Restaurant	Water_Heat	Existing	High-Efficiency Water Heater	0.82			13	\$0.04	8%
Restaurant	Water_Heat	Existing	Hot Water (SHW) Pipe Insulation	0.82	95%	85%	15	\$0.02	2%
Restaurant	Water_Heat	Existing	Low Flow Spray Heads	0.82	30%	100%	5	\$0.04	5%
Restaurant	Water_Heat	Existing	Low-Flow Showerheads	0.82	25%	100%	10	\$0.01	0%
Restaurant	Water_Heat	Existing	Premium Efficiency Storage Water Heater	0.82			13	\$0.06	16%
Restaurant	Water_Heat	Existing	Solar Water Heater	0.82	95%	45%	15	\$2.21	40%
Restaurant	Water_Heat	Existing	Tankless Water Heater	0.82	95%	25%	15	\$1.11	27%
Restaurant	Water_Heat	Existing	Water Heater Temperature Setback	0.82	10%	100%	10	\$0.03	5%
Restaurant	Water_Heat	New	Chemical Dishwashing System	0.82	90%	100%	10	\$0.31	5%
Restaurant	Water_Heat	New	Condensing Water Heater	0.82	95%	45%	13	\$0.54	34%
Restaurant	Water_Heat	New	Demand controlled Circulating Systems	0.82	98%	60%	15	\$2.13	5%
Restaurant	Water_Heat	New	Faucet Aerators	0.82	20%	100%	10	\$0.02	3%
Restaurant	Water_Heat	New	High-Efficiency Water Heater	0.82			13	\$0.04	8%
Restaurant	Water_Heat	New	Hot Water (SHW) Pipe Insulation	0.82	95%	85%	15	\$0.02	2%
Restaurant	Water_Heat	New	Low Flow Spray Heads	0.82	30%	100%	5	\$0.04	5%
Restaurant	Water_Heat	New	Low-Flow Showerheads	0.82	25%	100%	10	\$0.01	0%
Restaurant	Water_Heat	New	Premium Efficiency Storage Water Heater	0.82			13	\$0.06	16%
Restaurant	Water_Heat	New	Solar Water Heater	0.82	95%	45%	15	\$2.21	40%
Restaurant	Water_Heat	New	Tankless Water Heater	0.82	95%	55%	15	\$1.11	27%
School	Cooking	Existing	Power Burner Fryer	0.02	90%	100%	15	\$0.10	4%
School	Cooking	Existing	Power Burner Oven	0.02	90%	100%	15	\$0.25	4%
School	Cooking	New	Power Burner Fryer	0.02	90%	100%	15	\$0.10	4%
School	Cooking	New	Power Burner Oven	0.02	90%	100%	15	\$0.25	4%
School	Pool_Heat	Existing	Installation of Solar Pool/Spa Heating Systems	0.10	98%	95%	10	\$0.31	16%
School	Pool_Heat	Existing	Installation of Swimming Pool / Spa Covers	0.10	25%	100%	5	\$0.02	35%
School	Pool_Heat	New	Installation of Solar Pool/Spa Heating Systems	0.02	98%	95%	10	\$0.30	16%
School	Pool_Heat	New	Installation of Swimming Pool / Spa Covers	0.02	25%	100%	5	\$0.01	35%
School	Space_Heat	Existing	Automated Ventilation VFD Control (Occupancy Sensors / CO2 Sensors)	0.18	95%	90%	15	\$0.28	10%
School	Space_Heat	Existing	Boiler Economizer	0.18	70%	40%	20	\$0.59	10%
School	Space_Heat	Existing	Boiler Tune-Up	0.18	45%	90%	3	\$0.04	2%
School	Space_Heat	Existing	Convert Constant Volume Air System to VAV	0.18	15%	80%	15	\$0.17	12%
School	Space_Heat	Existing	Duct Insulation	0.18	20%	65%	20	\$0.03	2%
School	Space_Heat	Existing	Duct Repair and Sealing	0.18	50%	65%	20	\$0.08	2%
School	Space_Heat	Existing	Exhaust Air to Ventilation Air Heat Recovery	0.18	95%	50%	20	\$1.00	20%
School	Space_Heat	Existing	High Efficiency Gas Furnace /Boiler	0.18			20	\$0.39	12%
School	Space_Heat	Existing	Insulation - Floor	0.18	40%	60%	20	\$0.47	5%
School	Space_Heat	Existing	Insulation - Roof / Ceiling	0.18	20%	75%	20	\$0.47	10%
School	Space_Heat	Existing	Programmable Thermostat	0.18	38%	100%	10	\$0.01	2%
School	Space_Heat	Existing	Retro-Commissioning	0.18	85%	92%	3	\$0.27	15%
School	Space_Heat	Existing	Windows-High Efficiency	0.18	75%	75%	30	\$0.12	4%

Building Type	End Use	Vintage	Measure Name	Base Usage	Incomplete Factor	Technical Feasibility	Measure Life	Per Unit Cost	Energy Savings
School	Space_Heat	Existing	Wireless Performance Monitoring, Diagnostics and Control	0.18	100%	30%	10	\$0.50	10%
School	Space_Heat	New	Automated Ventilation VFD Control (Occupancy Sensors / CO2 Sensors)	0.18	95%	90%	15	\$0.28	10%
School	Space_Heat	New	Boiler Economizer	0.18	70%	40%	20	\$0.59	10%
School	Space_Heat	New	Exhaust Air to Ventilation Air Heat Recovery	0.18	85%	95%	20	\$0.93	15%
School	Space_Heat	New	Green Roof	0.18	100%	10%	40	\$15.00	13%
School	Space_Heat	New	High Efficiency Gas Furnace /Boiler	0.18			20	\$0.39	12%
School	Space_Heat	New	Leak Proof Duct Fittings	0.18	100%	40%	30	\$0.10	15%
School	Space_Heat	New	Retro-Commissioning	0.18	85%	92%	3	\$1.00	15%
School	Space_Heat	New	Windows-High Efficiency	0.18	75%	75%	30	\$0.04	4%
School	Space_Heat	New	Wireless Performance Monitoring, Diagnostics and Control	0.18	100%	30%	10	\$0.50	10%
School	Water_Heat	Existing	Condensing Water Heater	0.12	95%	45%	13	\$0.29	34%
School	Water_Heat	Existing	Demand controlled Circulating Systems	0.12	98%	60%	15	\$0.45	5%
School	Water_Heat	Existing	Faucet Aerators	0.12	20%	100%	10	\$0.01	3%
School	Water_Heat	Existing	High-Efficiency Water Heater	0.12			13	\$0.01	8%
School	Water_Heat	Existing	Hot Water (SHW) Pipe Insulation	0.12	9%	85%	15	\$0.01	2%
School	Water_Heat	Existing	Low Flow Spray Heads	0.12	30%	100%	5	\$0.00	1%
School	Water_Heat	Existing	Low-Flow Showerheads	0.12	25%	100%	10	\$0.02	2%
School	Water_Heat	Existing	Premium Efficiency Storage Water Heater	0.12			13	\$0.01	16%
School	Water_Heat	Existing	Solar Water Heater	0.12	95%	45%	15	\$1.93	40%
School	Water_Heat	Existing	Tankless Water Heater	0.12	95%	10%	15	\$0.16	27%
School	Water_Heat	Existing	Water Heater Temperature Setback	0.12	10%	100%	10	\$0.01	5%
School	Water_Heat	New	Condensing Water Heater	0.12	95%	45%	13	\$0.21	34%
School	Water_Heat	New	Demand controlled Circulating Systems	0.12	98%	60%	15	\$0.45	5%
School	Water_Heat	New	Faucet Aerators	0.12	20%	100%	10	\$0.01	3%
School	Water_Heat	New	High-Efficiency Water Heater	0.12			13	\$0.01	8%
School	Water_Heat	New	Hot Water (SHW) Pipe Insulation	0.12	9%	85%	15	\$0.01	2%
School	Water_Heat	New	Low Flow Spray Heads	0.12	30%	100%	5	\$0.00	1%
School	Water_Heat	New	Low-Flow Showerheads	0.12	25%	100%	10	\$0.02	2%
School	Water_Heat	New	Premium Efficiency Storage Water Heater	0.12			13	\$0.01	16%
School	Water_Heat	New	Solar Water Heater	0.12	95%	45%	15	\$1.93	40%
School	Water_Heat	New	Tankless Water Heater	0.12	95%	25%	15	\$0.16	27%
University	Cooking	Existing	Power Burner Fryer	0.02	90%	100%	15	\$0.06	4%
University	Cooking	Existing	Power Burner Oven	0.02	90%	100%	15	\$0.14	4%
University	Cooking	New	Power Burner Fryer	0.02	90%	100%	15	\$0.06	4%
University	Cooking	New	Power Burner Oven	0.02	90%	100%	15	\$0.14	4%
University	Pool_Heat	Existing	Installation of Solar Pool/Spa Heating Systems	0.10	98%	95%	10	\$0.20	16%
University	Pool_Heat	Existing	Installation of Swimming Pool / Spa Covers	0.10	25%	100%	5	\$0.02	35%
University	Pool_Heat	New	Installation of Solar Pool/Spa Heating Systems	0.04	98%	95%	10	\$0.20	16%
University	Pool_Heat	New	Installation of Swimming Pool / Spa Covers	0.04	25%	100%	5	\$0.01	35%
University	Space_Heat	Existing	Automated Ventilation VFD Control (Occupancy Sensors / CO2 Sensors)	0.26	95%	90%	15	\$0.28	10%
University	Space_Heat	Existing	Boiler Economizer	0.26	95%	40%	20	\$0.59	10%
University	Space_Heat	Existing	Boiler Tune-Up	0.26	45%	90%	3	\$0.02	2%
University	Space_Heat	Existing	Convert Constant Volume Air System to VAV	0.26	15%	80%	15	\$0.35	12%
University	Space_Heat	Existing	Duct Insulation	0.26	20%	65%	20	\$0.04	2%
University	Space_Heat	Existing	Duct Repair and Sealing	0.26	50%	65%	20	\$0.06	2%
University	Space_Heat	Existing	Exhaust Air to Ventilation Air Heat Recovery	0.26	95%	50%	20	\$1.00	20%
University	Space_Heat	Existing	High Efficiency Gas Furnace /Boiler	0.26			20	\$0.15	12%
University	Space_Heat	Existing	Insulation - Floor	0.26	40%	60%	20	\$0.30	5%
University	Space_Heat	Existing	Insulation - Roof / Ceiling	0.26	17%	75%	20	\$0.48	10%
University	Space_Heat	Existing	Programmable Thermostat	0.26	28%	100%	10	\$0.04	2%
University	Space_Heat	Existing	Retro-Commissioning	0.26	85%	92%	3	\$0.27	15%
University	Space_Heat	Existing	Windows-High Efficiency	0.26	75%	75%	30	\$0.32	4%
University	Space_Heat	Existing	Wireless Performance Monitoring, Diagnostics and Control	0.26	100%	30%	10	\$0.50	10%
University	Space_Heat	New	Automated Ventilation VFD Control (Occupancy Sensors / CO2 Sensors)	0.26	95%	90%	15	\$0.28	10%
University	Space_Heat	New	Boiler Economizer	0.26	95%	40%	20	\$0.59	10%

Building Type	End Use	Vintage	Measure Name	Base Usage	Incomplete Factor	Technical Feasibility	Measure Life	Per Unit Cost	Energy Savings
University	Space_Heat	New	Exhaust Air to Ventilation Air Heat Recovery	0.26	85%	95%	20	\$0.93	15%
University	Space_Heat	New	Green Roof	0.26	100%	10%	40	\$15.00	13%
University	Space_Heat	New	High Efficiency Gas Furnace /Boiler	0.26			20	\$0.15	12%
University	Space_Heat	New	Leak Proof Duct Fittings	0.26	100%	40%	30	\$0.11	15%
University	Space_Heat	New	Retro-Commisioning	0.26	85%	92%	3	\$1.00	15%
University	Space_Heat	New	Windows-High Efficiency	0.26	75%	75%	30	\$0.11	4%
University	Space_Heat	New	Wireless Performance Monitoring, Diagnostics and Control	0.26	100%	30%	10	\$0.50	10%
University	Water_Heat	Existing	Condensing Water Heater	0.27	95%	45%	13	\$0.64	34%
University	Water_Heat	Existing	Demand controlled Circulating Systems	0.27	98%	60%	15	\$0.31	5%
University	Water_Heat	Existing	Faucet Aerators	0.27	20%	100%	10	\$0.00	3%
University	Water_Heat	Existing	High-Efficiency Water Heater	0.27			13	\$0.01	8%
University	Water_Heat	Existing	Hot Water (SHW) Pipe Insulation	0.27	75%	85%	15	\$0.02	2%
University	Water_Heat	Existing	Low-Flow Showerheads	0.27	25%	100%	10	\$0.02	2%
University	Water_Heat	Existing	Premium Efficency Storage Water Heater	0.27			13	\$0.09	16%
University	Water_Heat	Existing	Solar Water Heater	0.27	95%	45%	15	\$3.42	40%
University	Water_Heat	Existing	Tankless Water Heater	0.27	95%	10%	15	\$0.29	27%
University	Water_Heat	Existing	Water Heater Temperature Setback	0.27	10%	100%	10	\$0.00	5%
University	Water_Heat	New	Condensing Water Heater	0.27	95%	45%	13	\$0.47	34%
University	Water_Heat	New	Demand controlled Circulating Systems	0.27	98%	60%	15	\$0.31	5%
University	Water_Heat	New	Faucet Aerators	0.27	20%	100%	10	\$0.00	3%
University	Water_Heat	New	High-Efficiency Water Heater	0.27			13	\$0.01	8%
University	Water_Heat	New	Hot Water (SHW) Pipe Insulation	0.27	75%	85%	15	\$0.02	2%
University	Water_Heat	New	Low-Flow Showerheads	0.27	25%	100%	10	\$0.02	2%
University	Water_Heat	New	Premium Efficency Storage Water Heater	0.27			13	\$0.09	16%
University	Water_Heat	New	Solar Water Heater	0.27	95%	45%	15	\$3.42	40%
University	Water_Heat	New	Tankless Water Heater	0.27	95%	25%	15	\$0.29	27%
Warehouse	Space_Heat	Existing	Automated Ventilation VFD Control (Occupancy Sensors / CO2 Sensors)	0.12	95%	90%	15	\$0.28	10%
Warehouse	Space_Heat	Existing	Boiler Economizer	0.12	95%	40%	20	\$0.59	10%
Warehouse	Space_Heat	Existing	Duct Insulation	0.12	20%	65%	20	\$0.05	2%
Warehouse	Space_Heat	Existing	Duct Repair and Sealing	0.12	50%	65%	20	\$0.05	2%
Warehouse	Space_Heat	Existing	High Efficiency Gas Furnace /Boiler	0.12			20	\$0.08	12%
Warehouse	Space_Heat	Existing	Insulation - Floor	0.12	50%	60%	20	\$0.45	5%
Warehouse	Space_Heat	Existing	Insulation - Roof / Ceiling	0.12	15%	75%	20	\$0.45	10%
Warehouse	Space_Heat	Existing	Programmable Thermostat	0.12	42%	100%	10	\$0.01	2%
Warehouse	Space_Heat	Existing	Retro-Commisioning	0.12	85%	92%	3	\$0.27	15%
Warehouse	Space_Heat	Existing	Windows-High Efficiency	0.12	75%	75%	30	\$0.09	1%
Warehouse	Space_Heat	New	Automated Ventilation VFD Control (Occupancy Sensors / CO2 Sensors)	0.12	95%	90%	15	\$0.28	10%
Warehouse	Space_Heat	New	Boiler Economizer	0.12	95%	40%	20	\$0.59	10%
Warehouse	Space_Heat	New	Green Roof	0.12	100%	10%	40	\$15.00	13%
Warehouse	Space_Heat	New	High Efficiency Gas Furnace /Boiler	0.12			20	\$0.08	12%
Warehouse	Space_Heat	New	Leak Proof Duct Fittings	0.12	100%	40%	30	\$0.16	15%
Warehouse	Space_Heat	New	Retro-Commisioning	0.12	85%	92%	3	\$1.00	15%
Warehouse	Space_Heat	New	Windows-High Efficiency	0.12	75%	75%	30	\$0.03	1%
Warehouse	Water_Heat	Existing	Condensing Water Heater	0.04	95%	45%	13	\$0.20	34%
Warehouse	Water_Heat	Existing	Demand controlled Circulating Systems	0.04	98%	60%	15	\$0.65	5%
Warehouse	Water_Heat	Existing	Faucet Aerators	0.04	20%	100%	10	\$0.00	3%
Warehouse	Water_Heat	Existing	High-Efficiency Water Heater	0.04			13	\$0.01	8%
Warehouse	Water_Heat	Existing	Hot Water (SHW) Pipe Insulation	0.04	92%	85%	15	\$0.00	2%
Warehouse	Water_Heat	Existing	Low-Flow Showerheads	0.04	25%	100%	10	\$0.01	3%
Warehouse	Water_Heat	Existing	Premium Efficency Storage Water Heater	0.04			13	\$0.02	16%
Warehouse	Water_Heat	Existing	Solar Water Heater	0.04	95%	45%	15	\$0.60	40%
Warehouse	Water_Heat	Existing	Tankless Water Heater	0.04	95%	25%	15	\$0.12	27%
Warehouse	Water_Heat	Existing	Water Heater Temperature Setback	0.04	40%	100%	10	\$0.01	5%
Warehouse	Water_Heat	New	Condensing Water Heater	0.04	95%	45%	13	\$0.15	34%
Warehouse	Water_Heat	New	Demand controlled Circulating Systems	0.04	98%	60%	15	\$0.65	5%

Building Type	End Use	Vintage	Measure Name	Base Usage	Incomplete Factor	Technical Feasibility	Measure Life	Per Unit Cost	Energy Savings
Warehouse	Water_Heat	New	Faucet Aerators	0.04	20%	100%	10	\$0.00	3%
Warehouse	Water_Heat	New	High-Efficiency Water Heater	0.04			13	\$0.01	8%
Warehouse	Water_Heat	New	Hot Water (SHW) Pipe Insulation	0.04	92%	85%	15	\$0.00	2%
Warehouse	Water_Heat	New	Low-Flow Showerheads	0.04	25%	100%	10	\$0.01	3%
Warehouse	Water_Heat	New	Premium Efficiency Storage Water Heater	0.04			13	\$0.02	16%
Warehouse	Water_Heat	New	Solar Water Heater	0.04	95%	45%	15	\$0.60	40%
Warehouse	Water_Heat	New	Tankless Water Heater	0.04	95%	55%	15	\$0.12	27%

**Table A-5. Industrial Electric Measures**

Building Type	End Use	Vintage	Measure Name	Base Usage	Measure Life	Per Unit Cost	Energy Savings
Chemical_Mfg	HVAC	Existing	HVAC Improvements	51,895	12	\$2,627	11%
Chemical_Mfg	Lighting	Existing	Lighting Improvements	38,275	10	\$1,856	19%
Chemical_Mfg	Process_Cool	Existing	Process Cooling Improvements	75,514	15	\$453	4%
Chemical_Mfg	Process_Motors_AirComp	Existing	Air Compressor Improvements	142,288	15	\$3,220	19%
Chemical_Mfg	Process_Motors_AirComp	Existing	Air Compressor O&M	142,288	2	\$640	15%
Chemical_Mfg	Process_Motors_Fans	Existing	Fan System Improvements	61,127	15	\$1,543	17%
Chemical_Mfg	Process_Motors_Other	Existing	Other Motor System Improvements	137,151	15	\$2,138	10%
Chemical_Mfg	Process_Motors_Pumps	Existing	Pump System Improvements	133,555	15	\$7,681	38%
Chemical_Mfg	Process_Motors_Refrig	Existing	Refrigeration Improvements	39,553	15	\$237	4%
Computer_Electronic_Mfg	HVAC	Existing	HVAC Improvements	109,535	12	\$5,545	11%
Computer_Electronic_Mfg	Lighting	Existing	Lighting Improvements	49,050	10	\$1,077	9%
Computer_Electronic_Mfg	Process_Cool	Existing	Process Cooling Improvements	34,423	15	\$413	8%
Computer_Electronic_Mfg	Process_Motors_AirComp	Existing	Air Compressor Improvements	4,017	15	\$65	13%
Computer_Electronic_Mfg	Process_Motors_AirComp	Existing	Air Compressor O&M	4,017	2	\$18	15%
Computer_Electronic_Mfg	Process_Motors_Fans	Existing	Fan System Improvements	17,290	15	\$295	11%
Computer_Electronic_Mfg	Process_Motors_Other	Existing	Other Motor System Improvements	34,231	15	\$294	6%
Computer_Electronic_Mfg	Process_Motors_Pumps	Existing	Pump System Improvements	27,420	15	\$1,357	33%
Computer_Electronic_Mfg	Process_Motors_Refrig	Existing	Refrigeration Improvements	4,366	15	\$52	8%
Electrical_Equipment_Mfg	HVAC	Existing	HVAC Improvements	50,597	12	\$2,561	11%
Electrical_Equipment_Mfg	Lighting	Existing	Lighting Improvements	38,326	10	\$2,044	21%
Electrical_Equipment_Mfg	Process_Cool	Existing	Process Cooling Improvements	13,081	15	\$157	8%
Electrical_Equipment_Mfg	Process_Motors_AirComp	Existing	Air Compressor Improvements	29,388	15	\$715	20%
Electrical_Equipment_Mfg	Process_Motors_AirComp	Existing	Air Compressor O&M	29,388	2	\$132	15%
Electrical_Equipment_Mfg	Process_Motors_Fans	Existing	Fan System Improvements	12,625	15	\$345	18%
Electrical_Equipment_Mfg	Process_Motors_Other	Existing	Other Motor System Improvements	28,327	15	\$534	13%
Electrical_Equipment_Mfg	Process_Motors_Pumps	Existing	Pump System Improvements	27,585	15	\$1,649	40%
Electrical_Equipment_Mfg	Process_Motors_Refrig	Existing	Refrigeration Improvements	8,169	15	\$98	8%
Fabricated_Metal_Products	HVAC	Existing	HVAC Improvements	53,821	12	\$2,725	11%
Fabricated_Metal_Products	Lighting	Existing	Lighting Improvements	50,175	10	\$1,282	10%
Fabricated_Metal_Products	Process_Cool	Existing	Process Cooling Improvements	18,419	15	\$111	4%
Fabricated_Metal_Products	Process_Motors_AirComp	Existing	Air Compressor Improvements	37,026	15	\$621	14%
Fabricated_Metal_Products	Process_Motors_AirComp	Existing	Air Compressor O&M	37,026	2	\$167	15%
Fabricated_Metal_Products	Process_Motors_Fans	Existing	Fan System Improvements	32,105	15	\$576	12%
Fabricated_Metal_Products	Process_Motors_Other	Existing	Other Motor System Improvements	91,393	15	\$864	6%
Fabricated_Metal_Products	Process_Motors_Pumps	Existing	Pump System Improvements	58,116	15	\$2,926	34%
Fabricated_Metal_Products	Process_Motors_Refrig	Existing	Refrigeration Improvements	15,701	15	\$94	4%
Food_Mfg	HVAC	Existing	HVAC Improvements	41,726	12	\$2,112	11%
Food_Mfg	Lighting	Existing	Lighting Improvements	39,978	10	\$2,434	24%
Food_Mfg	Process_Cool	Existing	Process Cooling Improvements	150,716	15	\$5,426	24%
Food_Mfg	Process_Motors_AirComp	Existing	Air Compressor Improvements	23,268	15	\$612	22%
Food_Mfg	Process_Motors_AirComp	Existing	Air Compressor O&M	23,268	2	\$105	15%
Food_Mfg	Process_Motors_Fans	Existing	Fan System Improvements	22,664	15	\$676	20%
Food_Mfg	Process_Motors_Other	Existing	Other Motor System Improvements	117,853	15	\$2,230	13%
Food_Mfg	Process_Motors_Pumps	Existing	Pump System Improvements	49,559	15	\$3,118	42%
Food_Mfg	Process_Motors_Refrig	Existing	Refrigeration Improvements	88,843	15	\$3,198	24%

Building Type	End Use	Vintage	Measure Name	Base Usage	Measure Life	Per Unit Cost	Energy Savings
Industrial_Machinery	HVAC	Existing	HVAC Improvements	32,702	12	\$1,656	11%
Industrial_Machinery	Lighting	Existing	Lighting Improvements	24,329	10	\$1,160	19%
Industrial_Machinery	Process_Cool	Existing	Process Cooling Improvements	5,793	15	\$35	4%
Industrial_Machinery	Process_Motors_AirComp	Existing	Air Compressor Improvements	13,596	15	\$313	19%
Industrial_Machinery	Process_Motors_AirComp	Existing	Air Compressor O&M	13,596	2	\$61	15%
Industrial_Machinery	Process_Motors_Fans	Existing	Fan System Improvements	11,789	15	\$304	17%
Industrial_Machinery	Process_Motors_Other	Existing	Other Motor System Improvements	33,561	15	\$580	12%
Industrial_Machinery	Process_Motors_Pumps	Existing	Pump System Improvements	21,341	15	\$1,242	39%
Industrial_Machinery	Process_Motors_Refrig	Existing	Refrigeration Improvements	5,766	15	\$35	4%
Miscellaneous_Mfg	HVAC	Existing	HVAC Improvements	28,093	12	\$1,422	11%
Miscellaneous_Mfg	Lighting	Existing	Lighting Improvements	20,135	10	\$113	2%
Miscellaneous_Mfg	Process_Cool	Existing	Process Cooling Improvements	8,252	15	\$25	2%
Miscellaneous_Mfg	Process_Motors_AirComp	Existing	Air Compressor Improvements	7,184	15	\$89	10%
Miscellaneous_Mfg	Process_Motors_AirComp	Existing	Air Compressor O&M	7,184	2	\$15	7%
Miscellaneous_Mfg	Process_Motors_Fans	Existing	Fan System Improvements	7,686	15	\$95	8%
Miscellaneous_Mfg	Process_Motors_Other	Existing	Other Motor System Improvements	30,946	15	\$121	3%
Miscellaneous_Mfg	Process_Motors_Pumps	Existing	Pump System Improvements	4,371	15	\$196	30%
Miscellaneous_Mfg	Process_Motors_Refrig	Existing	Refrigeration Improvements	50	15	\$0	2%
Nonmetallic_Mineral_Products	HVAC	Existing	HVAC Improvements	33,828	12	\$1,713	11%
Nonmetallic_Mineral_Products	Lighting	Existing	Lighting Improvements	26,273	10	\$2,032	31%
Nonmetallic_Mineral_Products	Process_Cool	Existing	Process Cooling Improvements	18,848	15	\$113	4%
Nonmetallic_Mineral_Products	Process_Motors_AirComp	Existing	Air Compressor Improvements	51,147	15	\$1,207	20%
Nonmetallic_Mineral_Products	Process_Motors_AirComp	Existing	Air Compressor O&M	51,147	2	\$230	15%
Nonmetallic_Mineral_Products	Process_Motors_Fans	Existing	Fan System Improvements	44,349	15	\$1,173	18%
Nonmetallic_Mineral_Products	Process_Motors_Other	Existing	Other Motor System Improvements	126,248	15	\$2,269	12%
Nonmetallic_Mineral_Products	Process_Motors_Pumps	Existing	Pump System Improvements	80,281	15	\$4,727	39%
Nonmetallic_Mineral_Products	Process_Motors_Refrig	Existing	Refrigeration Improvements	21,689	15	\$130	4%
Paper_Mfg	HVAC	Existing	HVAC Improvements	34,710	12	\$1,757	11%
Paper_Mfg	Lighting	Existing	Lighting Improvements	33,625	10	\$711	8%
Paper_Mfg	Process_Cool	Existing	Process Cooling Improvements	12,778	15	\$77	4%
Paper_Mfg	Process_Motors_AirComp	Existing	Air Compressor Improvements	31,733	15	\$736	19%
Paper_Mfg	Process_Motors_AirComp	Existing	Air Compressor O&M	31,733	2	\$143	15%
Paper_Mfg	Process_Motors_Fans	Existing	Fan System Improvements	136,592	15	\$3,546	17%
Paper_Mfg	Process_Motors_Other	Existing	Other Motor System Improvements	270,424	15	\$4,725	12%
Paper_Mfg	Process_Motors_Pumps	Existing	Pump System Improvements	216,615	15	\$12,645	39%
Paper_Mfg	Process_Motors_Refrig	Existing	Refrigeration Improvements	34,493	15	\$207	4%
Petroleum_Coal_Products	HVAC	Existing	HVAC Improvements	9,623	12	\$487	11%
Petroleum_Coal_Products	Lighting	Existing	Lighting Improvements	7,384	10	\$235	13%
Petroleum_Coal_Products	Process_Cool	Existing	Process Cooling Improvements	16,723	15	\$100	4%
Petroleum_Coal_Products	Process_Motors_AirComp	Existing	Air Compressor Improvements	38,195	15	\$573	13%
Petroleum_Coal_Products	Process_Motors_AirComp	Existing	Air Compressor O&M	38,195	2	\$172	15%
Petroleum_Coal_Products	Process_Motors_Fans	Existing	Fan System Improvements	33,119	15	\$700	14%
Petroleum_Coal_Products	Process_Motors_Other	Existing	Other Motor System Improvements	94,279	15	\$1,179	8%
Petroleum_Coal_Products	Process_Motors_Pumps	Existing	Pump System Improvements	59,952	15	\$2,776	31%
Petroleum_Coal_Products	Process_Motors_Refrig	Existing	Refrigeration Improvements	16,197	15	\$97	4%
Plastics_Rubber_Products	HVAC	Existing	HVAC Improvements	99,399	12	\$5,032	11%
Plastics_Rubber_Products	Lighting	Existing	Lighting Improvements	81,323	10	\$2,766	14%

Building Type	End Use	Vintage	Measure Name	Base Usage	Measure Life	Per Unit Cost	Energy Savings
Plastics_Rubber_Products	Process_Cool	Existing	Process Cooling Improvements	82,726	15	\$993	8%
Plastics_Rubber_Products	Process_Motors_AirComp	Existing	Air Compressor Improvements	85,143	15	\$1,802	18%
Plastics_Rubber_Products	Process_Motors_AirComp	Existing	Air Compressor O&M	85,143	2	\$383	15%
Plastics_Rubber_Products	Process_Motors_Fans	Existing	Fan System Improvements	73,826	15	\$1,729	16%
Plastics_Rubber_Products	Process_Motors_Other	Existing	Other Motor System Improvements	210,163	15	\$3,138	10%
Plastics_Rubber_Products	Process_Motors_Pumps	Existing	Pump System Improvements	133,642	15	\$7,462	37%
Plastics_Rubber_Products	Process_Motors_Refrig	Existing	Refrigeration Improvements	36,105	15	\$433	8%
Primary_Metal_Mfg	HVAC	Existing	HVAC Improvements	3,412	12	\$173	11%
Primary_Metal_Mfg	Lighting	Existing	Lighting Improvements	2,734	10	\$82	12%
Primary_Metal_Mfg	Process_Cool	Existing	Process Cooling Improvements	761	15	\$5	4%
Primary_Metal_Mfg	Process_Motors_AirComp	Existing	Air Compressor Improvements	4,272	15	\$185	36%
Primary_Metal_Mfg	Process_Motors_AirComp	Existing	Air Compressor O&M	4,272	2	\$19	15%
Primary_Metal_Mfg	Process_Motors_Fans	Existing	Fan System Improvements	4,571	15	\$185	27%
Primary_Metal_Mfg	Process_Motors_Other	Existing	Other Motor System Improvements	18,404	15	\$528	19%
Primary_Metal_Mfg	Process_Motors_Pumps	Existing	Pump System Improvements	2,599	15	\$223	57%
Primary_Metal_Mfg	Process_Motors_Refrig	Existing	Refrigeration Improvements	30	15	\$0	4%
Printing_Related_Support	HVAC	Existing	HVAC Improvements	22,793	12	\$1,154	11%
Printing_Related_Support	Lighting	Existing	Lighting Improvements	14,257	10	\$201	6%
Printing_Related_Support	Process_Cool	Existing	Process Cooling Improvements	5,617	15	\$101	12%
Printing_Related_Support	Process_Motors_AirComp	Existing	Air Compressor Improvements	9,831	15	\$151	13%
Printing_Related_Support	Process_Motors_AirComp	Existing	Air Compressor O&M	9,831	2	\$44	15%
Printing_Related_Support	Process_Motors_Fans	Existing	Fan System Improvements	8,524	15	\$137	11%
Printing_Related_Support	Process_Motors_Other	Existing	Other Motor System Improvements	24,267	15	\$185	5%
Printing_Related_Support	Process_Motors_Pumps	Existing	Pump System Improvements	15,431	15	\$749	32%
Printing_Related_Support	Process_Motors_Refrig	Existing	Refrigeration Improvements	4,169	15	\$75	12%
Transportation_Equipment_Mfg	HVAC	Existing	HVAC Improvements	82,120	12	\$4,157	11%
Transportation_Equipment_Mfg	Lighting	Existing	Lighting Improvements	64,293	10	\$1,685	10%
Transportation_Equipment_Mfg	Process_Cool	Existing	Process Cooling Improvements	19,412	15	\$116	4%
Transportation_Equipment_Mfg	Process_Motors_AirComp	Existing	Air Compressor Improvements	51,771	15	\$912	15%
Transportation_Equipment_Mfg	Process_Motors_AirComp	Existing	Air Compressor O&M	51,771	2	\$233	15%
Transportation_Equipment_Mfg	Process_Motors_Fans	Existing	Fan System Improvements	22,241	15	\$422	13%
Transportation_Equipment_Mfg	Process_Motors_Other	Existing	Other Motor System Improvements	49,902	15	\$524	7%
Transportation_Equipment_Mfg	Process_Motors_Pumps	Existing	Pump System Improvements	48,594	15	\$2,498	34%
Transportation_Equipment_Mfg	Process_Motors_Refrig	Existing	Refrigeration Improvements	14,391	15	\$86	4%
Wood_Product_Mfg	HVAC	Existing	HVAC Improvements	22,023	12	\$1,115	11%
Wood_Product_Mfg	Lighting	Existing	Lighting Improvements	23,312	10	\$243	4%
Wood_Product_Mfg	Process_Cool	Existing	Process Cooling Improvements	2,059	15	\$12	4%
Wood_Product_Mfg	Process_Motors_AirComp	Existing	Air Compressor Improvements	37,071	15	\$1,247	28%
Wood_Product_Mfg	Process_Motors_AirComp	Existing	Air Compressor O&M	37,071	2	\$167	15%
Wood_Product_Mfg	Process_Motors_Fans	Existing	Fan System Improvements	32,144	15	\$890	18%
Wood_Product_Mfg	Process_Motors_Other	Existing	Other Motor System Improvements	91,505	15	\$1,541	11%
Wood_Product_Mfg	Process_Motors_Pumps	Existing	Pump System Improvements	58,188	15	\$4,319	49%
Wood_Product_Mfg	Process_Motors_Refrig	Existing	Refrigeration Improvements	15,720	15	\$94	4%

**Table A-6. Industrial Gas Measures**

Building Type	End Use	Vintage	Measure Name	Base Usage	Measure Life	Per Unit Cost	Energy Savings
Chemical_Mfg	HVAC	Existing	HVAC Improvements	56	12	\$35	11%
Chemical_Mfg	Process_Boiler	Existing	Process Boiler O&M	1,581	2	\$31	5%
Chemical_Mfg	Process_Boiler	Existing	Process Boiler Upgrades	1,581	15	\$173	7%
Chemical_Mfg	Process_Boiler	Existing	Steam Distribution Systems	1,581	15	\$277	14%
Computer_Electronic_Mfg	HVAC	Existing	HVAC Improvements	169	12	\$104	11%
Computer_Electronic_Mfg	Process_Boiler	Existing	Process Boiler O&M	220	2	\$4	5%
Computer_Electronic_Mfg	Process_Boiler	Existing	Process Boiler Upgrades	220	15	\$24	7%
Computer_Electronic_Mfg	Process_Boiler	Existing	Steam Distribution Systems	220	15	\$39	14%
Electrical_Equipment_Mfg	HVAC	Existing	HVAC Improvements	118	12	\$73	11%
Electrical_Equipment_Mfg	Process_Boiler	Existing	Process Boiler O&M	47	2	\$1	5%
Electrical_Equipment_Mfg	Process_Boiler	Existing	Process Boiler Upgrades	47	15	\$5	7%
Electrical_Equipment_Mfg	Process_Boiler	Existing	Steam Distribution Systems	47	15	\$8	14%
Fabricated_Metal_Products	HVAC	Existing	HVAC Improvements	371	12	\$228	11%
Fabricated_Metal_Products	Process_Boiler	Existing	Process Boiler O&M	282	2	\$5	5%
Fabricated_Metal_Products	Process_Boiler	Existing	Process Boiler Upgrades	282	15	\$31	7%
Fabricated_Metal_Products	Process_Boiler	Existing	Steam Distribution Systems	282	15	\$49	14%
Food_Mfg	HVAC	Existing	HVAC Improvements	271	12	\$167	11%
Food_Mfg	Process_Boiler	Existing	Process Boiler O&M	2,014	2	\$39	5%
Food_Mfg	Process_Boiler	Existing	Process Boiler Upgrades	2,014	15	\$220	7%
Food_Mfg	Process_Boiler	Existing	Steam Distribution Systems	2,014	15	\$353	14%
Industrial_Machinery	HVAC	Existing	HVAC Improvements	327	12	\$201	11%
Industrial_Machinery	Process_Boiler	Existing	Process Boiler O&M	158	2	\$3	5%
Industrial_Machinery	Process_Boiler	Existing	Process Boiler Upgrades	158	15	\$17	7%
Industrial_Machinery	Process_Boiler	Existing	Steam Distribution Systems	158	15	\$28	14%
Miscellaneous_Mfg	HVAC	Existing	HVAC Improvements	224	12	\$138	11%
Miscellaneous_Mfg	Process_Boiler	Existing	Process Boiler O&M	201	2	\$4	5%
Miscellaneous_Mfg	Process_Boiler	Existing	Process Boiler Upgrades	201	15	\$22	7%
Miscellaneous_Mfg	Process_Boiler	Existing	Steam Distribution Systems	201	15	\$35	14%
Nonmetallic_Mineral_Products	HVAC	Existing	HVAC Improvements	156	12	\$96	11%
Nonmetallic_Mineral_Products	Process_Boiler	Existing	Process Boiler O&M	94	2	\$2	5%
Nonmetallic_Mineral_Products	Process_Boiler	Existing	Process Boiler Upgrades	94	15	\$10	7%
Nonmetallic_Mineral_Products	Process_Boiler	Existing	Steam Distribution Systems	94	15	\$16	14%
Paper_Mfg	HVAC	Existing	HVAC Improvements	183	12	\$113	11%
Paper_Mfg	Process_Boiler	Existing	Process Boiler O&M	2,868	2	\$56	5%
Paper_Mfg	Process_Boiler	Existing	Process Boiler Upgrades	2,868	15	\$314	7%
Paper_Mfg	Process_Boiler	Existing	Steam Distribution Systems	2,868	15	\$503	14%
Petroleum_Coal_Products	HVAC	Existing	HVAC Improvements	39	12	\$24	11%
Petroleum_Coal_Products	Process_Boiler	Existing	Process Boiler O&M	1,556	2	\$30	5%
Petroleum_Coal_Products	Process_Boiler	Existing	Process Boiler Upgrades	1,556	15	\$170	7%
Petroleum_Coal_Products	Process_Boiler	Existing	Steam Distribution Systems	1,556	15	\$273	14%
Plastics_Rubber_Products	HVAC	Existing	HVAC Improvements	950	12	\$586	11%
Plastics_Rubber_Products	Process_Boiler	Existing	Process Boiler O&M	1,901	2	\$37	5%
Plastics_Rubber_Products	Process_Boiler	Existing	Process Boiler Upgrades	1,901	15	\$208	7%
Plastics_Rubber_Products	Process_Boiler	Existing	Steam Distribution Systems	1,901	15	\$333	14%
Primary_Metal_Mfg	HVAC	Existing	HVAC Improvements	169	12	\$104	11%



Building Type	End Use	Vintage	Measure Name	Base Usage	Measure Life	Per Unit Cost	Energy Savings
Primary_Metal_Mfg	Process_Boiler	Existing	Process Boiler O&M	272	2	\$5	5%
Primary_Metal_Mfg	Process_Boiler	Existing	Process Boiler Upgrades	272	15	\$30	7%
Primary_Metal_Mfg	Process_Boiler	Existing	Steam Distribution Systems	272	15	\$48	14%
Printing_Related_Support	HVAC	Existing	HVAC Improvements	127	12	\$78	11%
Printing_Related_Support	Process_Boiler	Existing	Process Boiler O&M	76	2	\$1	5%
Printing_Related_Support	Process_Boiler	Existing	Process Boiler Upgrades	76	15	\$8	7%
Printing_Related_Support	Process_Boiler	Existing	Steam Distribution Systems	76	15	\$13	14%
Transportation_Equipment_Mfg	HVAC	Existing	HVAC Improvements	360	12	\$222	11%
Transportation_Equipment_Mfg	Process_Boiler	Existing	Process Boiler O&M	295	2	\$6	5%
Transportation_Equipment_Mfg	Process_Boiler	Existing	Process Boiler Upgrades	295	15	\$32	7%
Transportation_Equipment_Mfg	Process_Boiler	Existing	Steam Distribution Systems	295	15	\$52	14%
Wood_Product_Mfg	HVAC	Existing	HVAC Improvements	157	12	\$97	11%
Wood_Product_Mfg	Process_Boiler	Existing	Process Boiler O&M	336	2	\$7	5%
Wood_Product_Mfg	Process_Boiler	Existing	Process Boiler Upgrades	336	15	\$37	7%
Wood_Product_Mfg	Process_Boiler	Existing	Steam Distribution Systems	336	15	\$59	14%

## **Appendix C: Fuel Conversion: Inputs and Assumptions**

---

Appendix C follows.

**Table C-1. Residential Fuel Conversion Measures--Single Family**

End Use	Gas Measure	Electric Baseline	Electricity Use Data					Measure Life
			kWh/yr.	W/ T&D Savings	kBtu/yr.	AnnualCost	Equip Cost	
Space Heating	Standard Furnace, 80 AFUE, 60 kBtu	Electric Furnace	8,008	8,583	27,331	\$649	\$1,400	18
	Condensing Furnace, 90 AFUE		8,008	8,583	27,331	\$649	\$1,400	18
	Condensing Furnace, 96 AFUE		8,008	8,583	27,331	\$649	\$1,400	18
Zone Heating	Wall heater 84% eff	Elec baseboard	4,004	4,292	13,666	\$324	\$500	15
Water Heating	Storage Water Heater, 50 gal., EF=.59	Electric Water Heater, 50 gal.	3,510	3,762	11,980	\$230	\$190	13
	Storage Water Heater, 50 gal., EF=.64		3,510	3,762	11,980	\$230	\$190	13
	Tankless water heater EF=0.82		3,510	3,762	11,980	\$230	\$190	13
Appliances	Gas Dryer, 6.5 cuft	Electric Dryer, 6.5 cuft	1,275	1,367	4,352	\$103	\$300	14
	Gas Dryer w/ Moisture Sens., 7.0 cuft	Electric dryer w/ moisture sens, 7.0cuft	1,084	1,162	3,699	\$88	\$450	14
	Standard Gas Range, Free-Standing, 30"	Electric Range, 30"	890	954	3,038	\$72	\$330	18
	Convection Gas Range, Free-Standing, 30"	Convection Electric range, 30"	712	763	2,430	\$58	\$1,050	18

End Use	Gas Measure	Electric Baseline	Gas Conversion Data							Measure Life	
			Therms/yr.	w/T&D savings	kBtu/yr.	AnnualCost	Equip Cost	Piping & Labor	Installed Cost w/ labor		Installed Cost Main Ext
Space Heating	Standard Furnace, 80 AFUE, 60 kBtu	Electric Furnace	625	630	62,465	\$775	\$2,000	\$700	\$2,700	\$2,700	18
	Condensing Furnace, 90 AFUE		555	560	55,525	\$689	\$2,300	\$700	\$3,000	\$3,000	18
	Condensing Furnace, 96 AFUE		521	525	52,055	\$645	\$2,650	\$700	\$3,350	\$3,350	18
Zone Heating	Wall heater 84% eff	Elec baseboard	297	300	29,745	\$369	\$1,500	\$500	\$2,000		15
Water Heating	Storage Water Heater, 50 gal., EF=.59	Electric Water Heater, 50 gal.	203	205	20,287	\$252	\$430	\$0	\$430		13
	Storage Water Heater, 50 gal., EF=.64		187	189	18,702	\$232	\$450	\$0	\$450		13
	Tankless water heater EF=0.82		146	147	14,596	\$181	\$800	\$0	\$800		13
Appliances	Gas Dryer, 6.5 cuft	Electric Dryer, 6.5 cuft	49	49	4,901	\$61	\$360	\$0	\$360		14
	Gas Dryer w/ Moisture Sens., 7.0 cuft	Electric dryer w/ moisture sens, 7.0cuft	42	42	4,166	\$52	\$510	\$0	\$510		14
	Standard Gas Range, Free-Standing, 30"	Electric Range, 30"	50	50	4,999	\$62	\$330	\$0	\$330		18
	Convection Gas Range, Free-Standing, 30"	Convection Electric range, 30"	40	40	3,999	\$50	\$1,150	\$0	\$1,150		18

**NOTES:**

Cost of electricity is \$.08/kWh; cost of gas is \$1.24/therm;

T&D Savings is 6.7% for electric, 0.8% for gas;

Admin. adder is 15%;

Discount rate is 8.4%;

Service line cost is \$0 (no charge) for a 1600 square foot home (S&WH);

Main Extension Cost is \$2,000 for a 50' extension for a 2000 square foot home (S&WH);

In-house fuel line cost is \$200;

Source for Electricity Use Data is 2001 Electric End Use Model;

Labor is included for Space/Zone Heating .

**Table C-2. Technical Potential**

End Use	Number of Customers			
	PSE Gas	Svc Line Only	Main Ext.	Total
All	293,331	18,523	17,597	329,451
Space Heat	0	4,013	3,813	7,826
Water Heat	42,017	18,523	17,597	78,137
Dryer	246,266	18,523	17,597	282,386
Range	202,026	18,523	17,597	238,146
Zone Heat	9,945	0	0	9,945

End Use	Electric Savings (kWh/yr.)			
	PSE Gas	Svc Line Only	Main Ext.	Total (aMW)
Space Heat	0	34,448,097	32,725,971	7.7
Water Heat	158,069,379	69,684,598	66,200,932	33.6
Dryer	286,056,615	21,515,864	20,440,245	37.4
Range	154,171,931	14,135,451	13,428,793	20.7
Zone Heat	42,679,293	0	0	4.9

Total (kWh/yr.)	913,557,171
Total (aMW)	104.3

End Use	Gas Usage--90 AFUE Furnace, 0.64 EF Water Heater (therms/yr.)			
	PSE Gas	Svc Line Only	Main Ext.	Total (Dth)
Space Heat	0	2,246,457	2,134,153	438,061
Water Heat	7,921,221	3,492,056	3,317,481	1,473,076
Dryer	10,342,644	777,926	739,036	1,185,961
Range	8,144,019	746,695	709,366	960,008
Zone Heat	2,982,039	0	0	298,204

Total (therms/yr.)	43,553,094
Total (Dth/yr.)	4,355,309

End Use	Gas Usage--96 AFUE Furnace, 0.82 EF Water Heater (therms/yr.)			
	PSE Gas	Svc Line Only	Main Ext.	Total (Dth)
Space Heat	0	2,106,054	2,000,768	410,682
Water Heat	6,182,416	2,725,507	2,589,254	1,149,718
Dryer	10,342,644	777,926	739,036	1,185,961
Range	8,144,019	746,695	709,366	960,008
Zone Heat	2,982,039	0	0	298,204

Total (therms/yr.)	40,045,724
Total (Dth/yr.)	4,004,572

**Table C-3. Economic Screen: Base Case Avoided Costs and Service Line**

End Use	Gas Measure	NPV Avoided Cost (2008 Base Year)		Service Line Extension						
		Elec Avoided Cost (\$/kWh)	Gas Avoided Cost (\$/therm)	First Yr. Cost (\$)	First Yr. Cost + Admin (\$)	Elec. Benefit (\$)	Elec.--Gas Benefit (\$)	Benefit/Cost	Benefit/Cost w/Admin.	
Space Heating	Standard Furnace, 80 AFUE, 60 kBtu	\$0.85	\$9.0	\$ 1,300	\$ 1,495	\$ 7,514	\$ 1,878	1.4	1.3	
	Condensing Furnace, 90 AFUE	\$0.85	\$9.0	\$ 1,600	\$ 1,840	\$ 7,514	\$ 2,504	1.6	1.4	
	Condensing Furnace, 96 AFUE	\$0.85	\$9.0	\$ 1,950	\$ 2,243	\$ 7,514	\$ 2,817	1.4	1.3	
Zone Heating	Wall heater 84% eff	\$0.76	\$8.1	\$ 1,500	\$ 1,725	\$ 3,375	\$ 957	0.6	0.6	
Water Heating	Storage Water Heater, 50 gal., EF=.59	\$0.70	\$7.0	\$ 440	\$ 506	\$ 2,700	\$ 1,271	2.9	2.5	
	Storage Water Heater, 50 gal., EF=.64	\$0.70	\$7.0	\$ 460	\$ 529	\$ 2,700	\$ 1,383	3.0	2.6	
	Tankless water heater EF=0.82	\$0.70	\$7.0	\$ 810	\$ 932	\$ 2,700	\$ 1,672	2.1	1.8	
Appliances	Gas Dryer, 6.5 cuft	\$0.75	\$7.3	\$ 260	\$ 299	\$ 1,083	\$ 721	2.8	2.4	
	Gas Dryer w/ Moisture Sens., 7.0 cuft	\$0.75	\$7.3	\$ 260	\$ 299	\$ 920	\$ 613	2.4	2.1	
	Standard Gas Range, Free-Standing, 30"	\$0.89	\$8.5	\$ 200	\$ 230	\$ 868	\$ 439	2.2	1.9	
	Convection Gas Range, Free-Standing, 30"	\$0.89	\$8.5	\$ 300	\$ 345	\$ 694	\$ 351	1.2	1.0	
<b>Bundles</b>										
Space + Water Heat	90 AFUE + 0.64			\$ 2,060	\$ 2,369	\$ 10,214	\$ 3,887	1.9	1.6	
Space + Dryer	90 AFUE + ms			\$ 1,860	\$ 2,139	\$ 8,435	\$ 3,117	1.7	1.5	
Space + Range	90 AFUE + conv			\$ 1,900	\$ 2,185	\$ 8,208	\$ 2,856	1.5	1.3	
Space + H2O + Dryer	90 AFUE + 0.64 + ms			\$ 2,320	\$ 2,668	\$ 11,134	\$ 4,500	1.9	1.7	
Space + H2O + Range	90 AFUE + 0.64 + conv			\$ 2,360	\$ 2,714	\$ 10,908	\$ 4,239	1.8	1.6	
Space + Dryer + Range	90 AFUE + ms + conv			\$ 2,160	\$ 2,484	\$ 9,129	\$ 3,469	1.6	1.4	
All	90 + 0.64 + ms + conv			\$ 2,620	\$ 3,013	\$ 11,829	\$ 4,852	1.9	1.6	
H2O + Dryer	0.64 + ms			\$ 720	\$ 828	\$ 3,620	\$ 1,996	2.8	2.4	
H2O + Range	0.64 + conv			\$ 760	\$ 874	\$ 3,394	\$ 1,734	2.3	2.0	
H2O + Dryer + Range	0.64+ ms+ conv			\$ 1,020	\$ 1,173	\$ 4,315	\$ 2,348	2.3	2.0	
Zone + water heat	84% + 0.64			\$ 1,960	\$ 2,254	\$ 6,075	\$ 2,340	1.2	1.0	
zone + water + dryer	84 % + 0.64 + ms			\$ 2,220	\$ 2,553	\$ 6,995	\$ 2,953	1.3	1.2	
zone + water + range	84% + 0.64 + conv			\$ 2,260	\$ 2,599	\$ 6,769	\$ 2,691	1.2	1.0	
zone + water + dryer + range	84% + 0.64 + ms+ conv			\$ 2,520	\$ 2,898	\$ 7,689	\$ 3,304	1.3	1.1	
<b>w/ tankless H2O &amp; 96 AFUE</b>										
Space + Water Heat	96 + 0.82			\$ 2,760	\$ 3,174	\$ 10,214	\$ 4,489	1.6	1.4	
Space + H2O + Dryer	96 + 0.82 + ms			\$ 3,020	\$ 3,473	\$ 11,134	\$ 5,102	1.7	1.5	
Space + H2O + Range	96 + 0.82 + conv			\$ 3,060	\$ 3,519	\$ 10,908	\$ 4,841	1.6	1.4	
All	96 + 0.82 + ms + conv			\$ 3,320	\$ 3,818	\$ 11,829	\$ 5,454	1.6	1.4	
H2O + Dryer	0.82 + ms			\$ 1,070	\$ 1,231	\$ 3,620	\$ 2,285	2.1	1.9	
H2O + Range	0.82 + conv			\$ 1,110	\$ 1,277	\$ 3,394	\$ 2,024	1.8	1.6	
H2O + Dryer + Range	0.82 + ms + conv			\$ 1,370	\$ 1,576	\$ 4,315	\$ 2,637	1.9	1.7	

**Table C-4. Economic Screen: Base Case Main Extension**

End Use	Gas Measure	Main Extension				
		First Yr. Cost (\$)	First Yr. Cost + Admin (\$)	Elec.--Gas Benefit (\$)	Benefit/ Cost	Benefit/Cost w/Admin.
Space Heating	Standard Furnace, 80 AFUE, 60 kBtu	\$ 3,300	\$ 3,795	\$ 1,878	0.6	0.5
	Condensing Furnace, 90 AFUE	\$ 3,600	\$ 4,140	\$ 2,504	0.7	0.6
	Condensing Furnace, 96 AFUE	\$ 3,950	\$ 4,543	\$ 2,817	0.7	0.6
<b>Using 90 AFUE Furnace Bundles</b>						
	Space + Water Heat	\$ 4,060	\$ 4,669	\$ 5,204	1.3	1.1
	Space + Dryer	\$ 3,860	\$ 4,439	\$ 3,117	0.8	0.7
	Space + Range	\$ 3,900	\$ 4,485	\$ 3,198	0.8	0.7
	Space + H2O + Dryer	\$ 4,320	\$ 4,968	\$ 6,124	1.4	1.2
	Space + H2O + Range	\$ 4,360	\$ 5,014	\$ 5,898	1.4	1.2
	Space + Dryer + Range	\$ 4,160	\$ 4,784	\$ 4,119	1.0	0.9
	All	\$ 4,620	\$ 5,313	\$ 6,819	1.5	1.3
<b>Using 96 AFUE Furnace Bundles</b>						
	Space + Water Heat	\$ 4,760	\$ 5,474	\$ 5,517	1.2	1.0
	Space + Dryer	\$ 4,210	\$ 4,842	\$ 3,738	0.9	0.8
	Space + Range	\$ 4,250	\$ 4,888	\$ 3,512	0.8	0.7
	Space + H2O + Dryer	\$ 5,020	\$ 5,773	\$ 6,438	1.3	1.1
	Space + H2O + Range	\$ 4,510	\$ 5,187	\$ 4,432	1.0	0.9
	Space + Dryer + Range	\$ 5,320	\$ 6,118	\$ 7,132	1.3	1.2
	All	\$ 4,520	\$ 5,198	\$ 7,155	1.6	1.4

**Table C-5. Economic Customer Count: Base Case**

End Use	% Bundle Adoption	Measures	Number of Customers			
			PSE Gas	Svc Line Only	Main Ext.	Total
Space Heat + Additional End Uses	5%	space heat	0	4013	0	4013
	80%	space + water	0	4013	3813	7826
	5%	space + water + dryer	0	4013	3813	7826
	5%	space + water + range	0	4013	3813	7826
	5%	All	0	4013	3813	7826
Zone Heat + Additional End Uses	5%	zone heat	0	0	0	0
	80%	zone + water	9945	0	0	9945
	5%	zone + water + dryer	9945	0	0	9945
	5%	zone + water + range	9945	0	0	9945
	5%	zone + all	9945	0	0	9945
Water Heat + Additional End Uses	3%	water + dryer	42017			42017
	3%	water + range	42017			42017
	85%	water only	42017			42017
	10%	water + dryer + range	42017			42017

**Table C-6. Economic Potential: Base Case**

Measures	Number of Customers			Measures	Electric Savings (kWh/yr.)		
	PSE Gas	Svc Line Only	Main Ext.		PSE Gas	Svc Line Only	Main Ext.
space heat		201	0	space heat		1,722,405	0
space + water		3211	3050	space + water		39,637,681	37,656,118
space + water + dryer		201	191	space + water + dryer		2,710,454	2,574,953
space + water + range		201	191	space + water + range		2,630,496	2,498,992
All		201	191	All		2,863,595	2,720,438
zone heat	0			zone heat	0		
zone + water	7956			zone + water	64,074,367		
zone + water + dryer	497			zone + water + dryer	4,582,241		
zone + water + range	497			zone + water + range	4,384,114		
zone + all	497			zone + all	4,961,708		
water + dryer	1050			water + dryer	5,171,875		
water + range	1050			water + range	4,753,340		
water only	35714			water only	134,358,972		
water + dryer + range	4202			water + dryer + range	23,893,920		
				<b>Total (aMW)</b>			<b>38.9</b>

Measures	Gas Usage--90 AFUE Furnace, 0. 64 EF Water Heater (therms/yr.)			Measures	Gas Usage--96 AFUE Furnace, 0.82 EF Water Heater (therms/yr.)		
	PSE Gas	Svc Line Only	Main Ext.		PSE Gas	Svc Line Only	Main Ext.
space heat		112,323	0	space heat		105,303	0
space + water		2,402,483	2,282,378	space + water		2,157,285	2,049,438
space + water + dryer		158,583	150,655	space + water + dryer		143,258	136,096
space + water + range		158,245	150,334	space + water + range		142,920	135,775
All		166,673	158,340	All		151,348	143,782
zone heat	0			zone heat	0		
zone + water	3,885,539			zone + water	3,556,291		
zone + water + dryer	263,730			zone + water + dryer	243,152		
zone + water + range	262,891			zone + water + range	242,313		
zone + all	283,775			zone + all	263,197		
water + dryer	242,146			water + dryer	198,676		
water + range	240,375			water + range	196,905		
water only	6,733,038			water only	5,255,054		
water + dryer + range	1,137,960			water + dryer + range	964,080		
<b>Total (Dth)</b>			<b>1878947</b>	<b>Total (Dth):</b>			<b>1608487</b>



**Table C-7. Economic Screen AC: -10% Scenario Avoided Costs and Service Line**

End Use	Gas Measure	NPV Avoided Cost (2008 Base Year)		Service Line Extension						
		Elec Avoided Cost (\$/kWh)	Gas Avoided Cost (\$/therm)	First Yr. Cost (\$)	First Yr. Cost + Admin (\$)	Elec. Benefit (\$)	Elec.--Gas Benefit (\$)	Benefit/Cost	Benefit/Cost w/Admin.	
Space Heating	Standard Furnace, 80 AFUE, 60 kBtu	\$0.85	\$9.0	\$ 1,300	\$ 1,495	\$ 6,782	\$ 1,710	1.3	1.1	
	Condensing Furnace, 90 AFUE	\$0.85	\$9.0	\$ 1,600	\$ 1,840	\$ 6,782	\$ 2,273	1.4	1.2	
	Condensing Furnace, 96 AFUE	\$0.85	\$9.0	\$ 1,950	\$ 2,243	\$ 6,782	\$ 2,555	1.3	1.1	
Zone Heating	Wall heater 84% eff	\$0.76	\$8.1	\$ 1,500	\$ 1,725	\$ 3,047	\$ 871	0.6	0.5	
Water Heating	Storage Water Heater, 50 gal., EF=.59	\$0.70	\$7.0	\$ 440	\$ 506	\$ 2,437	\$ 1,152	2.6	2.3	
	Storage Water Heater, 50 gal., EF=.64	\$0.70	\$7.0	\$ 460	\$ 529	\$ 2,437	\$ 1,252	2.7	2.4	
	Tankless water heater EF=0.82	\$0.70	\$7.0	\$ 810	\$ 932	\$ 2,437	\$ 1,512	1.9	1.6	
Appliances	Gas Dryer, 6.5 cuft	\$0.75	\$7.3	\$ 260	\$ 299	\$ 980	\$ 655	2.5	2.2	
	Gas Dryer w/ Moisture Sens., 7.0 cuft	\$0.75	\$7.3	\$ 260	\$ 299	\$ 833	\$ 557	2.1	1.9	
	Standard Gas Range, Free-Standing, 30"	\$0.89	\$8.5	\$ 200	\$ 230	\$ 783	\$ 397	2.0	1.7	
	Convection Gas Range, Free-Standing, 30"	\$0.89	\$8.5	\$ 300	\$ 345	\$ 627	\$ 318	1.1	0.9	
<b>Bundles</b>										
Space + Water Heat	90 AFUE + 0.64			\$ 2,060	\$ 2,369	\$ 9,219	\$ 3,525	1.7	1.5	
Space + Dryer	90 AFUE + ms			\$ 1,860	\$ 2,139	\$ 7,616	\$ 2,830	1.5	1.3	
Space + Range	90 AFUE + conv			\$ 1,900	\$ 2,185	\$ 7,409	\$ 2,591	1.4	1.2	
Space + H2O + Dryer	90 AFUE + 0.64 + ms			\$ 2,320	\$ 2,668	\$ 10,053	\$ 4,082	1.8	1.5	
Space + H2O + Range	90 AFUE + 0.64 + conv			\$ 2,360	\$ 2,714	\$ 9,846	\$ 3,843	1.6	1.4	
Space + Dryer + Range	90 AFUE + ms + conv			\$ 2,160	\$ 2,484	\$ 8,242	\$ 3,148	1.5	1.3	
All	90 + 0.64 + ms + conv			\$ 2,620	\$ 3,013	\$ 10,679	\$ 4,400	1.7	1.5	
H2O + Dryer	0.64 + ms			\$ 720	\$ 828	\$ 3,271	\$ 1,809	2.5	2.2	
H2O + Range	0.64 + conv			\$ 760	\$ 874	\$ 3,064	\$ 1,570	2.1	1.8	
H2O + Dryer + Range	0.64+ ms+ conv			\$ 1,020	\$ 1,173	\$ 3,897	\$ 2,127	2.1	1.8	
Zone + water heat	84% + 0.64			\$ 1,960	\$ 2,254	\$ 5,484	\$ 2,123	1.1	0.9	
zone + water + dryer	84 % + 0.64 + ms			\$ 2,220	\$ 2,553	\$ 6,318	\$ 2,680	1.2	1.0	
zone + water + range	84% + 0.64 + conv			\$ 2,260	\$ 2,599	\$ 6,111	\$ 2,441	1.1	0.9	
zone + water + dryer + range	84% + 0.64 + ms+ conv			\$ 2,520	\$ 2,898	\$ 6,944	\$ 2,998	1.2	1.0	
<b>w/ tankless H2O &amp; 96 AFUE</b>										
Space + Water Heat	96 + 0.82			\$ 2,760	\$ 3,174	\$ 9,219	\$ 4,067	1.5	1.3	
Space + H2O + Dryer	96 + 0.82 + ms			\$ 3,020	\$ 3,473	\$ 10,053	\$ 4,624	1.5	1.3	
Space + H2O + Range	96 + 0.82 + conv			\$ 3,060	\$ 3,519	\$ 9,846	\$ 4,385	1.4	1.2	
All	96 + 0.82 + ms + conv			\$ 3,320	\$ 3,818	\$ 10,679	\$ 4,942	1.5	1.3	
H2O + Dryer	0.82 + ms			\$ 1,070	\$ 1,231	\$ 3,271	\$ 2,069	1.9	1.7	
H2O + Range	0.82 + conv			\$ 1,110	\$ 1,277	\$ 3,064	\$ 1,830	1.6	1.4	
H2O + Dryer + Range	0.82 + ms + conv			\$ 1,370	\$ 1,576	\$ 3,897	\$ 2,387	1.7	1.5	

**Table C-8. Economic Screen AC: -10% Scenario Main Extension**

End Use	Gas Measure	Main Extension				
		First Yr. Cost (\$)	First Yr. Cost + Admin (\$)	Elec.--Gas Benefit (\$)	Benefit/ Cost	Benefit/Cost w/Admin.
Space Heating	Standard Furnace, 80 AFUE, 60 kBtu	\$ 3,300	\$ 3,795	\$ 1,710	0.5	0.5
	Condensing Furnace, 90 AFUE	\$ 3,600	\$ 4,140	\$ 2,273	0.6	0.5
	Condensing Furnace, 96 AFUE	\$ 3,950	\$ 4,543	\$ 2,555	0.6	0.6
<b>Using 90 AFUE Furnace Bundles</b>						
	Space + Water Heat	\$ 4,060	\$ 4,669	\$ 4,710	1.2	1.0
	Space + Dryer	\$ 3,860	\$ 4,439	\$ 2,830	0.7	0.6
	Space + Range	\$ 3,900	\$ 4,485	\$ 2,900	0.7	0.6
	Space + H2O + Dryer	\$ 4,320	\$ 4,968	\$ 5,544	1.3	1.1
	Space + H2O + Range	\$ 4,360	\$ 5,014	\$ 5,337	1.2	1.1
	Space + Dryer + Range	\$ 4,160	\$ 4,784	\$ 3,733	0.9	0.8
	All	\$ 4,620	\$ 5,313	\$ 6,170	1.3	1.2
<b>Using 96 AFUE Furnace Bundles</b>						
	Space + Water Heat	\$ 4,760	\$ 5,474	\$ 4,992	1.0	0.9
	Space + Dryer	\$ 4,210	\$ 4,842	\$ 3,388	0.8	0.7
	Space + Range	\$ 4,250	\$ 4,888	\$ 3,182	0.7	0.7
	Space + H2O + Dryer	\$ 5,020	\$ 5,773	\$ 5,826	1.2	1.0
	Space + H2O + Range	\$ 4,510	\$ 5,187	\$ 4,015	0.9	0.8
	Space + Dryer + Range	\$ 5,320	\$ 6,118	\$ 6,452	1.2	1.1
	All	\$ 4,520	\$ 5,198	\$ 6,474	1.4	1.2

**Table C-9. Economic Customer Count AC: -10% Scenario**

End Use	% Bundle Adoption	Measures	Number of Customers			
			PSE Gas	Svc Line Only	Main Ext.	Total
Space Heat + Additional End Uses	5%	space heat	0	4013	0	4013
	80%	space + water	0	4013	3813	7826
	5%	space + water + dryer	0	4013	3813	7826
	5%	space + water + range	0	4013	3813	7826
	5%	All	0	4013	3813	7826
Zone Heat + Additional End Uses	5%	zone heat	0	0	0	0
	80%	zone + water	0	0	0	0
	5%	zone + water + dryer	9945	0	0	9945
	5%	zone + water + range	0	0	0	0
	5%	zone + all	9945	0	0	9945
Water Heat + Additional End Uses	3%	water + dryer	42017			42017
	3%	water + range	42017			42017
	85%	water only	42017			42017
	10%	water + dryer + range	42017			42017

**Table C-10. Economic Potential AC: -10% Scenario**

Measures	Number of Customers			Measures	Electric Savings (kWh/yr.)		
	PSE Gas	Svc Line Only	Main Ext.		PSE Gas	Svc Line Only	Main Ext.
space heat		201		space heat		1,722,405	0
space + water		3211		space + water		39,637,681	37,656,118
space + water + dryer		201		space + water + dryer		2,710,454	2,574,953
space + water + range		201		space + water + range		2,630,496	2,498,992
All		201		All		2,863,595	2,720,438
zone heat	0			zone heat	0		
zone + water	0			zone + water	-		
zone + water + dryer	497			zone + water + dryer	4,582,241		
zone + water + range	0			zone + water + range	-		
zone + all	497			zone + all	4,961,708		
water + dryer	1050			water + dryer	5,171,875		
water + range	1050			water + range	4,753,340		
water only	35714			water only	134,358,972		
water + dryer + range	4202			water + dryer + range	23,893,920		
					Total (aMW)		31.1

Measures	Gas Usage--90 AFUE Furnace, 0. 64 EF Water Heater (therms/yr.)			Measures	Gas Usage--96 AFUE Furnace, 0.82 EF Water Heater (therms/yr.)			
	PSE Gas	Svc Line Only	Main Ext.		PSE Gas	Svc Line Only	Main Ext.	
space heat		112,323		space heat		105,303	0	
space + water		2,402,483		space + water		2,157,285	2,049,438	
space + water + dryer		158,583		space + water + dryer		143,258	136,096	
space + water + range		158,245		space + water + range		142,920	135,775	
All		166,673		All		151,348	143,782	
zone heat	0			zone heat	0			
zone + water	-			zone + water	-			
zone + water + dryer	263,730			zone + water + dryer	243,152			
zone + water + range	-			zone + water + range	-			
zone + all	283,775			zone + all	263,197			
water + dryer	242,146			water + dryer	198,676			
water + range	240,375			water + range	196,905			
water only	6,733,038			water only	5,255,054			
water + dryer + range	1,137,960			water + dryer + range	964,080			
Total (Dth)				1464104	Total (Dth):			1228627

**Table C-11. Economic Screen AC: +25% Scenario Avoided Costs and Service Line**

End Use	Gas Measure	NPV Avoided Cost (2008 Base Year)		Service Line Extension						
		Elec Avoided Cost (\$/kWh)	Gas Avoided Cost (\$/therm)	First Yr. Cost (\$)	First Yr. Cost + Admin (\$)	Elec. Benefit (\$)	Elec.--Gas Benefit (\$)	Benefit/Cost	Benefit/Cost w/Admin.	
Space Heating	Standard Furnace, 80 AFUE, 60 kBtu	\$0.85	\$9.0	\$ 1,300	\$ 1,495	\$ 9,344	\$ 2,298	1.8	1.5	
	Condensing Furnace, 90 AFUE	\$0.85	\$9.0	\$ 1,600	\$ 1,840	\$ 9,344	\$ 3,081	1.9	1.7	
	Condensing Furnace, 96 AFUE	\$0.85	\$9.0	\$ 1,950	\$ 2,243	\$ 9,344	\$ 3,473	1.8	1.5	
Zone Heating	Wall heater 84% eff	\$0.76	\$8.1	\$ 1,500	\$ 1,725	\$ 4,194	\$ 1,172	0.8	0.7	
Water Heating	Storage Water Heater, 50 gal., EF=.59	\$0.70	\$7.0	\$ 440	\$ 506	\$ 3,357	\$ 1,571	3.6	3.1	
	Storage Water Heater, 50 gal., EF=.64	\$0.70	\$7.0	\$ 460	\$ 529	\$ 3,357	\$ 1,710	3.7	3.2	
	Tankless water heater EF=0.82	\$0.70	\$7.0	\$ 810	\$ 932	\$ 3,357	\$ 2,072	2.6	2.2	
Appliances	Gas Dryer, 6.5 cuft	\$0.75	\$7.3	\$ 260	\$ 299	\$ 1,339	\$ 887	3.4	3.0	
	Gas Dryer w/ Moisture Sens., 7.0 cuft	\$0.75	\$7.3	\$ 260	\$ 299	\$ 1,138	\$ 754	2.9	2.5	
	Standard Gas Range, Free-Standing, 30"	\$0.89	\$8.5	\$ 200	\$ 230	\$ 1,080	\$ 544	2.7	2.4	
	Convection Gas Range, Free-Standing, 30"	\$0.89	\$8.5	\$ 300	\$ 345	\$ 864	\$ 435	1.5	1.3	
<b>Bundles</b>										
Space + Water Heat	90 AFUE + 0.64			\$ 2,060	\$ 2,369	\$ 12,700	\$ 4,792	2.3	2.0	
Space + Dryer	90 AFUE + ms			\$ 1,860	\$ 2,139	\$ 10,482	\$ 3,835	2.1	1.8	
Space + Range	90 AFUE + conv			\$ 1,900	\$ 2,185	\$ 10,208	\$ 3,517	1.9	1.6	
Space + H2O + Dryer	90 AFUE + 0.64 + ms			\$ 2,320	\$ 2,668	\$ 13,838	\$ 5,545	2.4	2.1	
Space + H2O + Range	90 AFUE + 0.64 + conv			\$ 2,360	\$ 2,714	\$ 13,564	\$ 5,227	2.2	1.9	
Space + Dryer + Range	90 AFUE + ms + conv			\$ 2,160	\$ 2,484	\$ 11,346	\$ 4,270	2.0	1.7	
All	90 + 0.64 + ms + conv			\$ 2,620	\$ 3,013	\$ 14,702	\$ 5,981	2.3	2.0	
H2O + Dryer	0.64 + ms			\$ 720	\$ 828	\$ 4,495	\$ 2,464	3.4	3.0	
H2O + Range	0.64 + conv			\$ 760	\$ 874	\$ 4,220	\$ 2,146	2.8	2.5	
H2O + Dryer + Range	0.64+ ms+ conv			\$ 1,020	\$ 1,173	\$ 5,358	\$ 2,899	2.8	2.5	
Zone + water heat	84% + 0.64			\$ 1,960	\$ 2,254	\$ 7,551	\$ 2,882	1.5	1.3	
zone + water + dryer	84 % + 0.64 + ms			\$ 2,220	\$ 2,553	\$ 8,689	\$ 3,636	1.6	1.4	
zone + water + range	84% + 0.64 + conv			\$ 2,260	\$ 2,599	\$ 8,414	\$ 3,317	1.5	1.3	
zone + water + dryer + range	84% + 0.64 + ms+ conv			\$ 2,520	\$ 2,898	\$ 9,552	\$ 4,071	1.6	1.4	
<b>w/ tankless H2O &amp; 96 AFUE</b>										
Space + Water Heat	96 + 0.82			\$ 2,760	\$ 3,174	\$ 12,700	\$ 5,544	2.0	1.7	
Space + H2O + Dryer	96 + 0.82 + ms			\$ 3,020	\$ 3,473	\$ 13,838	\$ 6,298	2.1	1.8	
Space + H2O + Range	96 + 0.82 + conv			\$ 3,060	\$ 3,519	\$ 13,564	\$ 5,980	2.0	1.7	
All	96 + 0.82 + ms + conv			\$ 3,320	\$ 3,818	\$ 14,702	\$ 6,733	2.0	1.8	
H2O + Dryer	0.82 + ms			\$ 1,070	\$ 1,231	\$ 4,495	\$ 2,826	2.6	2.3	
H2O + Range	0.82 + conv			\$ 1,110	\$ 1,277	\$ 4,220	\$ 2,507	2.3	2.0	
H2O + Dryer + Range	0.82 + ms + conv			\$ 1,370	\$ 1,576	\$ 5,358	\$ 3,261	2.4	2.1	

**Table C-12. Economic Screen AC: +25% Scenario Main Extension**

End Use	Gas Measure	Main Extension				
		First Yr. Cost (\$)	First Yr. Cost + Admin (\$)	Elec.--Gas Benefit (\$)	Benefit/ Cost	Benefit/Cost w/Admin.
Space Heating	Standard Furnace, 80 AFUE, 60 kBtu	\$ 3,300	\$ 3,795	\$ 1,834	0.6	0.5
	Condensing Furnace, 90 AFUE	\$ 3,600	\$ 4,140	\$ 2,531	0.7	0.6
	Condensing Furnace, 96 AFUE	\$ 3,950	\$ 4,543	\$ 2,879	0.7	0.6
<b>Using 90 AFUE Furnace Bundles</b>						
	Space + Water Heat	\$ 4,060	\$ 4,669	\$ 5,887	1.5	1.3
	Space + Dryer	\$ 3,860	\$ 4,439	\$ 3,285	0.9	0.7
	Space + Range	\$ 3,900	\$ 4,485	\$ 3,395	0.9	0.8
	Space + H2O + Dryer	\$ 4,320	\$ 4,968	\$ 7,025	1.6	1.4
	Space + H2O + Range	\$ 4,360	\$ 5,014	\$ 6,751	1.5	1.3
	Space + Dryer + Range	\$ 4,160	\$ 4,784	\$ 4,532	1.1	0.9
	All	\$ 4,620	\$ 5,313	\$ 7,889	1.7	1.5
<b>Using 96 AFUE Furnace Bundles</b>						
	Space + Water Heat	\$ 4,760	\$ 5,474	\$ 6,236	1.3	1.1
	Space + Dryer	\$ 4,210	\$ 4,842	\$ 4,017	1.0	0.8
	Space + Range	\$ 4,250	\$ 4,888	\$ 3,743	0.9	0.8
	Space + H2O + Dryer	\$ 5,020	\$ 5,773	\$ 7,374	1.5	1.3
	Space + H2O + Range	\$ 4,510	\$ 5,187	\$ 4,881	1.1	0.9
	Space + Dryer + Range	\$ 5,320	\$ 6,118	\$ 8,238	1.5	1.3
	All	\$ 4,520	\$ 5,198	\$ 8,306	1.8	1.6

**Table C-13. Economic Customer Count AC: +25% Scenario**

End Use	% Bundle Adoption	Measures	Number of Customers			
			PSE Gas	Svc Line Only	Main Ext.	Total
Space Heat + Additional End Uses	5%	space heat	0	4013	0	4013
	80%	space + water	0	4013	3813	7826
	5%	space + water + dryer	0	4013	3813	7826
	5%	space + water + range	0	4013	3813	7826
	5%	All	0	4013	3813	7826
Zone Heat + Additional End Uses	5%	zone heat	0	0	0	0
	80%	zone + water	9945	0	0	9945
	5%	zone + water + dryer	9945	0	0	9945
	5%	zone + water + range	9945	0	0	9945
	5%	zone + all	9945	0	0	9945
Water Heat + Additional End Uses	3%	water + dryer	42017			42017
	3%	water + range	42017			42017
	85%	water only	42017			42017
	10%	water + dryer + range	42017			42017

**Table C-14. Economic Potential AC: +25% Scenario**

Measures	Number of Customers			Measures	Electric Savings (kWh/yr.)			
	PSE Gas	Svc Line Only	Main Ext.		PSE Gas	Svc Line Only	Main Ext.	
space heat		201	0	space heat		1,722,405	0	
space + water		3211	3050	space + water		39,637,681	37,656,118	
space + water + dryer		201	191	space + water + dryer		2,710,454	2,574,953	
space + water + range		201	191	space + water + range		2,630,496	2,498,992	
All		201	191	All		2,863,595	2,720,438	
zone heat	0			zone heat	0			
zone + water	7956			zone + water	64,074,367			
zone + water + dryer	497			zone + water + dryer	4,582,241			
zone + water + range	497			zone + water + range	4,384,114			
zone + all	497			zone + all	4,961,708			
water + dryer	1050			water + dryer	5,171,875			
water + range	1050			water + range	4,753,340			
water only	35714			water only	134,358,972			
water + dryer + range	4202			water + dryer + range	23,893,920			
				Total (aMW)				38.9

Measures	Gas Usage--90 AFUE Furnace, 0.64 EF Water Heater (therms/yr.)			Measures	Gas Usage--96 AFUE Furnace, 0.82 EF Water Heater (therms/yr.)			
	PSE Gas	Svc Line Only	Main Ext.		PSE Gas	Svc Line Only	Main Ext.	
space heat		112,323	0	space heat		105,303	0	
space + water		2,402,483	2,282,378	space + water		2,157,285	2,049,438	
space + water + dryer		158,583	150,655	space + water + dryer		143,258	136,096	
space + water + range		158,245	150,334	space + water + range		142,920	135,775	
All		166,673	158,340	All		151,348	143,782	
zone heat	0			zone heat	0			
zone + water	3,885,539			zone + water	3,556,291			
zone + water + dryer	263,730			zone + water + dryer	243,152			
zone + water + range	262,891			zone + water + range	242,313			
zone + all	283,775			zone + all	263,197			
water + dryer	242,146			water + dryer	198,676			
water + range	240,375			water + range	196,905			
water only	6,733,038			water only	5,255,054			
water + dryer + range	1,137,960			water + dryer + range	964,080			
Total (Dth)				Total (Dth):				1608487



**Table C-15. Economic Screen: Green World Scenario Avoided Costs and Service Line**

End Use	Gas Measure	NPV Avoided Cost (2008 Base Year)		Service Line Extension						
		Elec Avoided Cost (\$/kWh)	Gas Avoided Cost (\$/therm)	First Yr. Cost (\$)	First Yr. Cost + Admin (\$)	Elec. Benefit (\$)	Elec.--Gas Benefit (\$)	Benefit/Cost	Benefit/Cost w/Admin.	
Space Heating	Standard Furnace, 80 AFUE, 60 kBtu	\$0.85	\$9.0	\$ 1,300	\$ 1,495	\$ 8,107	\$ 1,834	1.4	1.2	
	Condensing Furnace, 90 AFUE	\$0.85	\$9.0	\$ 1,600	\$ 1,840	\$ 8,107	\$ 2,531	1.6	1.4	
	Condensing Furnace, 96 AFUE	\$0.85	\$9.0	\$ 1,950	\$ 2,243	\$ 8,107	\$ 2,879	1.5	1.3	
Zone Heating	Wall heater 84% eff	\$0.76	\$8.1	\$ 1,500	\$ 1,725	\$ 3,628	\$ 955	0.6	0.6	
Water Heating	Storage Water Heater, 50 gal., EF=.59	\$0.70	\$7.0	\$ 440	\$ 506	\$ 3,011	\$ 1,383	3.1	2.7	
	Storage Water Heater, 50 gal., EF=.64	\$0.70	\$7.0	\$ 460	\$ 529	\$ 3,011	\$ 1,510	3.3	2.9	
	Tankless water heater EF=0.82	\$0.70	\$7.0	\$ 810	\$ 932	\$ 3,011	\$ 1,839	2.3	2.0	
Appliances	Gas Dryer, 6.5 cuft	\$0.75	\$7.3	\$ 260	\$ 299	\$ 1,210	\$ 795	3.1	2.7	
	Gas Dryer w/ Moisture Sens., 7.0 cuft	\$0.75	\$7.3	\$ 260	\$ 299	\$ 1,028	\$ 676	2.6	2.3	
	Standard Gas Range, Free-Standing, 30"	\$0.89	\$8.5	\$ 200	\$ 230	\$ 983	\$ 485	2.4	2.1	
	Convection Gas Range, Free-Standing, 30"	\$0.89	\$8.5	\$ 300	\$ 345	\$ 787	\$ 388	1.3	1.1	
<b>Bundles</b>										
Space + Water Heat	90 AFUE + 0.64			\$ 2,060	\$ 2,369	\$ 11,118	\$ 4,041	2.0	1.7	
Space + Dryer	90 AFUE + ms			\$ 1,860	\$ 2,139	\$ 9,135	\$ 3,207	1.7	1.5	
Space + Range	90 AFUE + conv			\$ 1,900	\$ 2,185	\$ 8,894	\$ 2,918	1.5	1.3	
Space + H2O + Dryer	90 AFUE + 0.64 + ms			\$ 2,320	\$ 2,668	\$ 12,146	\$ 4,716	2.0	1.8	
Space + H2O + Range	90 AFUE + 0.64 + conv			\$ 2,360	\$ 2,714	\$ 11,905	\$ 4,428	1.9	1.6	
Space + Dryer + Range	90 AFUE + ms + conv			\$ 2,160	\$ 2,484	\$ 9,922	\$ 3,594	1.7	1.4	
All	90 + 0.64 + ms + conv			\$ 2,620	\$ 3,013	\$ 12,933	\$ 5,104	1.9	1.7	
H2O + Dryer	0.64 + ms			\$ 720	\$ 828	\$ 4,039	\$ 2,186	3.0	2.6	
H2O + Range	0.64 + conv			\$ 760	\$ 874	\$ 3,798	\$ 1,897	2.5	2.2	
H2O + Dryer + Range	0.64+ ms+ conv			\$ 1,020	\$ 1,173	\$ 4,826	\$ 2,573	2.5	2.2	
Zone + water heat	84% + 0.64			\$ 1,960	\$ 2,254	\$ 6,639	\$ 2,465	1.3	1.1	
zone + water + dryer	84 % + 0.64 + ms			\$ 2,220	\$ 2,553	\$ 7,668	\$ 3,141	1.4	1.2	
zone + water + range	84% + 0.64 + conv			\$ 2,260	\$ 2,599	\$ 7,426	\$ 2,852	1.3	1.1	
zone + water + dryer + range	84% + 0.64 + ms+ conv			\$ 2,520	\$ 2,898	\$ 8,454	\$ 3,528	1.4	1.2	
<b>w/ tankless H2O &amp; 96 AFUE</b>										
Space + Water Heat	96 + 0.82			\$ 2,760	\$ 3,174	\$ 11,118	\$ 4,719	1.7	1.5	
Space + H2O + Dryer	96 + 0.82 + ms			\$ 3,020	\$ 3,473	\$ 12,146	\$ 5,394	1.8	1.6	
Space + H2O + Range	96 + 0.82 + conv			\$ 3,060	\$ 3,519	\$ 11,905	\$ 5,106	1.7	1.5	
All	96 + 0.82 + ms + conv			\$ 3,320	\$ 3,818	\$ 12,933	\$ 5,782	1.7	1.5	
H2O + Dryer	0.82 + ms			\$ 1,070	\$ 1,231	\$ 4,039	\$ 2,515	2.4	2.0	
H2O + Range	0.82 + conv			\$ 1,110	\$ 1,277	\$ 3,798	\$ 2,227	2.0	1.7	
H2O + Dryer + Range	0.82 + ms + conv			\$ 1,370	\$ 1,576	\$ 4,826	\$ 2,903	2.1	1.8	

**Table C-16. Economic Screen: Green World Scenario Main Extension**

End Use	Gas Measure	Main Extension				
		First Yr. Cost (\$)	First Yr. Cost + Admin (\$)	Elec.--Gas Benefit (\$)	Benefit/Cost	Benefit/Cost w/Admin.
Space Heating	Standard Furnace, 80 AFUE, 60 kBtu	\$ 3,300	\$ 3,795	\$ 1,834	0.6	0.5
	Condensing Furnace, 90 AFUE	\$ 3,600	\$ 4,140	\$ 2,531	0.7	0.6
	Condensing Furnace, 96 AFUE	\$ 3,950	\$ 4,543	\$ 2,879	0.7	0.6
<b>Using 90 AFUE Furnace Bundles</b>						
	Space + Water Heat	\$ 4,060	\$ 4,669	\$ 5,542	1.4	1.2
	Space + Dryer	\$ 3,860	\$ 4,439	\$ 3,207	0.8	0.7
	Space + Range	\$ 3,900	\$ 4,485	\$ 3,317	0.9	0.7
	Space + H2O + Dryer	\$ 4,320	\$ 4,968	\$ 6,570	1.5	1.3
	Space + H2O + Range	\$ 4,360	\$ 5,014	\$ 6,328	1.5	1.3
	Space + Dryer + Range	\$ 4,160	\$ 4,784	\$ 4,345	1.0	0.9
	All	\$ 4,620	\$ 5,313	\$ 7,357	1.6	1.4
<b>Using 96 AFUE Furnace Bundles</b>						
	Space + Water Heat	\$ 4,760	\$ 5,474	\$ 5,890	1.2	1.1
	Space + Dryer	\$ 4,210	\$ 4,842	\$ 3,907	0.9	0.8
	Space + Range	\$ 4,250	\$ 4,888	\$ 3,666	0.9	0.8
	Space + H2O + Dryer	\$ 5,020	\$ 5,773	\$ 6,919	1.4	1.2
	Space + H2O + Range	\$ 4,510	\$ 5,187	\$ 4,694	1.0	0.9
	Space + Dryer + Range	\$ 5,320	\$ 6,118	\$ 7,705	1.4	1.3
	All	\$ 4,520	\$ 5,198	\$ 7,735	1.7	1.5

**Table C-17. Economic Customer Count: Green World Scenario**

End Use	% Bundle Adoption	Measures	Number of Customers			
			PSE Gas	Svc Line Only	Main Ext.	Total
Space Heat + Additional End Uses	5%	space heat	0	4013	0	4013
	80%	space + water	0	4013	3813	7826
	5%	space + water + dryer	0	4013	3813	7826
	5%	space + water + range	0	4013	3813	7826
	5%	All	0	4013	3813	7826
Zone Heat + Additional End Uses	5%	zone heat	0	0	0	0
	80%	zone + water	9945	0	0	9945
	5%	zone + water + dryer	9945	0	0	9945
	5%	zone + water + range	9945	0	0	9945
	5%	zone + all	9945	0	0	9945
Water Heat + Additional End Uses	3%	water + dryer	42017			42017
	3%	water + range	42017			42017
	85%	water only	42017			42017
	10%	water + dryer + range	42017			42017

**Table C-18. Economic Potential: Green World Scenario**

Measures	Number of Customers			Measures	Electric Savings (kWh/yr.)		
	PSE Gas	Svc Line Only	Main Ext.		PSE Gas	Svc Line Only	Main Ext.
space heat		201	0	space heat		1,722,405	0
space + water		3211	3050	space + water		39,637,681	37,656,118
space + water + dryer		201	191	space + water + dryer		2,710,454	2,574,953
space + water + range		201	191	space + water + range		2,630,496	2,498,992
All		201	191	All		2,863,595	2,720,438
zone heat	0			zone heat	0		
zone + water	7956			zone + water	64,074,367		
zone + water + dryer	497			zone + water + dryer	4,582,241		
zone + water + range	497			zone + water + range	4,384,114		
zone + all	497			zone + all	4,961,708		
water + dryer	1050			water + dryer	5,171,875		
water + range	1050			water + range	4,753,340		
water only	35714			water only	134,358,972		
water + dryer + range	4202			water + dryer + range	23,893,920		
				Total (aMW)   38.9			

Measures	Gas Usage--90 AFUE Furnace, 0.64 EF Water Heater (therms/yr.)			Measures	Gas Usage--96 AFUE Furnace, 0.82 EF Water Heater (therms/yr.)		
	PSE Gas	Svc Line Only	Main Ext.		PSE Gas	Svc Line Only	Main Ext.
space heat		112,323	0	space heat		105,303	0
space + water		2,402,483	2,282,378	space + water		2,157,285	2,049,438
space + water + dryer		158,583	150,655	space + water + dryer		143,258	136,096
space + water + range		158,245	150,334	space + water + range		142,920	135,775
All		166,673	158,340	All		151,348	143,782
zone heat	0			zone heat	0		
zone + water	3,885,539			zone + water	3,556,291		
zone + water + dryer	263,730			zone + water + dryer	243,152		
zone + water + range	262,891			zone + water + range	242,313		
zone + all	283,775			zone + all	263,197		
water + dryer	242,146			water + dryer	198,676		
water + range	240,375			water + range	196,905		
water only	6,733,038			water only	5,255,054		
water + dryer + range	1,137,960			water + dryer + range	964,080		
Total (Dth)   1878947				Total (Dth):   1608487			

**Table C-19. Economic Screen: Low Growth Scenario Avoided Costs and Service Line**

End Use	Gas Measure	NPV Avoided Cost (2008 Base Year)		Service Line Extension						
		Elec Avoided Cost (\$/kWh)	Gas Avoided Cost (\$/therm)	First Yr. Cost (\$)	First Yr. Cost + Admin (\$)	Elec. Benefit (\$)	Elec.--Gas Benefit (\$)	Benefit/Cost	Benefit/Cost w/Admin.	
Space Heating	Standard Furnace, 80 AFUE, 60 kBtu	\$0.85	\$9.0	\$ 1,300	\$ 1,495	\$ 6,484	\$ 1,590	1.2	1.1	
	Condensing Furnace, 90 AFUE	\$0.85	\$9.0	\$ 1,600	\$ 1,840	\$ 6,484	\$ 2,134	1.3	1.2	
	Condensing Furnace, 96 AFUE	\$0.85	\$9.0	\$ 1,950	\$ 2,243	\$ 6,484	\$ 2,405	1.2	1.1	
Zone Heating	Wall heater 84% eff	\$0.76	\$8.1	\$ 1,500	\$ 1,725	\$ 2,992	\$ 856	0.6	0.5	
Water Heating	Storage Water Heater, 50 gal., EF=.59	\$0.70	\$7.0	\$ 440	\$ 506	\$ 2,392	\$ 1,115	2.5	2.2	
	Storage Water Heater, 50 gal., EF=.64	\$0.70	\$7.0	\$ 460	\$ 529	\$ 2,392	\$ 1,215	2.6	2.3	
	Tankless water heater EF=0.82	\$0.70	\$7.0	\$ 810	\$ 932	\$ 2,392	\$ 1,474	1.8	1.6	
Appliances	Gas Dryer, 6.5 cuft	\$0.75	\$7.3	\$ 260	\$ 299	\$ 959	\$ 637	2.5	2.1	
	Gas Dryer w/ Moisture Sens., 7.0 cuft	\$0.75	\$7.3	\$ 260	\$ 299	\$ 815	\$ 542	2.1	1.8	
	Standard Gas Range, Free-Standing, 30"	\$0.89	\$8.5	\$ 200	\$ 230	\$ 754	\$ 381	1.9	1.7	
	Convection Gas Range, Free-Standing, 30"	\$0.89	\$8.5	\$ 300	\$ 345	\$ 603	\$ 304	1.0	0.9	
<b>Bundles</b>										
Space + Water Heat	90 AFUE + 0.64			\$ 2,060	\$ 2,369	\$ 8,876	\$ 3,349	1.6	1.4	
Space + Dryer	90 AFUE + ms			\$ 1,860	\$ 2,139	\$ 7,299	\$ 2,675	1.4	1.3	
Space + Range	90 AFUE + conv			\$ 1,900	\$ 2,185	\$ 7,088	\$ 2,438	1.3	1.1	
Space + H2O + Dryer	90 AFUE + 0.64 + ms			\$ 2,320	\$ 2,668	\$ 9,691	\$ 3,890	1.7	1.5	
Space + H2O + Range	90 AFUE + 0.64 + conv			\$ 2,360	\$ 2,714	\$ 9,480	\$ 3,653	1.5	1.3	
Space + Dryer + Range	90 AFUE + ms + conv			\$ 2,160	\$ 2,484	\$ 7,902	\$ 2,980	1.4	1.2	
All	90 + 0.64 + ms + conv			\$ 2,620	\$ 3,013	\$ 10,295	\$ 4,195	1.6	1.4	
H2O + Dryer	0.64 + ms			\$ 720	\$ 828	\$ 3,207	\$ 1,757	2.4	2.1	
H2O + Range	0.64 + conv			\$ 760	\$ 874	\$ 2,996	\$ 1,520	2.0	1.7	
H2O + Dryer + Range	0.64+ ms+ conv			\$ 1,020	\$ 1,173	\$ 3,810	\$ 2,061	2.0	1.8	
Zone + water heat	84% + 0.64			\$ 1,960	\$ 2,254	\$ 5,384	\$ 2,072	1.1	0.9	
zone + water + dryer	84 % + 0.64 + ms			\$ 2,220	\$ 2,553	\$ 6,199	\$ 2,613	1.2	1.0	
zone + water + range	84% + 0.64 + conv			\$ 2,260	\$ 2,599	\$ 5,988	\$ 2,376	1.1	0.9	
zone + water + dryer + range	84% + 0.64 + ms+ conv			\$ 2,520	\$ 2,898	\$ 6,803	\$ 2,918	1.2	1.0	
<b>w/ tankless H2O &amp; 96 AFUE</b>										
Space + Water Heat	96 + 0.82			\$ 2,760	\$ 3,174	\$ 8,876	\$ 3,879	1.4	1.2	
Space + H2O + Dryer	96 + 0.82 + ms			\$ 3,020	\$ 3,473	\$ 9,691	\$ 4,421	1.5	1.3	
Space + H2O + Range	96 + 0.82 + conv			\$ 3,060	\$ 3,519	\$ 9,480	\$ 4,183	1.4	1.2	
All	96 + 0.82 + ms + conv			\$ 3,320	\$ 3,818	\$ 10,295	\$ 4,725	1.4	1.2	
H2O + Dryer	0.82 + ms			\$ 1,070	\$ 1,231	\$ 3,207	\$ 2,015	1.9	1.6	
H2O + Range	0.82 + conv			\$ 1,110	\$ 1,277	\$ 2,996	\$ 1,778	1.6	1.4	
H2O + Dryer + Range	0.82 + ms + conv			\$ 1,370	\$ 1,576	\$ 3,810	\$ 2,320	1.7	1.5	

**Table C-20. Economic Screen: Low Growth Scenario Main Extension**

End Use	Gas Measure	Main Extension				
		First Yr. Cost (\$)	First Yr. Cost + Admin (\$)	Elec.--Gas Benefit (\$)	Benefit/Cost	Benefit/Cost w/Admin.
Space Heating	Standard Furnace, 80 AFUE, 60 kBtu	\$ 3,300	\$ 3,795	\$ 1,590	0.5	0.4
	Condensing Furnace, 90 AFUE	\$ 3,600	\$ 4,140	\$ 2,134	0.6	0.5
	Condensing Furnace, 96 AFUE	\$ 3,950	\$ 4,543	\$ 2,405	0.6	0.5
<b>Using 90 AFUE Furnace Bundles</b>						
	Space + Water Heat	\$ 4,060	\$ 4,669	\$ 4,526	1.1	1.0
	Space + Dryer	\$ 3,860	\$ 4,439	\$ 2,675	0.7	0.6
	Space + Range	\$ 3,900	\$ 4,485	\$ 2,737	0.7	0.6
	Space + H2O + Dryer	\$ 4,320	\$ 4,968	\$ 5,340	1.2	1.1
	Space + H2O + Range	\$ 4,360	\$ 5,014	\$ 5,129	1.2	1.0
	Space + Dryer + Range	\$ 4,160	\$ 4,784	\$ 3,552	0.9	0.7
	All	\$ 4,620	\$ 5,313	\$ 5,944	1.3	1.1
<b>Using 96 AFUE Furnace Bundles</b>						
	Space + Water Heat	\$ 4,760	\$ 5,474	\$ 4,798	1.0	0.9
	Space + Dryer	\$ 4,210	\$ 4,842	\$ 3,220	0.8	0.7
	Space + Range	\$ 4,250	\$ 4,888	\$ 3,009	0.7	0.6
	Space + H2O + Dryer	\$ 5,020	\$ 5,773	\$ 5,612	1.1	1.0
	Space + H2O + Range	\$ 4,510	\$ 5,187	\$ 3,824	0.8	0.7
	Space + Dryer + Range	\$ 5,320	\$ 6,118	\$ 6,216	1.2	1.0
	All	\$ 4,520	\$ 5,198	\$ 6,239	1.4	1.2

**Table C-21. Economic Customer Count: Low Growth Scenario**

End Use	% Bundle Adoption	Measures	Number of Customers			
			PSE Gas	Svc Line Only	Main Ext.	Total
Space Heat + Additional End Uses	5%	space heat	0	4013	0	4013
	80%	space + water	0	4013	0	4013
	5%	space + water + dryer	0	4013	3813	7826
	5%	space + water + range	0	4013	3813	7826
	5%	All	0	4013	3813	7826
Zone Heat + Additional End Uses	5%	zone heat	0	0	0	0
	80%	zone + water	0	0	0	0
	5%	zone + water + dryer	9945	0	0	9945
	5%	zone + water + range	0	0	0	0
	5%	zone + all	9945	0	0	9945
Water Heat + Additional End Uses	3%	water + dryer	42017			42017
	3%	water + range	42017			42017
	85%	water only	42017			42017
	10%	water + dryer + range	42017			42017

**Table C-22. Economic Potential: Low Growth Scenario**

Measures	Number of Customers			Measures	Electric Savings (kWh/yr.)		
	PSE Gas	Svc Line Only	Main Ext.		PSE Gas	Svc Line Only	Main Ext.
space heat		201	0	space heat		1,722,405	0
space + water		3211	0	space + water		39,637,681	-
space + water + dryer		201	191	space + water + dryer		2,710,454	2,574,953
space + water + range		201	191	space + water + range		2,630,496	2,498,992
All		201	191	All		2,863,595	2,720,438
zone heat	0			zone heat	0		
zone + water	0			zone + water	-		
zone + water + dryer	497			zone + water + dryer	4,582,241		
zone + water + range	0			zone + water + range	-		
zone + all	497			zone + all	4,961,708		
water + dryer	1050			water + dryer	5,171,875		
water + range	1050			water + range	4,753,340		
water only	35714			water only	134,358,972		
water + dryer + range	4202			water + dryer + range	23,893,920		
					Total (aMW)		26.8

Measures	Gas Usage--90 AFUE Furnace, 0.64 EF Water Heater (therms/yr.)			Measures	Gas Usage--96 AFUE Furnace, 0.82 EF Water Heater (therms/yr.)				
	PSE Gas	Svc Line Only	Main Ext.		PSE Gas	Svc Line Only	Main Ext.		
space heat		112,323	0	space heat		105,303	0		
space + water		2,402,483	-	space + water		2,157,285	-		
space + water + dryer		158,583	150,655	space + water + dryer		143,258	136,096		
space + water + range		158,245	150,334	space + water + range		142,920	135,775		
All		166,673	158,340	All		151,348	143,782		
zone heat	0			zone heat	0				
zone + water	-			zone + water	-				
zone + water + dryer	263,730			zone + water + dryer	243,152				
zone + water + range	-			zone + water + range	-				
zone + all	283,775			zone + all	263,197				
water + dryer	242,146			water + dryer	198,676				
water + range	240,375			water + range	196,905				
water only	6,733,038			water only	5,255,054				
water + dryer + range	1,137,960			water + dryer + range	964,080				
Total (Dth)				1235866	Total (Dth):				1023683



**Table C-23. Achievable Potential Base Case Scenario: Gas Customers**

	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
water + dryer (# cust)	1050	473	762	1050	1050	1050	1050	1050	1050	1050
water + range (# cust)	1050	473	762	1050	1050	1050	1050	1050	1050	1050
water only (# cust)	35714	16071	25893	35714	35714	35714	35714	35714	35714	35714
water + dryer + range (# cust)	4202	1891	3046	4202	4202	4202	4202	4202	4202	4202
zone heat (# cust)	0	0	0	0	0	0	0	0	0	0
zone + water (# cust)	7956	179	288	398	398	398	398	398	398	398
zone + water + dryer (# cust)	497	6	9	12	12	12	12	12	12	12
zone + water + range	497	6	9	12	12	12	12	12	12	12
zone + all (# cust)	497	11	18	25	25	25	25	25	25	25
water heat elec (kWh)	1,117,872	4,471,486	9,874,532	17,327,009	24,779,487	32,231,964	39,684,441	47,136,918	54,589,395	62,041,873
dryer elec (kWh)	42,993	171,971	379,770	666,388	953,007	1,239,625	1,526,244	1,812,862	2,099,481	2,386,100
range elec (kWh)	28,245	112,981	249,500	437,802	626,105	814,407	1,002,709	1,191,011	1,379,313	1,567,615
zone heat (kWh)	13,439	53,757	118,713	208,307	297,902	387,496	477,091	566,685	656,280	745,874
total elec (kWh)	1,202,549	4,810,195	10,622,515	18,639,507	26,656,500	34,673,492	42,690,484	50,707,477	58,724,469	66,741,461
water heat gas (th)	59,562	236,285	517,847	901,850	1,281,494	1,656,781	2,027,709	2,394,279	2,756,491	3,114,345
dryer gas (th)	1,653	6,611	14,599	25,618	36,636	47,654	58,672	69,691	80,709	91,727
range gas (th)	1,586	6,346	14,013	24,589	35,165	45,741	56,317	66,893	77,469	88,045
zone gas (th)	998	3,994	8,819	15,475	22,131	28,787	35,443	42,099	48,755	55,410
total gas (th)	63,799	253,235	555,278	967,531	1,375,426	1,778,963	2,178,141	2,572,961	2,963,423	3,349,527

NOTE: Percentages of space heat adoption: (1) zone heat--10%; (2) zone + water--5%; (3) zone + water + dryer--2.5%; (4) zone + water + range--2.5%; (5) zone + all--5%.

	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027
water + dryer (# cust)	1050	1050	1050	1050	1050	1050	1050	1050	1050	1050
water + range (# cust)	1050	1050	1050	1050	1050	1050	1050	1050	1050	1050
water only (# cust)	35714	35714	35714	35714	35714	35714	35714	35714	35714	35714
water + dryer + range (# cust)	4202	4202	4202	4202	4202	4202	4202	4202	4202	4202
zone heat (# cust)	0	0	0	0	0	0	0	0	0	0
zone + water (# cust)	398	398	398	398	398	398	398	398	398	398
zone + water + dryer (# cust)	12	12	12	12	12	12	12	12	12	12
zone + water + range	12	12	12	12	12	12	12	12	12	12
zone + all (# cust)	25	25	25	25	25	25	25	25	25	25
water heat elec (kWh)	69,494,350	76,946,827	84,399,304	91,851,781	99,304,258	106,756,736	114,209,213	121,661,690	129,114,167	136,566,644
dryer elec (kWh)	2,672,718	2,959,337	3,245,955	3,532,574	3,819,192	4,105,811	4,392,430	4,679,048	4,965,667	5,252,285
range elec (kWh)	1,755,917	1,944,219	2,132,521	2,320,824	2,509,126	2,697,428	2,885,730	3,074,032	3,262,334	3,450,636
zone heat (kWh)	835,469	925,063	1,014,658	1,104,252	1,193,847	1,283,441	1,373,036	1,462,630	1,552,225	1,641,819
total elec (kWh)	74,758,454	82,775,446	90,792,439	98,809,431	106,826,423	114,843,416	122,860,408	130,877,400	138,894,393	146,911,385
water heat gas (th)	3,467,841	3,821,336	4,174,832	4,528,328	4,881,823	5,235,319	5,588,815	5,942,310	6,295,806	6,649,302
dryer gas (th)	102,745	113,764	124,782	135,800	146,819	157,837	168,855	179,873	190,892	201,910
range gas (th)	98,621	109,197	119,772	130,348	140,924	151,500	162,076	172,652	183,228	193,804
zone gas (th)	62,066	68,722	75,378	82,034	88,690	95,346	102,002	108,658	115,314	121,970
total gas (th)	3,731,273	4,113,019	4,494,765	4,876,510	5,258,256	5,640,002	6,021,748	6,403,494	6,785,239	7,166,985

NOTE: Percentages of space heat adoption: (1) zone heat--10%; (2) zone + water--5%; (3) zone + water + dryer--2.5%; (4) zone + water + range--2.5%; (5) zone + all--5%.

**Table C-24. Achievable Potential Base Case Scenario: Electric-Only Customers**

	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
space heat (# cust)	201	90	145	201	201	201	201	201	201	201
space + water	6261	2817	4539	6261	6261	6261	6261	6261	6261	6261
space + water + dryer	391	176	284	391	391	391	391	391	391	391
space + water + range	391	176	284	391	391	391	391	391	391	391
All	391	176	284	391	391	391	391	391	391	391
space heat elec (kWh)	458,601	1,834,402	4,050,971	7,108,308	10,165,645	13,222,982	16,280,319	19,337,656	22,394,993	25,452,330
water heat elec (kWh)	195,727	782,909	1,728,924	3,033,772	4,338,620	5,643,468	6,948,316	8,253,164	9,558,012	10,862,860
dryer elec (kWh)	6,361	25,445	56,192	98,601	141,010	183,419	225,828	268,237	310,646	353,055
range elec (kWh)	4,179	16,717	36,917	64,779	92,640	120,502	148,364	176,226	204,088	231,950
total electric (kWh)	664,868	2,659,474	5,873,004	10,305,460	14,737,916	19,170,372	23,602,828	28,035,284	32,467,740	36,900,195
space heat gas (th)	31,798	126,893	279,622	489,620	698,956	907,629	1,115,640	1,322,989	1,529,675	1,735,698
water heat gas (th)	10,429	41,371	90,669	157,904	224,376	290,084	355,030	419,212	482,632	545,288
dryer gas (th)	245	978	2,160	3,790	5,421	7,051	8,681	10,312	11,942	13,572
range gas (th)	235	939	2,073	3,638	5,203	6,768	8,333	9,898	11,463	13,027
total gas (th)	42,706	170,181	374,525	654,953	933,956	1,211,533	1,487,684	1,762,410	2,035,711	2,307,586

	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027
space heat (# cust)	201	201	201	201	201	201	201	201	201	201
space + water	6261	6261	6261	6261	6261	6261	6261	6261	6261	6261
space + water + dryer	391	391	391	391	391	391	391	391	391	391
space + water + range	391	391	391	391	391	391	391	391	391	391
All	391	391	391	391	391	391	391	391	391	391
space heat elec (kWh)	28,509,667	31,567,004	34,624,341	37,681,678	40,739,015	43,796,352	46,853,689	49,911,026	52,968,363	56,025,700
water heat elec (kWh)	12,167,709	13,472,557	14,777,405	16,082,253	17,387,101	18,691,949	19,996,797	21,301,645	22,606,493	23,911,341
dryer elec (kWh)	395,464	437,873	480,282	522,691	565,100	607,509	649,918	692,327	734,736	777,145
range elec (kWh)	259,811	287,673	315,535	343,397	371,259	399,120	426,982	454,844	482,706	510,568
total electric (kWh)	41,332,651	45,765,107	50,197,563	54,630,019	59,062,475	63,494,931	67,927,387	72,359,843	76,792,299	81,224,754
space heat gas (th)	1,941,059	2,146,420	2,351,781	2,557,142	2,762,503	2,967,864	3,173,225	3,378,586	3,583,947	3,789,308
water heat gas (th)	607,181	669,075	730,968	792,861	854,754	916,648	978,541	1,040,434	1,102,327	1,164,221
dryer gas (th)	15,203	16,833	18,463	20,093	21,724	23,354	24,984	26,615	28,245	29,875
range gas (th)	14,592	16,157	17,722	19,287	20,852	22,416	23,981	25,546	27,111	28,676
total gas (th)	2,578,035	2,848,485	3,118,934	3,389,383	3,659,833	3,930,282	4,200,732	4,471,181	4,741,630	5,012,080

**Table C-25. Achievable Potential Base Case Scenario: All Customers**

	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
space heat elec (kWh)	458,601	1,834,402	4,050,971	7,108,308	10,165,645	13,222,982	16,280,319	19,337,656	22,394,993	25,452,330
water heat elec (kWh)	1,313,599	5,254,395	11,603,456	20,360,781	29,118,107	37,875,432	46,632,757	55,390,082	64,147,408	72,904,733
dryer elec (kWh)	49,354	197,417	435,962	764,989	1,094,017	1,423,044	1,752,072	2,081,100	2,410,127	2,739,155
range elec (kWh)	32,425	129,698	286,417	502,581	718,745	934,909	1,151,073	1,367,237	1,583,401	1,799,565
zone heat (kWh)	13,439	53,757	118,713	208,307	297,902	387,496	477,091	566,685	656,280	745,874
total electric (kWh)	1,867,417	7,469,669	16,495,519	28,944,967	41,394,416	53,843,864	66,293,312	78,742,760	91,192,209	103,641,657
space heat gas (th)	31,798	126,893	279,622	489,620	698,956	907,629	1,115,640	1,322,989	1,529,675	1,735,698
water heat gas (th)	69,990	277,656	608,516	1,059,754	1,505,870	1,946,865	2,382,739	2,813,492	3,239,123	3,659,633
dryer gas (th)	1,897	7,589	16,759	29,408	42,057	54,705	67,354	80,002	92,651	105,299
range gas (th)	1,821	7,284	16,087	28,227	40,368	52,509	64,650	76,790	88,931	101,072
zone heat (th)	998	3,994	8,819	15,475	22,131	28,787	35,443	42,099	48,755	55,410
total gas (th)	106,505	423,417	929,803	1,622,484	2,309,382	2,990,495	3,665,825	4,335,372	4,999,134	5,657,113

	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027
space heat elec (kWh)	28,509,667	31,567,004	34,624,341	37,681,678	40,739,015	43,796,352	46,853,689	49,911,026	52,968,363	56,025,700
water heat elec (kWh)	81,662,058	90,419,384	99,176,709	107,934,034	116,691,359	125,448,685	134,206,010	142,963,335	151,720,661	160,477,986
dryer elec (kWh)	3,068,182	3,397,210	3,726,238	4,055,265	4,384,293	4,713,320	5,042,348	5,371,376	5,700,403	6,029,431
range elec (kWh)	2,015,729	2,231,892	2,448,056	2,664,220	2,880,384	3,096,548	3,312,712	3,528,876	3,745,040	3,961,204
zone heat (kWh)	835,469	925,063	1,014,658	1,104,252	1,193,847	1,283,441	1,373,036	1,462,630	1,552,225	1,641,819
total electric (kWh)	116,091,105	128,540,553	140,990,002	153,439,450	165,888,898	178,338,347	190,787,795	203,237,243	215,686,691	228,136,140
space heat gas (th)	1,941,059	2,146,420	2,351,781	2,557,142	2,762,503	2,967,864	3,173,225	3,378,586	3,583,947	3,789,308
water heat gas (th)	4,075,022	4,490,411	4,905,800	5,321,189	5,736,578	6,151,967	6,567,356	6,982,744	7,398,133	7,813,522
dryer gas (th)	117,948	130,597	143,245	155,894	168,542	181,191	193,840	206,488	219,137	231,785
range gas (th)	113,213	125,354	137,494	149,635	161,776	173,917	186,057	198,198	210,339	222,480
zone heat (th)	62,066	68,722	75,378	82,034	88,690	95,346	102,002	108,658	115,314	121,970
total gas (th)	6,309,308	6,961,503	7,613,699	8,265,894	8,918,089	9,570,284	10,222,479	10,874,675	11,526,870	12,179,065

**Table C-26. Achievable Potential Base Case Scenario: Annual Cost (\$)**

	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
space heat	\$ 105,373	\$ 319,576	\$ 520,443	\$ 725,535	\$ 733,219	\$ 740,902	\$ 748,586	\$ 756,269	\$ 763,952	\$ 771,636
water heat	\$ 197,975	\$ 616,521	\$ 1,029,687	\$ 1,470,470	\$ 1,520,681	\$ 1,570,892	\$ 1,621,103	\$ 1,671,314	\$ 1,721,525	\$ 1,771,737
dryer	\$ 13,617	\$ 40,850	\$ 65,813	\$ 90,777	\$ 90,777	\$ 90,777	\$ 90,777	\$ 90,777	\$ 90,777	\$ 90,777
range	\$ 15,711	\$ 47,134	\$ 75,938	\$ 104,742	\$ 104,742	\$ 104,742	\$ 104,742	\$ 104,742	\$ 104,742	\$ 104,742
zone heat	\$ 5,790	\$ 17,370	\$ 27,984	\$ 38,599	\$ 38,599	\$ 38,599	\$ 38,599	\$ 38,599	\$ 38,599	\$ 38,599
total	\$ 338,466	\$ 1,041,450	\$ 1,719,866	\$ 2,430,123	\$ 2,488,018	\$ 2,545,912	\$ 2,603,807	\$ 2,661,701	\$ 2,719,596	\$ 2,777,491
Monthly cost (1000\$)	\$ 28.21	\$ 86.79	\$ 143.32	\$ 202.51	\$ 207.33	\$ 212.16	\$ 216.98	\$ 221.81	\$ 226.63	\$ 231.46

	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027
space heat	\$ 779,319	\$ 779,319	\$ 779,319	\$ 779,319	\$ 779,319	\$ 779,319	\$ 779,319	\$ 779,319	\$ 779,319	\$ 779,319
water heat	\$ 1,821,948	\$ 1,821,948	\$ 1,821,948	\$ 1,821,948	\$ 1,821,948	\$ 1,821,948	\$ 1,821,948	\$ 1,821,948	\$ 1,821,948	\$ 1,821,948
dryer	\$ 90,777	\$ 90,777	\$ 90,777	\$ 90,777	\$ 90,777	\$ 90,777	\$ 90,777	\$ 90,777	\$ 90,777	\$ 90,777
range	\$ 104,742	\$ 104,742	\$ 104,742	\$ 104,742	\$ 104,742	\$ 104,742	\$ 104,742	\$ 104,742	\$ 104,742	\$ 104,742
zone heat	\$ 38,599	\$ 38,599	\$ 38,599	\$ 38,599	\$ 38,599	\$ 38,599	\$ 38,599	\$ 38,599	\$ 38,599	\$ 38,599
total	\$ 2,835,385	\$ 2,835,385	\$ 2,835,385	\$ 2,835,385	\$ 2,835,385	\$ 2,835,385	\$ 2,835,385	\$ 2,835,385	\$ 2,835,385	\$ 2,835,385
Monthly cost (1000\$)	\$ 236.28	\$ 236.28	\$ 236.28	\$ 236.28	\$ 236.28	\$ 236.28	\$ 236.28	\$ 236.28	\$ 236.28	\$ 236.28

**Table C-27. Achievable Potential Avoided Cost -10% Scenario: Gas Customers**

	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
water + dryer (# cust)	1050	473	762	1050	1050	1050	1050	1050	1050	1050
water + range (# cust)	1050	473	762	1050	1050	1050	1050	1050	1050	1050
water only (# cust)	35714	16071	25893	35714	35714	35714	35714	35714	35714	35714
water + dryer + range (# cust)	4202	1891	3046	4202	4202	4202	4202	4202	4202	4202
zone heat (# cust)	0	0	0	0	0	0	0	0	0	0
zone + water (# cust)	0	0	0	0	0	0	0	0	0	0
zone + water + dryer (# cust)	497	6	9	12	12	12	12	12	12	12
zone + water + range	0	0	0	0	0	0	0	0	0	0
zone + all (# cust)	497	11	18	25	25	25	25	25	25	25
water heat elec (kWh)	1,107,072	4,428,289	9,779,138	17,159,620	24,540,101	31,920,583	39,301,065	46,681,546	54,062,028	61,442,509
dryer elec (kWh)	42,993	171,971	379,770	666,388	953,007	1,239,625	1,526,244	1,812,862	2,099,481	2,386,100
range elec (kWh)	28,179	112,716	248,914	436,773	624,633	812,493	1,000,352	1,188,212	1,376,071	1,563,931
zone heat (kWh)	1,120	4,480	9,893	17,359	24,825	32,291	39,758	47,224	54,690	62,156
total elec (kWh)	1,179,364	4,717,456	10,417,714	18,280,140	26,142,566	34,004,992	41,867,418	49,729,844	57,592,270	65,454,696
water heat gas (th)	58,986	234,003	512,844	893,137	1,269,114	1,640,775	2,008,120	2,371,149	2,729,862	3,084,259
dryer gas (th)	1,653	6,611	14,599	25,618	36,636	47,654	58,672	69,691	80,709	91,727
range gas (th)	1,586	6,346	14,013	24,589	35,165	45,741	56,317	66,893	77,469	88,045
zone gas (th)	83	333	735	1,290	1,844	2,399	2,954	3,508	4,063	4,618
total gas (th)	62,309	247,292	542,191	944,633	1,342,759	1,736,569	2,126,063	2,511,241	2,892,102	3,268,648

NOTE: Percentages of space heat adoption: (1) zone heat--10%; (2) zone + water--5%; (3) zone + water + dryer--2.5%; (4) zone + water + range--2.5%; (5) zone + all--5%.

	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027
water + dryer (# cust)	1050	1050	1050	1050	1050	1050	1050	1050	1050	1050
water + range (# cust)	1050	1050	1050	1050	1050	1050	1050	1050	1050	1050
water only (# cust)	35714	35714	35714	35714	35714	35714	35714	35714	35714	35714
water + dryer + range (# cust)	4202	4202	4202	4202	4202	4202	4202	4202	4202	4202
zone heat (# cust)	0	0	0	0	0	0	0	0	0	0
zone + water (# cust)	0	0	0	0	0	0	0	0	0	0
zone + water + dryer (# cust)	12	12	12	12	12	12	12	12	12	12
zone + water + range	0	0	0	0	0	0	0	0	0	0
zone + all (# cust)	25	25	25	25	25	25	25	25	25	25
water heat elec (kWh)	68,822,991	76,203,472	83,583,954	90,964,436	98,344,917	105,725,399	113,105,880	120,486,362	127,866,844	135,247,325
dryer elec (kWh)	2,672,718	2,959,337	3,245,955	3,532,574	3,819,192	4,105,811	4,392,430	4,679,048	4,965,667	5,252,285
range elec (kWh)	1,751,790	1,939,650	2,127,510	2,315,369	2,503,229	2,691,088	2,878,948	3,066,807	3,254,667	3,442,527
zone heat (kWh)	69,622	77,089	84,555	92,021	99,487	106,953	114,420	121,886	129,352	136,818
total elec (kWh)	73,317,122	81,179,548	89,041,974	96,904,400	104,766,826	112,629,252	120,491,677	128,354,103	136,216,529	144,078,955
water heat gas (th)	3,434,339	3,784,420	4,134,501	4,484,581	4,834,662	5,184,742	5,534,823	5,884,904	6,234,984	6,585,065
dryer gas (th)	102,745	113,764	124,782	135,800	146,819	157,837	168,855	179,873	190,892	201,910
range gas (th)	98,621	109,197	119,772	130,348	140,924	151,500	162,076	172,652	183,228	193,804
zone gas (th)	5,172	5,727	6,282	6,836	7,391	7,945	8,500	9,055	9,609	10,164
total gas (th)	3,640,877	4,013,107	4,385,337	4,757,566	5,129,796	5,502,025	5,874,255	6,246,484	6,618,714	6,990,943

NOTE: Percentages of space heat adoption: (1) zone heat--10%; (2) zone + water--5%; (3) zone + water + dryer--2.5%; (4) zone + water + range--2.5%; (5) zone + all--5%.

**Table C-28. Achievable Potential Avoided Cost -10% Scenario: Electric-Only Customers**

	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
space heat (# cust)	201	90	145	201	201	201	201	201	201	201
space + water	6261	2817	4539	6261	6261	6261	6261	6261	6261	6261
space + water + dryer	391	176	284	391	391	391	391	391	391	391
space + water + range	391	176	284	391	391	391	391	391	391	391
All	391	176	284	391	391	391	391	391	391	391
space heat elec (kWh)	458,601	1,834,402	4,050,971	7,108,308	10,165,645	13,222,982	16,280,319	19,337,656	22,394,993	25,452,330
water heat elec (kWh)	195,727	782,909	1,728,924	3,033,772	4,338,620	5,643,468	6,948,316	8,253,164	9,558,012	10,862,860
dryer elec (kWh)	6,361	25,445	56,192	98,601	141,010	183,419	225,828	268,237	310,646	353,055
range elec (kWh)	4,179	16,717	36,917	64,779	92,640	120,502	148,364	176,226	204,088	231,950
total electric (kWh)	664,868	2,659,474	5,873,004	10,305,460	14,737,916	19,170,372	23,602,828	28,035,284	32,467,740	36,900,195
space heat gas (th)	31,798	126,893	279,622	489,620	698,956	907,629	1,115,640	1,322,989	1,529,675	1,735,698
water heat gas (th)	10,429	41,371	90,669	157,904	224,376	290,084	355,030	419,212	482,632	545,288
dryer gas (th)	245	978	2,160	3,790	5,421	7,051	8,681	10,312	11,942	13,572
range gas (th)	235	939	2,073	3,638	5,203	6,768	8,333	9,898	11,463	13,027
total gas (th)	42,706	170,181	374,525	654,953	933,956	1,211,533	1,487,684	1,762,410	2,035,711	2,307,586

	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027
space heat (# cust)	201	201	201	201	201	201	201	201	201	201
space + water	6261	6261	6261	6261	6261	6261	6261	6261	6261	6261
space + water + dryer	391	391	391	391	391	391	391	391	391	391
space + water + range	391	391	391	391	391	391	391	391	391	391
All	391	391	391	391	391	391	391	391	391	391
space heat elec (kWh)	28,509,667	31,567,004	34,624,341	37,681,678	40,739,015	43,796,352	46,853,689	49,911,026	52,968,363	56,025,700
water heat elec (kWh)	12,167,709	13,472,557	14,777,405	16,082,253	17,387,101	18,691,949	19,996,797	21,301,645	22,606,493	23,911,341
dryer elec (kWh)	395,464	437,873	480,282	522,691	565,100	607,509	649,918	692,327	734,736	777,145
range elec (kWh)	259,811	287,673	315,535	343,397	371,259	399,120	426,982	454,844	482,706	510,568
total electric (kWh)	41,332,651	45,765,107	50,197,563	54,630,019	59,062,475	63,494,931	67,927,387	72,359,843	76,792,299	81,224,754
space heat gas (th)	1,941,059	2,146,420	2,351,781	2,557,142	2,762,503	2,967,864	3,173,225	3,378,586	3,583,947	3,789,308
water heat gas (th)	607,181	669,075	730,968	792,861	854,754	916,648	978,541	1,040,434	1,102,327	1,164,221
dryer gas (th)	15,203	16,833	18,463	20,093	21,724	23,354	24,984	26,615	28,245	29,875
range gas (th)	14,592	16,157	17,722	19,287	20,852	22,416	23,981	25,546	27,111	28,676
total gas (th)	2,578,035	2,848,485	3,118,934	3,389,383	3,659,833	3,930,282	4,200,732	4,471,181	4,741,630	5,012,080

**Table C-29. Achievable Potential Avoided Cost -10% Scenario: All Customers**

	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
space heat elec (kWh)	458,601	1,834,402	4,050,971	7,108,308	10,165,645	13,222,982	16,280,319	19,337,656	22,394,993	25,452,330
water heat elec (kWh)	1,302,799	5,211,198	11,508,062	20,193,392	28,878,721	37,564,051	46,249,381	54,934,710	63,620,040	72,305,370
dryer elec (kWh)	49,354	197,417	435,962	764,989	1,094,017	1,423,044	1,752,072	2,081,100	2,410,127	2,739,155
range elec (kWh)	32,358	129,433	285,831	501,552	717,274	932,995	1,148,716	1,364,438	1,580,159	1,795,880
zone heat (kWh)	1,120	4,480	9,893	17,359	24,825	32,291	39,758	47,224	54,690	62,156
total electric (kWh)	1,844,232	7,376,929	16,290,718	28,585,600	40,880,482	53,175,364	65,470,246	77,765,128	90,060,009	102,354,891
space heat gas (th)	31,798	126,893	279,622	489,620	698,956	907,629	1,115,640	1,322,989	1,529,675	1,735,698
water heat gas (th)	69,415	275,374	603,514	1,051,041	1,493,490	1,930,860	2,363,150	2,790,361	3,212,494	3,629,547
dryer gas (th)	1,897	7,589	16,759	29,408	42,057	54,705	67,354	80,002	92,651	105,299
range gas (th)	1,821	7,284	16,087	28,227	40,368	52,509	64,650	76,790	88,931	101,072
zone heat (th)	83	333	735	1,290	1,844	2,399	2,954	3,508	4,063	4,618
total gas (th)	105,014	417,473	916,717	1,599,587	2,276,715	2,948,102	3,613,747	4,273,651	4,927,813	5,576,234

	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027
space heat elec (kWh)	28,509,667	31,567,004	34,624,341	37,681,678	40,739,015	43,796,352	46,853,689	49,911,026	52,968,363	56,025,700
water heat elec (kWh)	80,990,699	89,676,029	98,361,359	107,046,689	115,732,018	124,417,348	133,102,678	141,788,007	150,473,337	159,158,667
dryer elec (kWh)	3,068,182	3,397,210	3,726,238	4,055,265	4,384,293	4,713,320	5,042,348	5,371,376	5,700,403	6,029,431
range elec (kWh)	2,011,602	2,227,323	2,443,044	2,658,766	2,874,487	3,090,209	3,305,930	3,521,651	3,737,373	3,953,094
zone heat (kWh)	69,622	77,089	84,555	92,021	99,487	106,953	114,420	121,886	129,352	136,818
total electric (kWh)	114,649,773	126,944,655	139,239,537	151,534,419	163,829,301	176,124,182	188,419,064	200,713,946	213,008,828	225,303,710
space heat gas (th)	1,941,059	2,146,420	2,351,781	2,557,142	2,762,503	2,967,864	3,173,225	3,378,586	3,583,947	3,789,308
water heat gas (th)	4,041,521	4,453,494	4,865,468	5,277,442	5,689,416	6,101,390	6,513,364	6,925,338	7,337,312	7,749,286
dryer gas (th)	117,948	130,597	143,245	155,894	168,542	181,191	193,840	206,488	219,137	231,785
range gas (th)	113,213	125,354	137,494	149,635	161,776	173,917	186,057	198,198	210,339	222,480
zone heat (th)	5,172	5,727	6,282	6,836	7,391	7,945	8,500	9,055	9,609	10,164
total gas (th)	6,218,913	6,861,592	7,504,271	8,146,949	8,789,628	9,432,307	10,074,986	10,717,665	11,360,344	12,003,023

**Table C-30. Achievable Potential Avoided Cost -10% Scenario: Annual Cost (\$)**

	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
space heat	\$ 105,373	\$ 319,576	\$ 520,443	\$ 725,535	\$ 733,219	\$ 740,902	\$ 748,586	\$ 756,269	\$ 763,952	\$ 771,636
water heat	\$ 196,348	\$ 611,453	\$ 1,021,222	\$ 1,458,381	\$ 1,508,179	\$ 1,557,977	\$ 1,607,776	\$ 1,657,574	\$ 1,707,373	\$ 1,757,171
dryer	\$ 13,617	\$ 40,850	\$ 65,813	\$ 90,777	\$ 90,777	\$ 90,777	\$ 90,777	\$ 90,777	\$ 90,777	\$ 90,777
range	\$ 15,679	\$ 47,038	\$ 75,783	\$ 104,528	\$ 104,528	\$ 104,528	\$ 104,528	\$ 104,528	\$ 104,528	\$ 104,528
zone heat	\$ 482	\$ 1,447	\$ 2,332	\$ 3,217	\$ 3,217	\$ 3,217	\$ 3,217	\$ 3,217	\$ 3,217	\$ 3,217
total	\$ 331,499	\$ 1,020,363	\$ 1,685,593	\$ 2,382,437	\$ 2,439,919	\$ 2,497,401	\$ 2,554,883	\$ 2,612,364	\$ 2,669,846	\$ 2,727,328
Monthly cost (1000\$)	\$ 27.62	\$ 85.03	\$ 140.47	\$ 198.54	\$ 203.33	\$ 208.12	\$ 212.91	\$ 217.70	\$ 222.49	\$ 227.28

	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027
space heat	\$ 779,319	\$ 779,319	\$ 779,319	\$ 779,319	\$ 779,319	\$ 779,319	\$ 779,319	\$ 779,319	\$ 779,319	\$ 779,319
water heat	\$ 1,806,969	\$ 1,806,969	\$ 1,806,969	\$ 1,806,969	\$ 1,806,969	\$ 1,806,969	\$ 1,806,969	\$ 1,806,969	\$ 1,806,969	\$ 1,806,969
dryer	\$ 90,777	\$ 90,777	\$ 90,777	\$ 90,777	\$ 90,777	\$ 90,777	\$ 90,777	\$ 90,777	\$ 90,777	\$ 90,777
range	\$ 104,528	\$ 104,528	\$ 104,528	\$ 104,528	\$ 104,528	\$ 104,528	\$ 104,528	\$ 104,528	\$ 104,528	\$ 104,528
zone heat	\$ 3,217	\$ 3,217	\$ 3,217	\$ 3,217	\$ 3,217	\$ 3,217	\$ 3,217	\$ 3,217	\$ 3,217	\$ 3,217
total	\$ 2,784,810	\$ 2,784,810	\$ 2,784,810	\$ 2,784,810	\$ 2,784,810	\$ 2,784,810	\$ 2,784,810	\$ 2,784,810	\$ 2,784,810	\$ 2,784,810
Monthly cost (1000\$)	\$ 232.07	\$ 232.07	\$ 232.07	\$ 232.07	\$ 232.07	\$ 232.07	\$ 232.07	\$ 232.07	\$ 232.07	\$ 232.07



**Table C-31. Achievable Potential Avoided Cost +25% Scenario: Gas Customers**

	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
water + dryer (# cust)	1050	473	762	1050	1050	1050	1050	1050	1050	1050
water + range (# cust)	1050	473	762	1050	1050	1050	1050	1050	1050	1050
water only (# cust)	35714	16071	25893	35714	35714	35714	35714	35714	35714	35714
water + dryer + range (# cust)	4202	1891	3046	4202	4202	4202	4202	4202	4202	4202
zone heat (# cust)	0	0	0	0	0	0	0	0	0	0
zone + water (# cust)	7956	179	288	398	398	398	398	398	398	398
zone + water + dryer (# cust)	497	6	9	12	12	12	12	12	12	12
zone + water + range	497	6	9	12	12	12	12	12	12	12
zone + all (# cust)	497	11	18	25	25	25	25	25	25	25
water heat elec (kWh)	1,117,872	4,471,486	9,874,532	17,327,009	24,779,487	32,231,964	39,684,441	47,136,918	54,589,395	62,041,873
dryer elec (kWh)	42,993	171,971	379,770	666,388	953,007	1,239,625	1,526,244	1,812,862	2,099,481	2,386,100
range elec (kWh)	28,245	112,981	249,500	437,802	626,105	814,407	1,002,709	1,191,011	1,379,313	1,567,615
zone heat (kWh)	13,439	53,757	118,713	208,307	297,902	387,496	477,091	566,685	656,280	745,874
total elec (kWh)	1,202,549	4,810,195	10,622,515	18,639,507	26,656,500	34,673,492	42,690,484	50,707,477	58,724,469	66,741,461
water heat gas (th)	59,562	236,285	517,847	901,850	1,281,494	1,656,781	2,027,709	2,394,279	2,756,491	3,114,345
dryer gas (th)	1,653	6,611	14,599	25,618	36,636	47,654	58,672	69,691	80,709	91,727
range gas (th)	1,586	6,346	14,013	24,589	35,165	45,741	56,317	66,893	77,469	88,045
zone gas (th)	998	3,994	8,819	15,475	22,131	28,787	35,443	42,099	48,755	55,410
total gas (th)	63,799	253,235	555,278	967,531	1,375,426	1,778,963	2,178,141	2,572,961	2,963,423	3,349,527

NOTE: Percentages of space heat adoption: (1) zone heat--10%; (2) zone + water--5%; (3) zone + water + dryer--2.5%; (4) zone + water + range--2.5%; (5) zone + all--5%.

	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027
water + dryer (# cust)	1050	1050	1050	1050	1050	1050	1050	1050	1050	1050
water + range (# cust)	1050	1050	1050	1050	1050	1050	1050	1050	1050	1050
water only (# cust)	35714	35714	35714	35714	35714	35714	35714	35714	35714	35714
water + dryer + range (# cust)	4202	4202	4202	4202	4202	4202	4202	4202	4202	4202
zone heat (# cust)	0	0	0	0	0	0	0	0	0	0
zone + water (# cust)	398	398	398	398	398	398	398	398	398	398
zone + water + dryer (# cust)	12	12	12	12	12	12	12	12	12	12
zone + water + range	12	12	12	12	12	12	12	12	12	12
zone + all (# cust)	25	25	25	25	25	25	25	25	25	25
water heat elec (kWh)	69,494,350	76,946,827	84,399,304	91,851,781	99,304,258	106,756,736	114,209,213	121,661,690	129,114,167	136,566,644
dryer elec (kWh)	2,672,718	2,959,337	3,245,955	3,532,574	3,819,192	4,105,811	4,392,430	4,679,048	4,965,667	5,252,285
range elec (kWh)	1,755,917	1,944,219	2,132,521	2,320,824	2,509,126	2,697,428	2,885,730	3,074,032	3,262,334	3,450,636
zone heat (kWh)	835,469	925,063	1,014,658	1,104,252	1,193,847	1,283,441	1,373,036	1,462,630	1,552,225	1,641,819
total elec (kWh)	74,758,454	82,775,446	90,792,439	98,809,431	106,826,423	114,843,416	122,860,408	130,877,400	138,894,393	146,911,385
water heat gas (th)	3,467,841	3,821,336	4,174,832	4,528,328	4,881,823	5,235,319	5,588,815	5,942,310	6,295,806	6,649,302
dryer gas (th)	102,745	113,764	124,782	135,800	146,819	157,837	168,855	179,873	190,892	201,910
range gas (th)	98,621	109,197	119,772	130,348	140,924	151,500	162,076	172,652	183,228	193,804
zone gas (th)	62,066	68,722	75,378	82,034	88,690	95,346	102,002	108,658	115,314	121,970
total gas (th)	3,731,273	4,113,019	4,494,765	4,876,510	5,258,256	5,640,002	6,021,748	6,403,494	6,785,239	7,166,985

NOTE: Percentages of space heat adoption: (1) zone heat--10%; (2) zone + water--5%; (3) zone + water + dryer--2.5%; (4) zone + water + range--2.5%; (5) zone + all--5%.

**Table C-32. Achievable Potential Avoided Cost +25% Scenario: Electric-Only Customers**

	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
space heat (# cust)	201	90	145	201	201	201	201	201	201	201
space + water	6261	2817	4539	6261	6261	6261	6261	6261	6261	6261
space + water + dryer	391	176	284	391	391	391	391	391	391	391
space + water + range	391	176	284	391	391	391	391	391	391	391
All	391	176	284	391	391	391	391	391	391	391
space heat elec (kWh)	458,601	1,834,402	4,050,971	7,108,308	10,165,645	13,222,982	16,280,319	19,337,656	22,394,993	25,452,330
water heat elec (kWh)	195,727	782,909	1,728,924	3,033,772	4,338,620	5,643,468	6,948,316	8,253,164	9,558,012	10,862,860
dryer elec (kWh)	6,361	25,445	56,192	98,601	141,010	183,419	225,828	268,237	310,646	353,055
range elec (kWh)	4,179	16,717	36,917	64,779	92,640	120,502	148,364	176,226	204,088	231,950
total electric (kWh)	664,868	2,659,474	5,873,004	10,305,460	14,737,916	19,170,372	23,602,828	28,035,284	32,467,740	36,900,195
space heat gas (th)	31,798	126,893	279,622	489,620	698,956	907,629	1,115,640	1,322,989	1,529,675	1,735,698
water heat gas (th)	10,429	41,371	90,669	157,904	224,376	290,084	355,030	419,212	482,632	545,288
dryer gas (th)	245	978	2,160	3,790	5,421	7,051	8,681	10,312	11,942	13,572
range gas (th)	235	939	2,073	3,638	5,203	6,768	8,333	9,898	11,463	13,027
total gas (th)	42,706	170,181	374,525	654,953	933,956	1,211,533	1,487,684	1,762,410	2,035,711	2,307,586

	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027
space heat (# cust)	201	201	201	201	201	201	201	201	201	201
space + water	6261	6261	6261	6261	6261	6261	6261	6261	6261	6261
space + water + dryer	391	391	391	391	391	391	391	391	391	391
space + water + range	391	391	391	391	391	391	391	391	391	391
All	391	391	391	391	391	391	391	391	391	391
space heat elec (kWh)	28,509,667	31,567,004	34,624,341	37,681,678	40,739,015	43,796,352	46,853,689	49,911,026	52,968,363	56,025,700
water heat elec (kWh)	12,167,709	13,472,557	14,777,405	16,082,253	17,387,101	18,691,949	19,996,797	21,301,645	22,606,493	23,911,341
dryer elec (kWh)	395,464	437,873	480,282	522,691	565,100	607,509	649,918	692,327	734,736	777,145
range elec (kWh)	259,811	287,673	315,535	343,397	371,259	399,120	426,982	454,844	482,706	510,568
total electric (kWh)	41,332,651	45,765,107	50,197,563	54,630,019	59,062,475	63,494,931	67,927,387	72,359,843	76,792,299	81,224,754
space heat gas (th)	1,941,059	2,146,420	2,351,781	2,557,142	2,762,503	2,967,864	3,173,225	3,378,586	3,583,947	3,789,308
water heat gas (th)	607,181	669,075	730,968	792,861	854,754	916,648	978,541	1,040,434	1,102,327	1,164,221
dryer gas (th)	15,203	16,833	18,463	20,093	21,724	23,354	24,984	26,615	28,245	29,875
range gas (th)	14,592	16,157	17,722	19,287	20,852	22,416	23,981	25,546	27,111	28,676
total gas (th)	2,578,035	2,848,485	3,118,934	3,389,383	3,659,833	3,930,282	4,200,732	4,471,181	4,741,630	5,012,080

**Table C-33. Achievable Potential Avoided Cost +25% Scenario: All Customers**

	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
space heat elec (kWh)	458,601	1,834,402	4,050,971	7,108,308	10,165,645	13,222,982	16,280,319	19,337,656	22,394,993	25,452,330
water heat elec (kWh)	1,313,599	5,254,395	11,603,456	20,360,781	29,118,107	37,875,432	46,632,757	55,390,082	64,147,408	72,904,733
dryer elec (kWh)	49,354	197,417	435,962	764,989	1,094,017	1,423,044	1,752,072	2,081,100	2,410,127	2,739,155
range elec (kWh)	32,425	129,698	286,417	502,581	718,745	934,909	1,151,073	1,367,237	1,583,401	1,799,565
zone heat (kWh)	13,439	53,757	118,713	208,307	297,902	387,496	477,091	566,685	656,280	745,874
total electric (kWh)	1,867,417	7,469,669	16,495,519	28,944,967	41,394,416	53,843,864	66,293,312	78,742,760	91,192,209	103,641,657
space heat gas (th)	31,798	126,893	279,622	489,620	698,956	907,629	1,115,640	1,322,989	1,529,675	1,735,698
water heat gas (th)	69,990	277,656	608,516	1,059,754	1,505,870	1,946,865	2,382,739	2,813,492	3,239,123	3,659,633
dryer gas (th)	1,897	7,589	16,759	29,408	42,057	54,705	67,354	80,002	92,651	105,299
range gas (th)	1,821	7,284	16,087	28,227	40,368	52,509	64,650	76,790	88,931	101,072
zone heat (th)	998	3,994	8,819	15,475	22,131	28,787	35,443	42,099	48,755	55,410
total gas (th)	106,505	423,417	929,803	1,622,484	2,309,382	2,990,495	3,665,825	4,335,372	4,999,134	5,657,113

	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027
space heat elec (kWh)	28,509,667	31,567,004	34,624,341	37,681,678	40,739,015	43,796,352	46,853,689	49,911,026	52,968,363	56,025,700
water heat elec (kWh)	81,662,058	90,419,384	99,176,709	107,934,034	116,691,359	125,448,685	134,206,010	142,963,335	151,720,661	160,477,986
dryer elec (kWh)	3,068,182	3,397,210	3,726,238	4,055,265	4,384,293	4,713,320	5,042,348	5,371,376	5,700,403	6,029,431
range elec (kWh)	2,015,729	2,231,892	2,448,056	2,664,220	2,880,384	3,096,548	3,312,712	3,528,876	3,745,040	3,961,204
zone heat (kWh)	835,469	925,063	1,014,658	1,104,252	1,193,847	1,283,441	1,373,036	1,462,630	1,552,225	1,641,819
total electric (kWh)	116,091,105	128,540,553	140,990,002	153,439,450	165,888,898	178,338,347	190,787,795	203,237,243	215,686,691	228,136,140
space heat gas (th)	1,941,059	2,146,420	2,351,781	2,557,142	2,762,503	2,967,864	3,173,225	3,378,586	3,583,947	3,789,308
water heat gas (th)	4,075,022	4,490,411	4,905,800	5,321,189	5,736,578	6,151,967	6,567,356	6,982,744	7,398,133	7,813,522
dryer gas (th)	117,948	130,597	143,245	155,894	168,542	181,191	193,840	206,488	219,137	231,785
range gas (th)	113,213	125,354	137,494	149,635	161,776	173,917	186,057	198,198	210,339	222,480
zone heat (th)	62,066	68,722	75,378	82,034	88,690	95,346	102,002	108,658	115,314	121,970
total gas (th)	6,309,308	6,961,503	7,613,699	8,265,894	8,918,089	9,570,284	10,222,479	10,874,675	11,526,870	12,179,065

**Table C-34. Achievable Potential Avoided Cost +25% Scenario: Annual Cost (\$)**

	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
space heat	\$ 105,373	\$ 319,576	\$ 520,443	\$ 725,535	\$ 733,219	\$ 740,902	\$ 748,586	\$ 756,269	\$ 763,952	\$ 771,636
water heat	\$ 197,975	\$ 616,521	\$ 1,029,687	\$ 1,470,470	\$ 1,520,681	\$ 1,570,892	\$ 1,621,103	\$ 1,671,314	\$ 1,721,525	\$ 1,771,737
dryer	\$ 13,617	\$ 40,850	\$ 65,813	\$ 90,777	\$ 90,777	\$ 90,777	\$ 90,777	\$ 90,777	\$ 90,777	\$ 90,777
range	\$ 15,711	\$ 47,134	\$ 75,938	\$ 104,742	\$ 104,742	\$ 104,742	\$ 104,742	\$ 104,742	\$ 104,742	\$ 104,742
zone heat	\$ 5,790	\$ 17,370	\$ 27,984	\$ 38,599	\$ 38,599	\$ 38,599	\$ 38,599	\$ 38,599	\$ 38,599	\$ 38,599
total	\$ 338,466	\$ 1,041,450	\$ 1,719,866	\$ 2,430,123	\$ 2,488,018	\$ 2,545,912	\$ 2,603,807	\$ 2,661,701	\$ 2,719,596	\$ 2,777,491
Monthly cost (1000\$)	\$ 28.21	\$ 86.79	\$ 143.32	\$ 202.51	\$ 207.33	\$ 212.16	\$ 216.98	\$ 221.81	\$ 226.63	\$ 231.46

	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027
space heat	\$ 779,319	\$ 779,319	\$ 779,319	\$ 779,319	\$ 779,319	\$ 779,319	\$ 779,319	\$ 779,319	\$ 779,319	\$ 779,319
water heat	\$ 1,821,948	\$ 1,821,948	\$ 1,821,948	\$ 1,821,948	\$ 1,821,948	\$ 1,821,948	\$ 1,821,948	\$ 1,821,948	\$ 1,821,948	\$ 1,821,948
dryer	\$ 90,777	\$ 90,777	\$ 90,777	\$ 90,777	\$ 90,777	\$ 90,777	\$ 90,777	\$ 90,777	\$ 90,777	\$ 90,777
range	\$ 104,742	\$ 104,742	\$ 104,742	\$ 104,742	\$ 104,742	\$ 104,742	\$ 104,742	\$ 104,742	\$ 104,742	\$ 104,742
zone heat	\$ 38,599	\$ 38,599	\$ 38,599	\$ 38,599	\$ 38,599	\$ 38,599	\$ 38,599	\$ 38,599	\$ 38,599	\$ 38,599
total	\$ 2,835,385	\$ 2,835,385	\$ 2,835,385	\$ 2,835,385	\$ 2,835,385	\$ 2,835,385	\$ 2,835,385	\$ 2,835,385	\$ 2,835,385	\$ 2,835,385
Monthly cost (1000\$)	\$ 236.28	\$ 236.28	\$ 236.28	\$ 236.28	\$ 236.28	\$ 236.28	\$ 236.28	\$ 236.28	\$ 236.28	\$ 236.28

**Table C-35. Achievable Potential Avoided Cost Green World Scenario: Gas Customers**

	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
water + dryer (# cust)	1050	473	762	1050	1050	1050	1050	1050	1050	1050
water + range (# cust)	1050	473	762	1050	1050	1050	1050	1050	1050	1050
water only (# cust)	35714	16071	25893	35714	35714	35714	35714	35714	35714	35714
water + dryer + range (# cust)	4202	1891	3046	4202	4202	4202	4202	4202	4202	4202
zone heat (# cust)	0	0	0	0	0	0	0	0	0	0
zone + water (# cust)	7956	179	288	398	398	398	398	398	398	398
zone + water + dryer (# cust)	497	6	9	12	12	12	12	12	12	12
zone + water + range	497	6	9	12	12	12	12	12	12	12
zone + all (# cust)	497	11	18	25	25	25	25	25	25	25
water heat elec (kWh)	1,117,872	4,471,486	9,874,532	17,327,009	24,779,487	32,231,964	39,684,441	47,136,918	54,589,395	62,041,873
dryer elec (kWh)	42,993	171,971	379,770	666,388	953,007	1,239,625	1,526,244	1,812,862	2,099,481	2,386,100
range elec (kWh)	28,245	112,981	249,500	437,802	626,105	814,407	1,002,709	1,191,011	1,379,313	1,567,615
zone heat (kWh)	13,439	53,757	118,713	208,307	297,902	387,496	477,091	566,685	656,280	745,874
total elec (kWh)	1,202,549	4,810,195	10,622,515	18,639,507	26,656,500	34,673,492	42,690,484	50,707,477	58,724,469	66,741,461
water heat gas (th)	59,562	236,285	517,847	901,850	1,281,494	1,656,781	2,027,709	2,394,279	2,756,491	3,114,345
dryer gas (th)	1,653	6,611	14,599	25,618	36,636	47,654	58,672	69,691	80,709	91,727
range gas (th)	1,586	6,346	14,013	24,589	35,165	45,741	56,317	66,893	77,469	88,045
zone gas (th)	998	3,994	8,819	15,475	22,131	28,787	35,443	42,099	48,755	55,410
total gas (th)	63,799	253,235	555,278	967,531	1,375,426	1,778,963	2,178,141	2,572,961	2,963,423	3,349,527

NOTE: Percentages of space heat adoption: (1) zone heat--10%; (2) zone + water--5%; (3) zone + water + dryer--2.5%; (4) zone + water + range--2.5%; (5) zone + all--5%.

	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027
water + dryer (# cust)	1050	1050	1050	1050	1050	1050	1050	1050	1050	1050
water + range (# cust)	1050	1050	1050	1050	1050	1050	1050	1050	1050	1050
water only (# cust)	35714	35714	35714	35714	35714	35714	35714	35714	35714	35714
water + dryer + range (# cust)	4202	4202	4202	4202	4202	4202	4202	4202	4202	4202
zone heat (# cust)	0	0	0	0	0	0	0	0	0	0
zone + water (# cust)	398	398	398	398	398	398	398	398	398	398
zone + water + dryer (# cust)	12	12	12	12	12	12	12	12	12	12
zone + water + range	12	12	12	12	12	12	12	12	12	12
zone + all (# cust)	25	25	25	25	25	25	25	25	25	25
water heat elec (kWh)	69,494,350	76,946,827	84,399,304	91,851,781	99,304,258	106,756,736	114,209,213	121,661,690	129,114,167	136,566,644
dryer elec (kWh)	2,672,718	2,959,337	3,245,955	3,532,574	3,819,192	4,105,811	4,392,430	4,679,048	4,965,667	5,252,285
range elec (kWh)	1,755,917	1,944,219	2,132,521	2,320,824	2,509,126	2,697,428	2,885,730	3,074,032	3,262,334	3,450,636
zone heat (kWh)	835,469	925,063	1,014,658	1,104,252	1,193,847	1,283,441	1,373,036	1,462,630	1,552,225	1,641,819
total elec (kWh)	74,758,454	82,775,446	90,792,439	98,809,431	106,826,423	114,843,416	122,860,408	130,877,400	138,894,393	146,911,385
water heat gas (th)	3,467,841	3,821,336	4,174,832	4,528,328	4,881,823	5,235,319	5,588,815	5,942,310	6,295,806	6,649,302
dryer gas (th)	102,745	113,764	124,782	135,800	146,819	157,837	168,855	179,873	190,892	201,910
range gas (th)	98,621	109,197	119,772	130,348	140,924	151,500	162,076	172,652	183,228	193,804
zone gas (th)	62,066	68,722	75,378	82,034	88,690	95,346	102,002	108,658	115,314	121,970
total gas (th)	3,731,273	4,113,019	4,494,765	4,876,510	5,258,256	5,640,002	6,021,748	6,403,494	6,785,239	7,166,985

NOTE: Percentages of space heat adoption: (1) zone heat--10%; (2) zone + water--5%; (3) zone + water + dryer--2.5%; (4) zone + water + range--2.5%; (5) zone + all--5%.

**Table C-36. Achievable Potential Avoided Cost Green World Scenario: Electric-Only Customers**

	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
space heat (# cust)	201	90	145	201	201	201	201	201	201	201
space + water	6261	2817	4539	6261	6261	6261	6261	6261	6261	6261
space + water + dryer	391	176	284	391	391	391	391	391	391	391
space + water + range	391	176	284	391	391	391	391	391	391	391
All	391	176	284	391	391	391	391	391	391	391
space heat elec (kWh)	458,601	1,834,402	4,050,971	7,108,308	10,165,645	13,222,982	16,280,319	19,337,656	22,394,993	25,452,330
water heat elec (kWh)	195,727	782,909	1,728,924	3,033,772	4,338,620	5,643,468	6,948,316	8,253,164	9,558,012	10,862,860
dryer elec (kWh)	6,361	25,445	56,192	98,601	141,010	183,419	225,828	268,237	310,646	353,055
range elec (kWh)	4,179	16,717	36,917	64,779	92,640	120,502	148,364	176,226	204,088	231,950
total electric (kWh)	664,868	2,659,474	5,873,004	10,305,460	14,737,916	19,170,372	23,602,828	28,035,284	32,467,740	36,900,195
space heat gas (th)	31,798	126,893	279,622	489,620	698,956	907,629	1,115,640	1,322,989	1,529,675	1,735,698
water heat gas (th)	10,429	41,371	90,669	157,904	224,376	290,084	355,030	419,212	482,632	545,288
dryer gas (th)	245	978	2,160	3,790	5,421	7,051	8,681	10,312	11,942	13,572
range gas (th)	235	939	2,073	3,638	5,203	6,768	8,333	9,898	11,463	13,027
total gas (th)	42,706	170,181	374,525	654,953	933,956	1,211,533	1,487,684	1,762,410	2,035,711	2,307,586

	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027
space heat (# cust)	201	201	201	201	201	201	201	201	201	201
space + water	6261	6261	6261	6261	6261	6261	6261	6261	6261	6261
space + water + dryer	391	391	391	391	391	391	391	391	391	391
space + water + range	391	391	391	391	391	391	391	391	391	391
All	391	391	391	391	391	391	391	391	391	391
space heat elec (kWh)	28,509,667	31,567,004	34,624,341	37,681,678	40,739,015	43,796,352	46,853,689	49,911,026	52,968,363	56,025,700
water heat elec (kWh)	12,167,709	13,472,557	14,777,405	16,082,253	17,387,101	18,691,949	19,996,797	21,301,645	22,606,493	23,911,341
dryer elec (kWh)	395,464	437,873	480,282	522,691	565,100	607,509	649,918	692,327	734,736	777,145
range elec (kWh)	259,811	287,673	315,535	343,397	371,259	399,120	426,982	454,844	482,706	510,568
total electric (kWh)	41,332,651	45,765,107	50,197,563	54,630,019	59,062,475	63,494,931	67,927,387	72,359,843	76,792,299	81,224,754
space heat gas (th)	1,941,059	2,146,420	2,351,781	2,557,142	2,762,503	2,967,864	3,173,225	3,378,586	3,583,947	3,789,308
water heat gas (th)	607,181	669,075	730,968	792,861	854,754	916,648	978,541	1,040,434	1,102,327	1,164,221
dryer gas (th)	15,203	16,833	18,463	20,093	21,724	23,354	24,984	26,615	28,245	29,875
range gas (th)	14,592	16,157	17,722	19,287	20,852	22,416	23,981	25,546	27,111	28,676
total gas (th)	2,578,035	2,848,485	3,118,934	3,389,383	3,659,833	3,930,282	4,200,732	4,471,181	4,741,630	5,012,080

**Table C-37. Achievable Potential Avoided Cost Green World Scenario: All Customers**

	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
space heat elec (kWh)	458,601	1,834,402	4,050,971	7,108,308	10,165,645	13,222,982	16,280,319	19,337,656	22,394,993	25,452,330
water heat elec (kWh)	1,313,599	5,254,395	11,603,456	20,360,781	29,118,107	37,875,432	46,632,757	55,390,082	64,147,408	72,904,733
dryer elec (kWh)	49,354	197,417	435,962	764,989	1,094,017	1,423,044	1,752,072	2,081,100	2,410,127	2,739,155
range elec (kWh)	32,425	129,698	286,417	502,581	718,745	934,909	1,151,073	1,367,237	1,583,401	1,799,565
zone heat (kWh)	13,439	53,757	118,713	208,307	297,902	387,496	477,091	566,685	656,280	745,874
total electric (kWh)	1,867,417	7,469,669	16,495,519	28,944,967	41,394,416	53,843,864	66,293,312	78,742,760	91,192,209	103,641,657
space heat gas (th)	31,798	126,893	279,622	489,620	698,956	907,629	1,115,640	1,322,989	1,529,675	1,735,698
water heat gas (th)	69,990	277,656	608,516	1,059,754	1,505,870	1,946,865	2,382,739	2,813,492	3,239,123	3,659,633
dryer gas (th)	1,897	7,589	16,759	29,408	42,057	54,705	67,354	80,002	92,651	105,299
range gas (th)	1,821	7,284	16,087	28,227	40,368	52,509	64,650	76,790	88,931	101,072
zone heat (th)	998	3,994	8,819	15,475	22,131	28,787	35,443	42,099	48,755	55,410
total gas (th)	106,505	423,417	929,803	1,622,484	2,309,382	2,990,495	3,665,825	4,335,372	4,999,134	5,657,113

	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027
space heat elec (kWh)	28,509,667	31,567,004	34,624,341	37,681,678	40,739,015	43,796,352	46,853,689	49,911,026	52,968,363	56,025,700
water heat elec (kWh)	81,662,058	90,419,384	99,176,709	107,934,034	116,691,359	125,448,685	134,206,010	142,963,335	151,720,661	160,477,986
dryer elec (kWh)	3,068,182	3,397,210	3,726,238	4,055,265	4,384,293	4,713,320	5,042,348	5,371,376	5,700,403	6,029,431
range elec (kWh)	2,015,729	2,231,892	2,448,056	2,664,220	2,880,384	3,096,548	3,312,712	3,528,876	3,745,040	3,961,204
zone heat (kWh)	835,469	925,063	1,014,658	1,104,252	1,193,847	1,283,441	1,373,036	1,462,630	1,552,225	1,641,819
total electric (kWh)	116,091,105	128,540,553	140,990,002	153,439,450	165,888,898	178,338,347	190,787,795	203,237,243	215,686,691	228,136,140
space heat gas (th)	1,941,059	2,146,420	2,351,781	2,557,142	2,762,503	2,967,864	3,173,225	3,378,586	3,583,947	3,789,308
water heat gas (th)	4,075,022	4,490,411	4,905,800	5,321,189	5,736,578	6,151,967	6,567,356	6,982,744	7,398,133	7,813,522
dryer gas (th)	117,948	130,597	143,245	155,894	168,542	181,191	193,840	206,488	219,137	231,785
range gas (th)	113,213	125,354	137,494	149,635	161,776	173,917	186,057	198,198	210,339	222,480
zone heat (th)	62,066	68,722	75,378	82,034	88,690	95,346	102,002	108,658	115,314	121,970
total gas (th)	6,309,308	6,961,503	7,613,699	8,265,894	8,918,089	9,570,284	10,222,479	10,874,675	11,526,870	12,179,065

**Table C-38. Achievable Potential Avoided Cost Green World Scenario: Annual Cost (\$)**

	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
space heat	\$ 105,373	\$ 319,576	\$ 520,443	\$ 725,535	\$ 733,219	\$ 740,902	\$ 748,586	\$ 756,269	\$ 763,952	\$ 771,636
water heat	\$ 197,975	\$ 616,521	\$ 1,029,687	\$ 1,470,470	\$ 1,520,681	\$ 1,570,892	\$ 1,621,103	\$ 1,671,314	\$ 1,721,525	\$ 1,771,737
dryer	\$ 13,617	\$ 40,850	\$ 65,813	\$ 90,777	\$ 90,777	\$ 90,777	\$ 90,777	\$ 90,777	\$ 90,777	\$ 90,777
range	\$ 15,711	\$ 47,134	\$ 75,938	\$ 104,742	\$ 104,742	\$ 104,742	\$ 104,742	\$ 104,742	\$ 104,742	\$ 104,742
zone heat	\$ 5,790	\$ 17,370	\$ 27,984	\$ 38,599	\$ 38,599	\$ 38,599	\$ 38,599	\$ 38,599	\$ 38,599	\$ 38,599
total	\$ 338,466	\$ 1,041,450	\$ 1,719,866	\$ 2,430,123	\$ 2,488,018	\$ 2,545,912	\$ 2,603,807	\$ 2,661,701	\$ 2,719,596	\$ 2,777,491
Monthly cost (1000\$)	\$ 28.21	\$ 86.79	\$ 143.32	\$ 202.51	\$ 207.33	\$ 212.16	\$ 216.98	\$ 221.81	\$ 226.63	\$ 231.46

	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027
space heat	\$ 779,319	\$ 779,319	\$ 779,319	\$ 779,319	\$ 779,319	\$ 779,319	\$ 779,319	\$ 779,319	\$ 779,319	\$ 779,319
water heat	\$ 1,821,948	\$ 1,821,948	\$ 1,821,948	\$ 1,821,948	\$ 1,821,948	\$ 1,821,948	\$ 1,821,948	\$ 1,821,948	\$ 1,821,948	\$ 1,821,948
dryer	\$ 90,777	\$ 90,777	\$ 90,777	\$ 90,777	\$ 90,777	\$ 90,777	\$ 90,777	\$ 90,777	\$ 90,777	\$ 90,777
range	\$ 104,742	\$ 104,742	\$ 104,742	\$ 104,742	\$ 104,742	\$ 104,742	\$ 104,742	\$ 104,742	\$ 104,742	\$ 104,742
zone heat	\$ 38,599	\$ 38,599	\$ 38,599	\$ 38,599	\$ 38,599	\$ 38,599	\$ 38,599	\$ 38,599	\$ 38,599	\$ 38,599
total	\$ 2,835,385	\$ 2,835,385	\$ 2,835,385	\$ 2,835,385	\$ 2,835,385	\$ 2,835,385	\$ 2,835,385	\$ 2,835,385	\$ 2,835,385	\$ 2,835,385
Monthly cost (1000\$)	\$ 236.28	\$ 236.28	\$ 236.28	\$ 236.28	\$ 236.28	\$ 236.28	\$ 236.28	\$ 236.28	\$ 236.28	\$ 236.28



**Table C-39. Achievable Potential Avoided Cost Low Growth Scenario: Gas Customers**

	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
water + dryer (# cust)	1050	473	762	1050	1050	1050	1050	1050	1050	1050
water + range (# cust)	1050	473	762	1050	1050	1050	1050	1050	1050	1050
water only (# cust)	35714	16071	25893	35714	35714	35714	35714	35714	35714	35714
water + dryer + range (# cust)	4202	1891	3046	4202	4202	4202	4202	4202	4202	4202
zone heat (# cust)	0	0	0	0	0	0	0	0	0	0
zone + water (# cust)	0	0	0	0	0	0	0	0	0	0
zone + water + dryer (# cust)	497	6	9	12	12	12	12	12	12	12
zone + water + range	0	0	0	0	0	0	0	0	0	0
zone + all (# cust)	497	11	18	25	25	25	25	25	25	25
water heat elec (kWh)	1,107,072	4,428,289	9,779,138	17,159,620	24,540,101	31,920,583	39,301,065	46,681,546	54,062,028	61,442,509
dryer elec (kWh)	42,993	171,971	379,770	666,388	953,007	1,239,625	1,526,244	1,812,862	2,099,481	2,386,100
range elec (kWh)	28,179	112,716	248,914	436,773	624,633	812,493	1,000,352	1,188,212	1,376,071	1,563,931
zone heat (kWh)	1,120	4,480	9,893	17,359	24,825	32,291	39,758	47,224	54,690	62,156
total elec (kWh)	1,179,364	4,717,456	10,417,714	18,280,140	26,142,566	34,004,992	41,867,418	49,729,844	57,592,270	65,454,696
water heat gas (th)	58,986	234,003	512,844	893,137	1,269,114	1,640,775	2,008,120	2,371,149	2,729,862	3,084,259
dryer gas (th)	1,653	6,611	14,599	25,618	36,636	47,654	58,672	69,691	80,709	91,727
range gas (th)	1,586	6,346	14,013	24,589	35,165	45,741	56,317	66,893	77,469	88,045
zone gas (th)	83	333	735	1,290	1,844	2,399	2,954	3,508	4,063	4,618
total gas (th)	62,309	247,292	542,191	944,633	1,342,759	1,736,569	2,126,063	2,511,241	2,892,102	3,268,648

NOTE: Percentages of space heat adoption: (1) zone heat--10%; (2) zone + water--5%; (3) zone + water + dryer--2.5%; (4) zone + water + range--2.5%; (5) zone + all--5%.

	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027
water + dryer (# cust)	1050	1050	1050	1050	1050	1050	1050	1050	1050	1050
water + range (# cust)	1050	1050	1050	1050	1050	1050	1050	1050	1050	1050
water only (# cust)	35714	35714	35714	35714	35714	35714	35714	35714	35714	35714
water + dryer + range (# cust)	4202	4202	4202	4202	4202	4202	4202	4202	4202	4202
zone heat (# cust)	0	0	0	0	0	0	0	0	0	0
zone + water (# cust)	0	0	0	0	0	0	0	0	0	0
zone + water + dryer (# cust)	12	12	12	12	12	12	12	12	12	12
zone + water + range	0	0	0	0	0	0	0	0	0	0
zone + all (# cust)	25	25	25	25	25	25	25	25	25	25
water heat elec (kWh)	68,822,991	76,203,472	83,583,954	90,964,436	98,344,917	105,725,399	113,105,880	120,486,362	127,866,844	135,247,325
dryer elec (kWh)	2,672,718	2,959,337	3,245,955	3,532,574	3,819,192	4,105,811	4,392,430	4,679,048	4,965,667	5,252,285
range elec (kWh)	1,751,790	1,939,650	2,127,510	2,315,369	2,503,229	2,691,088	2,878,948	3,066,807	3,254,667	3,442,527
zone heat (kWh)	69,622	77,089	84,555	92,021	99,487	106,953	114,420	121,886	129,352	136,818
total elec (kWh)	73,317,122	81,179,548	89,041,974	96,904,400	104,766,826	112,629,252	120,491,677	128,354,103	136,216,529	144,078,955
water heat gas (th)	3,434,339	3,784,420	4,134,501	4,484,581	4,834,662	5,184,742	5,534,823	5,884,904	6,234,984	6,585,065
dryer gas (th)	102,745	113,764	124,782	135,800	146,819	157,837	168,855	179,873	190,892	201,910
range gas (th)	98,621	109,197	119,772	130,348	140,924	151,500	162,076	172,652	183,228	193,804
zone gas (th)	5,172	5,727	6,282	6,836	7,391	7,945	8,500	9,055	9,609	10,164
total gas (th)	3,640,877	4,013,107	4,385,337	4,757,566	5,129,796	5,502,025	5,874,255	6,246,484	6,618,714	6,990,943

NOTE: Percentages of space heat adoption: (1) zone heat--10%; (2) zone + water--5%; (3) zone + water + dryer--2.5%; (4) zone + water + range--2.5%; (5) zone + all--5%.

**Table C-40. Achievable Potential Avoided Cost Low Growth Scenario: Electric-Only Customers**

	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
space heat (# cust)	201	90	145	201	201	201	201	201	201	201
space + water	3211	1445	2328	3211	3211	3211	3211	3211	3211	3211
space + water + dryer	391	176	284	391	391	391	391	391	391	391
space + water + range	391	176	284	391	391	391	391	391	391	391
All	391	176	284	391	391	391	391	391	391	391
space heat elec (kWh)	275,401	1,101,602	2,432,705	4,268,709	6,104,712	7,940,716	9,776,720	11,612,724	13,448,727	15,284,731
water heat elec (kWh)	115,429	461,714	1,019,619	1,789,142	2,558,666	3,328,189	4,097,712	4,867,236	5,636,759	6,406,283
dryer elec (kWh)	6,361	25,445	56,192	98,601	141,010	183,419	225,828	268,237	310,646	353,055
range elec (kWh)	4,179	16,717	36,917	64,779	92,640	120,502	148,364	176,226	204,088	231,950
total electric (kWh)	401,370	1,605,479	3,545,432	6,221,230	8,897,028	11,572,826	14,248,624	16,924,422	19,600,220	22,276,018
space heat gas (th)	19,095	76,202	167,920	294,029	419,740	545,053	669,969	794,486	918,606	1,042,328
water heat gas (th)	6,150	24,398	53,472	93,123	132,324	171,075	209,376	247,227	284,628	321,579
dryer gas (th)	245	978	2,160	3,790	5,421	7,051	8,681	10,312	11,942	13,572
range gas (th)	235	939	2,073	3,638	5,203	6,768	8,333	9,898	11,463	13,027
total gas (th)	25,725	102,518	225,625	394,580	562,687	729,947	896,359	1,061,923	1,226,639	1,390,507

	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027
space heat (# cust)	201	201	201	201	201	201	201	201	201	201
space + water	3211	3211	3211	3211	3211	3211	3211	3211	3211	3211
space + water + dryer	391	391	391	391	391	391	391	391	391	391
space + water + range	391	391	391	391	391	391	391	391	391	391
All	391	391	391	391	391	391	391	391	391	391
space heat elec (kWh)	17,120,735	18,956,738	20,792,742	22,628,746	24,464,750	26,300,753	28,136,757	29,972,761	31,808,764	33,644,768
water heat elec (kWh)	7,175,806	7,945,330	8,714,853	9,484,377	10,253,900	11,023,424	11,792,947	12,562,471	13,331,994	14,101,517
dryer elec (kWh)	395,464	437,873	480,282	522,691	565,100	607,509	649,918	692,327	734,736	777,145
range elec (kWh)	259,811	287,673	315,535	343,397	371,259	399,120	426,982	454,844	482,706	510,568
total electric (kWh)	24,951,817	27,627,615	30,303,413	32,979,211	35,655,009	38,330,807	41,006,605	43,682,403	46,358,201	49,033,999
space heat gas (th)	1,165,652	1,288,976	1,412,301	1,535,625	1,658,949	1,782,273	1,905,597	2,028,921	2,152,246	2,275,570
water heat gas (th)	358,080	394,581	431,082	467,583	504,084	540,585	577,086	613,588	650,089	686,590
dryer gas (th)	15,203	16,833	18,463	20,093	21,724	23,354	24,984	26,615	28,245	29,875
range gas (th)	14,592	16,157	17,722	19,287	20,852	22,416	23,981	25,546	27,111	28,676
total gas (th)	1,553,527	1,716,548	1,879,568	2,042,588	2,205,609	2,368,629	2,531,649	2,694,670	2,857,690	3,020,711

**Table C-41. Achievable Potential Avoided Cost Low Growth Scenario: All Customers**

	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
space heat elec (kWh)	275,401	1,101,602	2,432,705	4,268,709	6,104,712	7,940,716	9,776,720	11,612,724	13,448,727	15,284,731
water heat elec (kWh)	1,222,501	4,890,003	10,798,757	18,948,762	27,098,767	35,248,772	43,398,777	51,548,782	59,698,787	67,848,792
dryer elec (kWh)	49,354	197,417	435,962	764,989	1,094,017	1,423,044	1,752,072	2,081,100	2,410,127	2,739,155
range elec (kWh)	32,358	129,433	285,831	501,552	717,274	932,995	1,148,716	1,364,438	1,580,159	1,795,880
zone heat (kWh)	1,120	4,480	9,893	17,359	24,825	32,291	39,758	47,224	54,690	62,156
total electric (kWh)	1,580,734	6,322,934	13,963,147	24,501,371	35,039,595	45,577,819	56,116,043	66,654,267	77,192,490	87,730,714
space heat gas (th)	19,095	76,202	167,920	294,029	419,740	545,053	669,969	794,486	918,606	1,042,328
water heat gas (th)	65,136	258,401	566,316	986,260	1,401,438	1,811,850	2,217,496	2,618,376	3,014,490	3,405,838
dryer gas (th)	1,897	7,589	16,759	29,408	42,057	54,705	67,354	80,002	92,651	105,299
range gas (th)	1,821	7,284	16,087	28,227	40,368	52,509	64,650	76,790	88,931	101,072
zone heat (th)	83	333	735	1,290	1,844	2,399	2,954	3,508	4,063	4,618
total gas (th)	88,033	349,810	767,816	1,339,214	1,905,447	2,466,516	3,022,422	3,573,163	4,118,741	4,659,155

	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027
space heat elec (kWh)	17,120,735	18,956,738	20,792,742	22,628,746	24,464,750	26,300,753	28,136,757	29,972,761	31,808,764	33,644,768
water heat elec (kWh)	75,998,797	84,148,802	92,298,807	100,448,812	108,598,817	116,748,822	124,898,828	133,048,833	141,198,838	149,348,843
dryer elec (kWh)	3,068,182	3,397,210	3,726,238	4,055,265	4,384,293	4,713,320	5,042,348	5,371,376	5,700,403	6,029,431
range elec (kWh)	2,011,602	2,227,323	2,443,044	2,658,766	2,874,487	3,090,209	3,305,930	3,521,651	3,737,373	3,953,094
zone heat (kWh)	69,622	77,089	84,555	92,021	99,487	106,953	114,420	121,886	129,352	136,818
total electric (kWh)	98,268,938	108,807,162	119,345,386	129,883,610	140,421,834	150,960,058	161,498,282	172,036,506	182,574,730	193,112,954
space heat gas (th)	1,165,652	1,288,976	1,412,301	1,535,625	1,658,949	1,782,273	1,905,597	2,028,921	2,152,246	2,275,570
water heat gas (th)	3,792,419	4,179,001	4,565,583	4,952,165	5,338,746	5,725,328	6,111,910	6,498,491	6,885,073	7,271,655
dryer gas (th)	117,948	130,597	143,245	155,894	168,542	181,191	193,840	206,488	219,137	231,785
range gas (th)	113,213	125,354	137,494	149,635	161,776	173,917	186,057	198,198	210,339	222,480
zone heat (th)	5,172	5,727	6,282	6,836	7,391	7,945	8,500	9,055	9,609	10,164
total gas (th)	5,194,405	5,729,655	6,264,904	6,800,154	7,335,404	7,870,654	8,405,904	8,941,154	9,476,404	10,011,654

**Table C-42. Achievable Potential Avoided Cost Low Growth Scenario: Annual Cost (\$)**

	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
space heat	\$ 63,279	\$ 191,913	\$ 312,538	\$ 435,701	\$ 440,315	\$ 444,929	\$ 449,543	\$ 454,158	\$ 458,772	\$ 463,386
water heat	\$ 184,246	\$ 573,766	\$ 958,279	\$ 1,368,493	\$ 1,415,222	\$ 1,461,951	\$ 1,508,680	\$ 1,555,409	\$ 1,602,138	\$ 1,648,867
dryer	\$ 13,617	\$ 40,850	\$ 65,813	\$ 90,777	\$ 90,777	\$ 90,777	\$ 90,777	\$ 90,777	\$ 90,777	\$ 90,777
range	\$ 15,679	\$ 47,038	\$ 75,783	\$ 104,528	\$ 104,528	\$ 104,528	\$ 104,528	\$ 104,528	\$ 104,528	\$ 104,528
zone heat	\$ 482	\$ 1,447	\$ 2,332	\$ 3,217	\$ 3,217	\$ 3,217	\$ 3,217	\$ 3,217	\$ 3,217	\$ 3,217
total	\$ 277,303	\$ 855,013	\$ 1,414,745	\$ 2,002,715	\$ 2,054,058	\$ 2,105,401	\$ 2,156,744	\$ 2,208,088	\$ 2,259,431	\$ 2,310,774
Monthly cost (1000\$)	\$ 23.11	\$ 71.25	\$ 117.90	\$ 166.89	\$ 171.17	\$ 175.45	\$ 179.73	\$ 184.01	\$ 188.29	\$ 192.56

	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027
space heat	\$ 468,000	\$ 468,000	\$ 468,000	\$ 468,000	\$ 468,000	\$ 468,000	\$ 468,000	\$ 468,000	\$ 468,000	\$ 468,000
water heat	\$ 1,695,596	\$ 1,695,596	\$ 1,695,596	\$ 1,695,596	\$ 1,695,596	\$ 1,695,596	\$ 1,695,596	\$ 1,695,596	\$ 1,695,596	\$ 1,695,596
dryer	\$ 90,777	\$ 90,777	\$ 90,777	\$ 90,777	\$ 90,777	\$ 90,777	\$ 90,777	\$ 90,777	\$ 90,777	\$ 90,777
range	\$ 104,528	\$ 104,528	\$ 104,528	\$ 104,528	\$ 104,528	\$ 104,528	\$ 104,528	\$ 104,528	\$ 104,528	\$ 104,528
zone heat	\$ 3,217	\$ 3,217	\$ 3,217	\$ 3,217	\$ 3,217	\$ 3,217	\$ 3,217	\$ 3,217	\$ 3,217	\$ 3,217
total	\$ 2,362,117	\$ 2,362,117	\$ 2,362,117	\$ 2,362,117	\$ 2,362,117	\$ 2,362,117	\$ 2,362,117	\$ 2,362,117	\$ 2,362,117	\$ 2,362,117
Monthly cost (1000\$)	\$ 196.84	\$ 196.84	\$ 196.84	\$ 196.84	\$ 196.84	\$ 196.84	\$ 196.84	\$ 196.84	\$ 196.84	\$ 196.84

## Sources

(Note: all costs are installed costs; all administrative costs are 15%)

<b>Furnace</b>	<a href="http://www.indoorclimate.com">www.indoorclimate.com</a>
Electric Furnace:	UBHA-14J11NF 10kW
Gas Furnace: 80 AFUE	UGPK07EAUER max 75k BTU
Gas Furnace: 90 AFUE	UGRA06EAME 60k BTU
Gas Furnace: 96 AFUE	incremental cost over AFUE 90 from EE measure list
\$700 for piping the gas line : PSE Website	

<b>Clothes Dryer</b>	<a href="http://www.sears.com">www.sears.com</a>
Electric:	Whirlpool WED5320SQ
Gas:	Whirlpool WGD5320SQ
Electric w/ Moisture Sensor:	Whirlpool WED5820SW
Gas w/ Moisture Sensor:	Whirlpool WGD5820SW

<b>Range</b>	<a href="http://www.sears.com">www.sears.com</a>
30" Standard Electric:	Kenmore 71054
30" Standard Gas Range:	Kenmore 91064
30" Convection Electric Range	GE JBP84KKCC
30" Gas Convection Range:	Maytag MGR5875QDW

<b>Water Heater</b>	<a href="http://www.sears.com">www.sears.com</a>
Electric	Kenmore 32656
EF=0.59	Kenmore 33976
EF=0.63	Kenmore 33154
Tankless	<a href="http://www.tanklesswaterheaters.com/">http://www.tanklesswaterheaters.com/</a>

<b>Gas And Electric Rates</b>	
Electric Rate:	<a href="http://www.pse.com/InsidePSE/ratesDocs/summ_elec_prices_2006_10_01.pdf">http://www.pse.com/InsidePSE/ratesDocs/summ_elec_prices_2006_10_01.pdf</a>
Gas Rate:	<a href="http://www.pse.com/InsidePSE/ratesDocs/summ_gas_prices_2006_10_01.pdf">http://www.pse.com/InsidePSE/ratesDocs/summ_gas_prices_2006_10_01.pdf</a>

<b>UECs for electric dryer/cooking:</b>	PSE gas tariff information
<b>UECs for space/water heating:</b>	EndUse Forecaster Model

# Appendix D: Demand Response: Methodology, Inputs and Assumptions

---

## Data Sources

This study required compilation of a large and complex database on load data, end-use and appliance saturations, demand response impacts, and costs, which were gathered from multiple sources. To the extent possible, this study has sought to rely on forecasts and usage data available from PSE. For other data, the most recent regional data were used. Specific data elements and their respective sources are listed in Table D–1.

**Table D–1. Data Sources**

Data	Sources
Hourly System Load Profile	<ul style="list-style-type: none"><li>• PSE 2005 hourly profile</li></ul>
End-Use Shares and Load Shapes	<ul style="list-style-type: none"><li>• Calibrated ForecastPro end-use percentages</li><li>• Northwest Conservation and Planning Council &amp; ELCAP load shapes (1999)</li></ul>
End-Use and Appliance Saturations	<ul style="list-style-type: none"><li>• PSE Residential Appliance Saturation Surveys (RASS)</li><li>• Commercial Building Stock Assessment</li><li>• Northwest Energy Efficiency Alliance, 2002</li></ul>
Demand Response Impact Estimates	<ul style="list-style-type: none"><li>• PSE Experience</li><li>• California Energy Commission</li><li>• Edison Electric Institute (EEI)</li><li>• Peak Load Management Alliance (PLMA)</li><li>• Various RTO and utility reports</li></ul>
Costs	<ul style="list-style-type: none"><li>• PSE Experience</li><li>• California Energy Commission</li><li>• Various utility reports</li></ul>

## Load Analysis

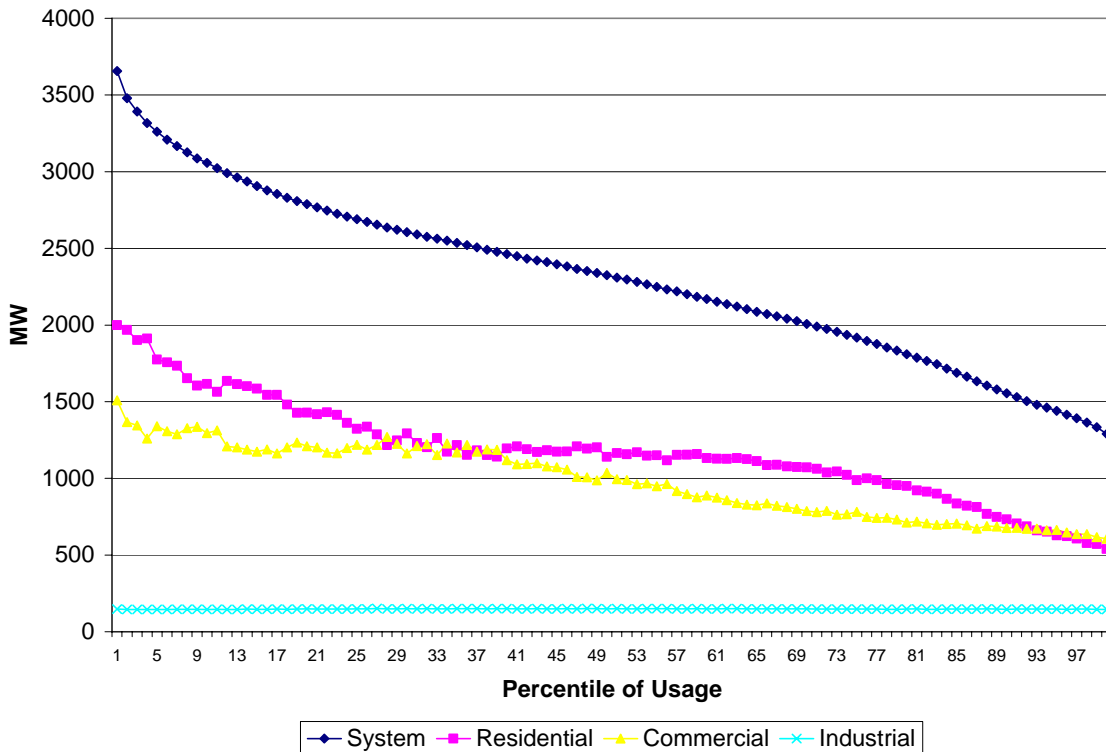
To estimate the quantity of potential available for demand-responsive resources, the first step was to conduct a thorough analysis of system loads, breaking them down into customer class (or sector), market segments, and finally, end-use loads. Using hourly (8760) load profiles, the data could be summarized to estimate average loads during likely curtailment periods.

The first step of this process was to define customer sectors, market segments, and applicable end uses, similarly to the energy-efficiency study. System loads were disaggregated into three sectors: (1) residential, (2) commercial, and (3) industrial. The commercial sector was further broken down into eleven segments consisting of the following:

Education	Food Stores
Hospitals	Hotels/Motels
Other Health	Miscellaneous
Offices	Public Assembly
Restaurants	Retail
Warehouses	

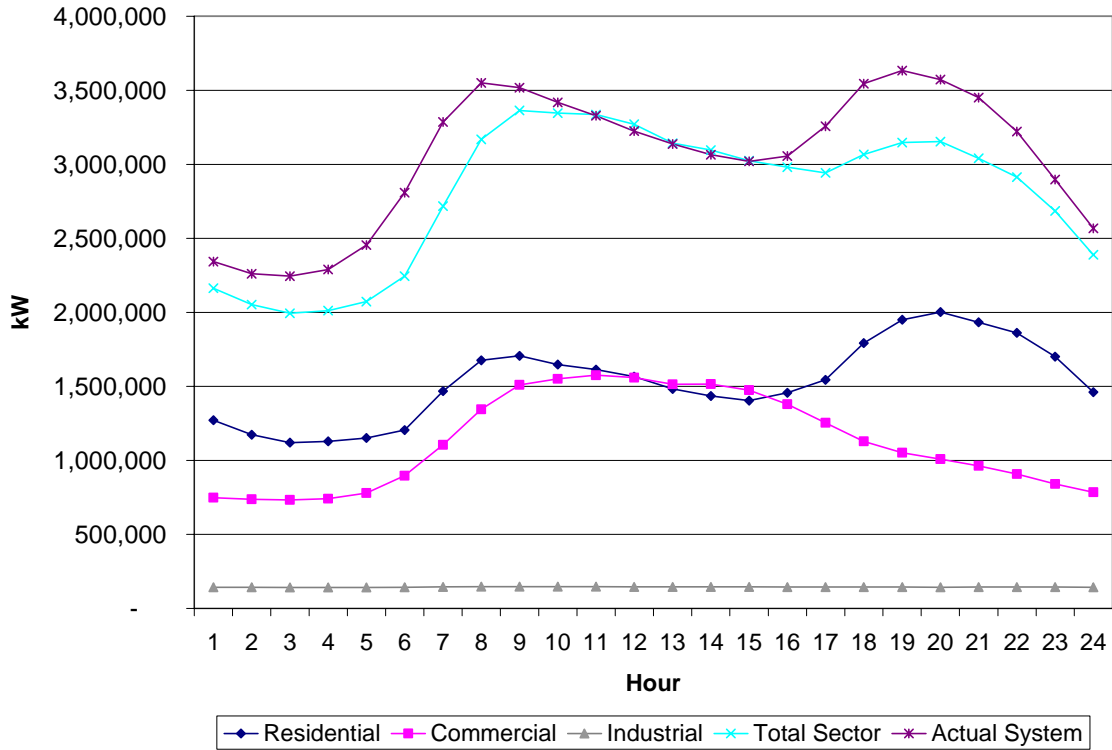
Using the system hourly shape for 2005, Figure D–1 displays the load duration curve representing the average demand (MW) during each percentile of hours in the year. The top 87 (top 1%) hours for the system have an average demand of 3650 MW, of which 2000 is residential load, 1500 is commercial load and 150 is industrial load. The various sectors were calculated using total energy sales by sector, and sector hourly load profiles.

**Figure D–1. Load Duration Curve (Average 2005 MW by Percentile of Usage)**



Because PSE is a winter-peaking utility, the winter period is most important for demand response, as curtailments will primarily happen during on-peak weekday periods. Figure D–2 shows the load, for each hour on the average winter weekday, for each sector. The small difference between the “Total Sector” line (which represents the sum of the sectors) and the “Actual System” is primarily a function of differences in the hourly sector shapes, which came from secondary data.

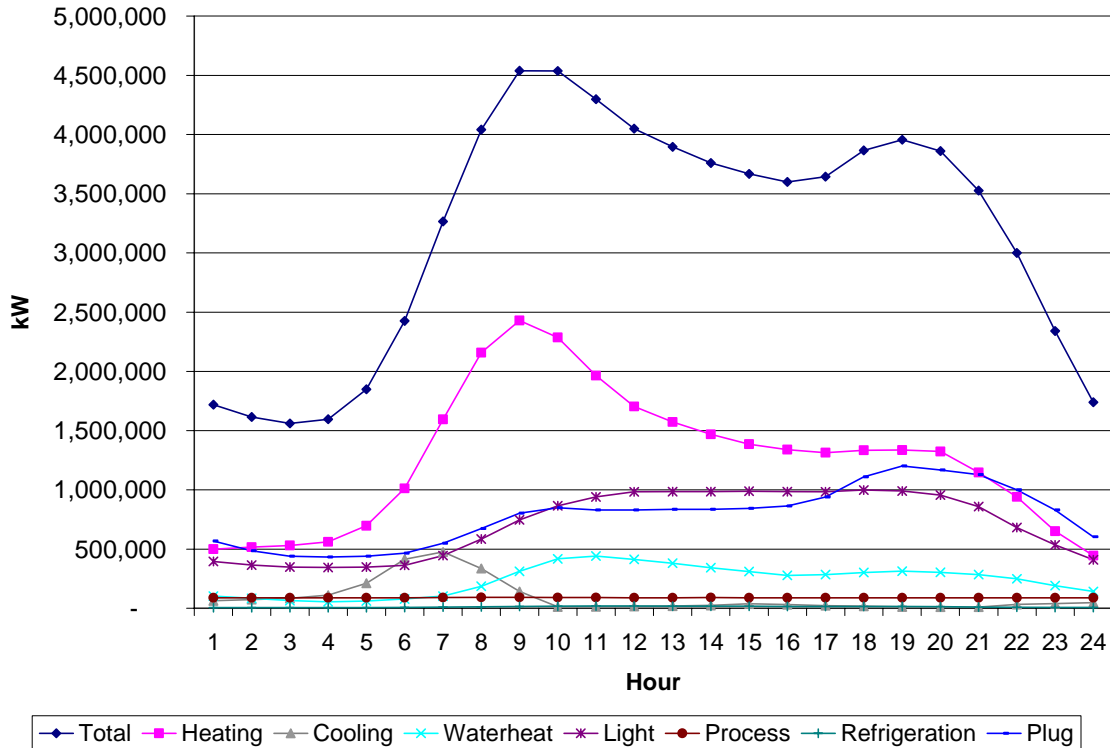
**Figure D-2. Average Winter Weekdays—All Sectors**



These sector-level analyses were then broken down into the various end uses using end-use saturation data from PSE surveys and base-case energy-efficiency potential results of the portion of energy sales by end use. Figure D-3 shows the end-use breakdown (across all sectors).



**Figure D-3. Average Winter Weekdays—All End Uses**



Finally, the analyses shown above produce the end-use and sector-specific loads for the most likely curtailment periods. For all program strategies, the top 87 hours of winter are used (which correspond with the top 1% of the load duration curve), except for demand buyback, which would be offered more frequently, and therefore corresponds with the top 175 hours of winter. The following table provides the total sector results for the top 87 and 175 hours of winter, including 6.7% line losses.

**Table D–2. Top Hours of Winter, by Sector**

Sector	Top 87 Winter	Top 175 Winter
Residential	2,131,404	2,105,573
Education	319,147	293,245
Food Stores	18,217	18,050
Hospitals	21,711	21,353
Hotels/Motels	67,001	66,001
Other Health	14,692	14,238
Misc	479,870	459,245
Offices	297,931	286,027
Assembly	34,580	33,130
Restaurants	22,723	22,105
Retail	197,445	193,461
Warehouses	135,299	129,985
Industrial	156,297	155,865

## Methodology for Estimating Technical Potential

For demand response generically, it may be technically feasible to shed all load during a demand-response event, but potential would then equal system load, which is not useful for planning purposes, and not possible for any single DRR strategy. Therefore, technical potential for a DRR strategy adjusts total load to account for those sectors and segments that are eligible for participation, and the applicability and technical constraints of specific end uses. Technical potential is first estimated for the base year, then increased annually to 2027 by the annual peak forecast.

Technical potential for each demand response strategy is assumed to be a function of customer applicability in each class and the expected impact of the strategy on the targeted end uses. Analytically, technical potential ( $TP$ ) for demand-response strategy ( $s$ ) is calculated as the sum of impacts at the end-use level ( $e$ ), generated in customer sector ( $c$ ), by the strategy, or:

$$TP_s = \sum TP_{sce} \quad (1)$$

and

$$TP_{sce} = LE_{cs} \times LI_{se} \quad (2)$$

where

$LE_{cs}$  (load applicability) represents the percent of customer class loads that are applicable for strategy ( $s$ ), and

$LI_{se}$  (load impact) is the percentage reduction in end-use load ( $e$ ) resulting from strategy ( $s$ ).

Load applicability ( $LE_{cs}$ ) thresholds are established by calculating the percent of load by customer sector and market segment that meet load criteria for each strategy. Table D–3 outlines the portion of load that is applicable for program strategies, using secondary data from regional sources.

**Table D–3. Sector Applicability, by Program**

Program Name/Sector	DLC - Water Heating	DLC - Space Heating	DLC - Large C&I	Demand Buyback	Curtable Rates	Critical Peak Pricing	Standby Generation
Residential	100%	100%	-	-	-	100%	-
Education	-	-	19%	50%	50%	2%	-
Food Stores	-	-	27%	70%	70%	5%	-
Hospitals	-	-	-	-	-	-	-
Hotels/Motels	-	-	5%	12%	12%	19%	-
Other Health	-	-	23%	60%	60%	-	-
Miscellaneous	-	-	-	-	-	-	100%
Offices	-	-	19%	50%	50%	10%	-
Assembly	-	-	8%	20%	20%	-	-
Restaurants	-	-	-	-	-	-	-
Retail	-	-	-	-	-	-	-
Warehouses	-	-	15%	40%	40%	-	-
Industrial	-	-	30%	80%	80%	-	-
Eligibility	Residential	Large C&I - >250 kW with EMS	Large C&I - >250 kW with EMS	Large C&I - >250 kW	Large C&I - >250 kW	Residential and some small commercial sectors	Non-targeted sectors

Estimates of maximum load impacts (i.e., percentage reduction of end use or total load) resulting from various demand response strategies ( $LI_{se}$ ), are derived from the commercial and industrial Enhanced Automation Study sponsored by the California Energy Commission, studies by Lawrence Berkeley National Laboratories (e.g., Goldman, 2004), and the experiences of PSE and other utilities with similar DR programs. Table D-4 outlines these inputs and assumptions. The final row provides the technical assumptions.

**Table D-4. Technical Load Impacts (Percentage Reduction)**

Program Name/Sector	DLC - Water Heating	DLC - Space Heating	DLC - Large C&I	Demand Buyback	Curtable Rates	Critical Peak Pricing	Standby Generation
End Use	Hot Water	Space Heating	All End Uses	All End Uses	All End Uses	All End Uses	All End Uses
Residential	90%	12%	-	-	-	10%	-
Education	-	-	22%	22%	22%	10%	-
Food Stores	-	-	20%	20%	20%	10%	-
Hospitals	-	-	-	-	-	-	-
Hotels/Motels	-	-	20%	20%	20%	10%	-
Other Health	-	-	8%	8%	8%	-	-
Misc	-	-	-	-	-	-	11%
Offices	-	-	32%	32%	32%	10%	-
Assembly	-	-	20%	20%	20%	-	-
Restaurants	-	-	-	-	-	-	-
Retail	-	-	-	-	-	-	-
Warehouses	-	-	30%	30%	30%	-	-
Industrial	-	-	30%	30%	30%	10%	-
Technical Assumptions	90% technical ability.	90% technical ability, 50% cycling; 27% of electric heating load is central heat and heat pumps.	Total curtable load based on Goldman (2004)–National Trends, by sector. If not mentioned, unclassified was used.			10% from flat CPP program (2003 Statewide Pricing Pilot by Charles River Associates–Zone 2 Inland).	Corresponds with technical potential similar to Portland General Electric territory.

## Methodology for Estimating Achievable Potential

Achievable potential is the subset of technical potential that may reasonably be implemented, taking into account the customers’ ability and willingness to participate in load reduction programs, subject to their price/value considerations, unique (business) priorities, and operating requirements. Market levels of potential are derived by adjusting technical potentials by two factors: expected rates of *program* (sign-up) and *event* participation. Assumed rates of program and event participation were estimated based on the recent experiences of PSE, other utilities in

the Northwest, other national utilities, and Regional Transmission Organizations (RTOs) which have offered similar programs.

Achievable potential ( $AP$ ) is calculated as the product of technical potential, sector program participation (sign-up) rates ( $PP_c$ ), and expected event participation ( $EP_c$ ) rates thus:

$$AP_s = TP_{sc} \times PP_c \times EP_c \quad (3)$$

Rates of program sign-up and event participation were estimated using the experience of regional and national programs and that of PSE, and shown in Table D–5.

**Table D–5. Program Sign-up and Event Participation**

	DLC - Water Heating	DLC - Space Heating	DLC - Large C&I	Demand Buyback	Curtable Rates	Critical Peak Pricing	Standby Generation
Program Participation	10%	10%	8%	25%	15%	5%	50%
Event Participation	90%	90%	90%	12%	90%	90%	90%
NOTES	Residential only; 10% Program participation based on FPL On Call program, and Mid American and Duke. Event participation assumed to be less than all– i.e., 90%.		PSE 03 Sectors >250kW and only 38% with EMS systems (CBSA 05); Participation: Florida Power and Light C&I On Call has less than 1% of all customers. Because our figures already account for those not eligible, we have assumed a 7.5% base; event participation is assumed to be less than all– i.e., 90%.	IEA DSM 2006 provides a low of 4% participation; Goldman 2002– average portion of customers enrolled in DR programs is 30%; we use a medium-high figure. Event participation is based on 2001-2002 PSE program experience.	National participation ranges from slightly greater than 0% (ISO NE) of customers to 30% (NYISO 29%, Duke 14%). We used the midpoint. Duke: 90%+ compliance; CEC: 90%+ compliance.	Program participation: current programs in the nation have very low participation– the base is 5%. (We reviewed seven programs with the range having a maximum of 3%.) Event participation is assumed to be less than all– i.e., 90%.	Portland General Electric includes the ability to dispatch as required in contract. Currently, the focus is on new equipment installations, rather than retrofit, due to the additional cost.

## Methodology for Estimating Per-unit Costs

Demand response strategies vary significantly with respect to both type and level of costs. Applicable resource acquisition costs for DR generally fall into two categories: (1) fixed program expenses such as infrastructure, administration, maintenance and data acquisition; and (2) variable costs. Further, variable costs also fall into two categories: costs that vary by the number of customers (e.g., hardware costs) and those that vary by kW reduction (primarily incentives).

In developing estimates of per-unit costs, all program costs were first allocated annually over the expected program life cycle (20 years), and then discounted by a real cost of capital at 5.8% to estimate the per-kilowatt levelized costs for each resource (based on achievable potential). Additionally, attrition rates were used to account for program turnover (15% for residential DLC and CPP programs and 10% for C&I DLC and Curtailment).<sup>3</sup> Table D-6 outlines the development (up-front investment) and annual costs for the three categories of cost inputs: per-kW, per-customer, and program administration.

---

<sup>3</sup> Attrition rate of 10% approximates a 10-year program life and 15% approximates a 7-year life, which roughly corresponds to the average rate of housing turnover.

**Table D-6. Cost Inputs**

Frequency	DLC - Water Heating	DLC - Space Heating	DLC - Large C&I	Demand Buyback	Curtable Rates	Critical Peak Pricing	Standby Generation
<b>Variable Costs – Per Customer</b>							
Development	\$300	\$300	-	-	\$1,200	-	-
Annual	\$35	\$35	-	-	-	\$57	-
<b>Variable Costs – Per kW</b>							
Development	-	-	-	-	-	-	\$175
Annual	-	-	\$95	\$20	\$48	-	\$13
<b>Fixed Program Expenses</b>							
Development	\$300,000	\$300,000	\$100,000	\$300,000	\$300,000	\$492,000	\$300,000
Annual	\$50,000	\$50,000	\$50,000	\$100,000	\$100,000	\$100,000	\$100,000
<b>COST NOTES</b>	<ul style="list-style-type: none"> <li>• Variable costs per customer include \$300 in DLC equipment and \$35 per year, which includes incentives and communications.</li> <li>• Fixed program expenses assume \$300,000 in billing system set-up, marketing and internal administration, with \$50,000 each year in administration (equal to 0.5 FTE).</li> </ul>	<ul style="list-style-type: none"> <li>• Variable costs per customer include \$300 in DLC equipment and \$35 per year, which includes incentives and communications.</li> <li>• Fixed program expenses assume \$300,000 in billing system set-up, marketing and internal administration, with \$50,000 each year in administration (equal to 0.5 FTE).</li> </ul>	<ul style="list-style-type: none"> <li>• Costs based on EnerNOC Bid of \$95/kW for annual costs.</li> <li>• Assumes reduced start-up costs due to external contractor costs included in EnerNOC bid.</li> </ul>	<ul style="list-style-type: none"> <li>• Assumes no required hardware and incentives paid on a per event/per MWh basis, based on costs from 2001-2002 program experience (\$16K of incentives between 2001 and 2003, with an average reduction of 840kW).</li> <li>• Fixed program expenses assume \$300,000 in billing system set-up, marketing and internal administration, with \$50,000 each year in administration (equal to 0.5 FTE).</li> </ul>	<ul style="list-style-type: none"> <li>• Development: Per Customer of \$500 for marketing and \$700 for equipment and installation.</li> <li>• Incentive of \$48 (\$4/kWMonth: PG&amp;E pays \$3-\$7/kWMonth, SCE pays \$7/kWMonth, Wisconsin pays \$3.3/kWMonth, Mid-American pays \$3.3, Duke pays \$3.5/kW-Month).</li> <li>• Fixed program expenses assume \$300,000 in billing system set-up, marketing and internal administration, with \$50,000 each year in administration (equal to 0.5 FTE)</li> </ul>	<ul style="list-style-type: none"> <li>• Annual customer costs include \$12 for meter reading, \$42 in hourly load profiles, \$2.5 in PAR3 Messaging.</li> <li>• Program costs are based on PSE CPP Pilot Attachment A - June 2006.</li> <li>• Development costs include \$25K for fixed MCC costs, \$200K for billing system, \$75K for meter data warehouse, \$192K for recruiting (excludes \$66K for evaluation).</li> <li>• Annual costs of \$100K for marketing (actual was \$112).</li> </ul>	<ul style="list-style-type: none"> <li>• Installation costs of \$175 per kW and O&amp;M of \$5/kW from PGE Standby Generation program.</li> <li>• Annual per kW costs also include \$8/kW in fuel assuming 100 hours/year, 20 gallons per hour of fuel for 500 kW unit, \$2/gallon fuel.</li> <li>• Fixed program expenses assume \$300,000 in billing system set-up, marketing and internal administration, with \$50,000 each year in administration (equal to 0.5 FTE).</li> </ul>

## 20-year Results

Finally, a ramping assumption was created to account for the increasing acceptance by customers and increased expertise of PSE with DR programs; 5% of base-year potential would be achieved in 2008, 15% in 2009, 35% in 2010, 65% in 2011 and 100% by 2012. The peak capacity forecast was used to increase potential for all subsequent years.

**Table D–7. Achievable Potential, kW**

kW	DLC - Water Heating	DLC - Space Heating	DLC - Large C&I	Demand Buyback	Curtable Rates	Critical Peak Pricing	Standby Generation
1	1,336	388	183	206	964	490	1,200
2	4,062	1,180	557	626	2,931	1,492	3,648
3	9,597	2,789	1,316	1,478	6,924	3,524	8,619
4	18,045	5,243	2,474	2,779	13,019	6,626	16,205
5	28,133	8,174	3,857	4,333	20,298	10,331	25,266
6	28,549	8,295	3,914	4,397	20,598	10,483	25,639
7	29,038	8,437	3,981	4,472	20,951	10,663	26,078
8	29,600	8,601	4,058	4,559	21,356	10,869	26,583
9	30,154	8,762	4,134	4,644	21,755	11,073	27,080
10	30,691	8,918	4,207	4,727	22,143	11,270	27,563
11	31,214	9,070	4,279	4,807	22,520	11,462	28,032
12	31,730	9,220	4,350	4,887	22,893	11,652	28,496
13	32,264	9,375	4,423	4,969	23,278	11,848	28,975
14	32,810	9,533	4,498	5,053	23,672	12,048	29,466
15	33,378	9,698	4,575	5,141	24,082	12,257	29,976
16	33,985	9,875	4,659	5,234	24,520	12,480	30,521
17	34,612	10,057	4,745	5,331	24,972	12,710	31,084
18	35,248	10,242	4,832	5,429	25,431	12,944	31,656
19	35,896	10,430	4,921	5,529	25,898	13,181	32,237
20	36,549	10,620	5,010	5,629	26,370	13,421	32,824



## **Appendix E: Distributed Generation: Inputs and Assumptions**

---

Appendix E follows.

**Table E-1. Distributed Generation Base Case Scenario: CHP (Natural Gas)**

CHP (Natural gas)	% Penetration (by MW)			2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
	Res	Com	Ind										
Recip Engine	0%	65%	35%										
	MW			0.07	0.20	0.51	1.08	2.20	3.74	5.28	6.82	8.36	9.90
	aMW			0.06	0.18	0.46	0.97	1.98	3.37	4.75	6.14	7.53	8.91
	Inst costs (\$/kW)			\$ 1,087	\$ 1,087	\$ 1,087	\$ 1,087	\$ 1,087	\$ 1,087	\$ 1,087	\$ 1,087	\$ 1,087	\$ 1,087
	O&M (\$/MW)			\$ 101,345	\$ 101,345	\$ 101,345	\$ 101,345	\$ 101,345	\$ 101,345	\$ 101,345	\$ 101,345	\$ 101,345	\$ 101,345
	Fuel (\$/kW)			\$ 312	\$ 301	\$ 292	\$ 277	\$ 285	\$ 287	\$ 289	\$ 292	\$ 296	\$ 309
Lump sum (\$)			\$ 106,249	\$ 237,544	\$ 567,394	\$ 1,092,595	\$ 2,191,755	\$ 3,294,699	\$ 3,905,981	\$ 4,525,960	\$ 5,162,231	\$ 5,908,582	
Microturbine	0%	65%	35%										
	MW			0.01	0.04	0.10	0.21	0.43	0.74	1.04	1.34	1.64	1.95
	aMW			0.01	0.04	0.09	0.20	0.41	0.70	0.99	1.27	1.56	1.85
	Inst costs (\$/kW)			\$ 1,634	\$ 1,634	\$ 1,634	\$ 1,634	\$ 1,634	\$ 1,634	\$ 1,634	\$ 1,634	\$ 1,634	\$ 1,634
	O&M (\$/MW)			\$ 108,135	\$ 108,135	\$ 108,135	\$ 108,135	\$ 108,135	\$ 108,135	\$ 108,135	\$ 108,135	\$ 108,135	\$ 108,135
	Fuel (\$/kW)			\$ 487	\$ 469	\$ 455	\$ 432	\$ 444	\$ 447	\$ 451	\$ 455	\$ 461	\$ 482
Lump sum (\$)			\$ 31,043	\$ 69,114	\$ 164,857	\$ 316,715	\$ 635,300	\$ 952,684	\$ 1,124,904	\$ 1,299,789	\$ 1,479,666	\$ 1,693,277	
Fuel Cell	0%	65%	35%										
	MW			0.01	0.02	0.05	0.10	0.21	0.35	0.50	0.64	0.79	0.93
	aMW			0.01	0.02	0.05	0.10	0.20	0.33	0.47	0.61	0.75	0.89
	Inst costs (\$/kW)			\$ 5,314	\$ 5,314	\$ 5,314	\$ 5,314	\$ 5,314	\$ 5,314	\$ 5,314	\$ 5,314	\$ 5,314	\$ 5,314
	O&M (\$/MW)			\$ 14,403	\$ 14,403	\$ 14,403	\$ 14,403	\$ 14,403	\$ 14,403	\$ 14,403	\$ 14,403	\$ 14,403	\$ 14,403
	Fuel (\$/kW)			\$ 380	\$ 366	\$ 355	\$ 338	\$ 347	\$ 349	\$ 352	\$ 356	\$ 360	\$ 377
Lump sum (\$)			\$ 38,798	\$ 79,792	\$ 187,234	\$ 350,758	\$ 692,721	\$ 976,247	\$ 1,030,547	\$ 1,085,844	\$ 1,143,010	\$ 1,212,802	

CHP (Natural gas)			2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	Gen SS Resource	\$0.10 \$/kWh
Recip Engine	MW	11.44	12.98	14.52	16.06	17.61	18.93	20.03	20.69	21.35	22.01			
	aMW	10.30	11.69	13.07	14.46	15.84	17.03	18.02	18.62	19.21	19.81			
	Inst costs (\$/kW)	\$ 1,087	\$ 1,087	\$ 1,087	\$ 1,087	\$ 1,087	\$ 1,087	\$ 1,087	\$ 1,087	\$ 1,087	\$ 1,087			
	O&M (\$/MW)	\$ 101,345	\$ 101,345	\$ 101,345	\$ 101,345	\$ 101,345	\$ 101,345	\$ 101,345	\$ 101,345	\$ 101,345	\$ 101,345			
	Fuel (\$/kW)	\$ 313	\$ 324	\$ 336	\$ 339	\$ 349	\$ 358	\$ 368	\$ 378	\$ 386	\$ 394			
	Lump sum (\$)	\$ 6,580,051	\$ 7,363,294	\$ 8,198,835	\$ 8,922,516	\$ 9,764,658	\$ 10,274,939	\$ 10,712,607	\$ 10,699,778	\$ 11,183,057	\$ 11,681,788			
Microturbine	MW	2.25	2.55	2.85	3.16	3.46	3.72	3.94	4.07	4.20	4.32			
	aMW	2.14	2.42	2.71	3.00	3.29	3.53	3.74	3.86	3.99	4.11			
	Inst costs (\$/kW)	\$ 1,634	\$ 1,634	\$ 1,634	\$ 1,634	\$ 1,634	\$ 1,634	\$ 1,634	\$ 1,634	\$ 1,634	\$ 1,634			
	O&M (\$/MW)	\$ 108,135	\$ 108,135	\$ 108,135	\$ 108,135	\$ 108,135	\$ 108,135	\$ 108,135	\$ 108,135	\$ 108,135	\$ 108,135			
	Fuel (\$/kW)	\$ 488	\$ 505	\$ 524	\$ 529	\$ 544	\$ 558	\$ 574	\$ 589	\$ 601	\$ 614			
	Lump sum (\$)	\$ 1,883,941	\$ 2,108,857	\$ 2,349,800	\$ 2,556,464	\$ 2,799,429	\$ 2,969,080	\$ 3,118,636	\$ 3,176,230	\$ 3,411,163	\$ 3,751,916			
Fuel Cell	MW	1.08	1.22	1.37	1.51	1.66	1.78	1.89	1.95	2.01	2.07			
	aMW	1.02	1.16	1.30	1.44	1.58	1.69	1.79	1.85	1.91	1.97			
	Inst costs (\$/kW)	\$ 5,314	\$ 5,314	\$ 5,314	\$ 5,314	\$ 5,314	\$ 5,314	\$ 5,314	\$ 5,314	\$ 5,314	\$ 5,314			
	O&M (\$/MW)	\$ 14,403	\$ 14,403	\$ 14,403	\$ 14,403	\$ 14,403	\$ 14,403	\$ 14,403	\$ 14,403	\$ 14,403	\$ 14,403			
	Fuel (\$/kW)	\$ 381	\$ 394	\$ 410	\$ 413	\$ 425	\$ 436	\$ 448	\$ 460	\$ 470	\$ 479			
	Lump sum (\$)	\$ 1,310,352	\$ 1,420,722	\$ 1,597,668	\$ 1,810,243	\$ 2,193,905	\$ 2,378,106	\$ 2,326,048	\$ 2,135,871	\$ 2,184,527	\$ 2,234,955			

NOTES: Red indicates levelized cost is less than cost of generic resource; all admin. costs are 10%

**Table E-2. Distributed Generation Base Case Scenario: Renewables**

Renewable	% Penetration (by MW)					2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	
	Res	Com	Ind													
Small Wind	30%	70%	0%													
	MW					0.00	0.00	0.01	0.01	0.03	0.04	0.06	0.08	0.10	0.12	
	aMW					0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.01	0.01	0.02	
	Inst costs (\$/kW)					\$ 2,598	\$ 2,598	\$ 2,598	\$ 2,598	\$ 2,598	\$ 2,598	\$ 2,598	\$ 2,598	\$ 2,598	\$ 2,598	
	O&M (\$/MW)					\$ 87,600	\$ 87,600	\$ 87,600	\$ 87,600	\$ 87,600	\$ 87,600	\$ 87,600	\$ 87,600	\$ 87,600	\$ 87,600	
	Lump sum (\$)					\$ 2,263	\$ 4,592	\$ 10,760	\$ 20,124	\$ 39,562	\$ 55,036	\$ 56,606	\$ 58,176	\$ 59,747	\$ 61,317	
	PV	50%	50%	0%												
		MW					0.00	0.01	0.01	0.03	0.06	0.10	0.15	0.19	0.23	0.27
		aMW					0.00	0.00	0.00	0.00	0.01	0.01	0.02	0.02	0.03	0.03
		Inst costs (\$/kW)					\$ 6,700	\$ 6,700	\$ 6,700	\$ 6,700	\$ 6,700	\$ 6,700	\$ 6,700	\$ 6,700	\$ 6,700	\$ 6,700
O&M (\$/MW)						\$ 16,800	\$ 16,800	\$ 16,800	\$ 16,800	\$ 16,800	\$ 16,800	\$ 16,800	\$ 16,800	\$ 16,800	\$ 16,800	
Lump sum (\$)					\$ 13,498	\$ 27,026	\$ 63,082	\$ 117,217	\$ 229,964	\$ 315,973	\$ 316,689	\$ 317,405	\$ 318,121	\$ 318,838		
Biomass	Industrial	0%	0%	100%												
		MW					0.04	0.11	0.29	0.62	1.27	2.15	3.04	3.93	4.81	5.70
		aMW					0.03	0.09	0.23	0.50	1.01	1.72	2.43	3.14	3.85	4.56
		Inst costs (\$/kW)					\$ 1,600	\$ 1,600	\$ 1,600	\$ 1,600	\$ 1,600	\$ 1,600	\$ 1,600	\$ 1,600	\$ 1,600	\$ 1,600
		O&M (\$/MW)					\$ 111,600	\$ 111,600	\$ 111,600	\$ 111,600	\$ 111,600	\$ 111,600	\$ 111,600	\$ 111,600	\$ 111,600	\$ 111,600
	Lump sum (\$)					\$ 71,112	\$ 146,465	\$ 344,578	\$ 648,816	\$ 1,278,168	\$ 1,800,631	\$ 1,899,512	\$ 1,998,512	\$ 2,097,452	\$ 2,196,392	
	Anaerobic Digester	0%	100%	0%												
		MW					0.02	0.07	0.17	0.37	0.76	1.29	1.82	2.35	2.88	3.41
		aMW					0.02	0.05	0.14	0.30	0.61	1.03	1.45	1.88	2.30	2.73
		Inst costs (\$/kW)					\$ 3,906	\$ 3,906	\$ 3,906	\$ 3,906	\$ 3,906	\$ 3,906	\$ 3,906	\$ 3,906	\$ 3,906	\$ 3,906
O&M (\$/MW)						\$ 96,013	\$ 96,013	\$ 96,013	\$ 96,013	\$ 96,013	\$ 96,013	\$ 96,013	\$ 96,013	\$ 96,013	\$ 96,013	
Lump sum (\$)					\$ 99,779	\$ 201,739	\$ 472,178	\$ 881,471	\$ 1,731,864	\$ 2,400,875	\$ 2,451,766	\$ 2,502,658	\$ 2,553,549	\$ 2,604,441		

Renewable						2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	Levelized Cost	
Small Wind	MW		0.13	0.15	0.17	0.19	0.20	0.22	0.23	0.24	0.25	0.26					
	aMW		0.02	0.02	0.03	0.03	0.03	0.03	0.03	0.04	0.04	0.04				Capacity Factor 15%	
	Inst costs (\$/kW)	\$	2,598	\$ 2,598	\$ 2,598	\$ 2,598	\$ 2,598	\$ 2,598	\$ 2,598	\$ 2,598	\$ 2,598	\$ 2,598				Levelized Cost \$0.32 \$/kWh	
	O&M (\$/MW)	\$	87,600	\$ 87,600	\$ 87,600	\$ 87,600	\$ 87,600	\$ 87,600	\$ 87,600	\$ 87,600	\$ 87,600	\$ 87,600					
	Lump sum (\$)	\$	62,888	\$ 64,458	\$ 66,028	\$ 67,599	\$ 69,169	\$ 70,740	\$ 72,311	\$ 73,882	\$ 75,453	\$ 77,024	\$ 78,595	\$ 80,166	\$ 81,737	\$ 83,308	
	PV	MW		0.32	0.36	0.40	0.44	0.49	0.52	0.55	0.57	0.59	0.61				
		aMW		0.04	0.04	0.05	0.05	0.06	0.06	0.07	0.07	0.07	0.07				Capacity Factor 12%
		Inst costs (\$/kW)	\$	6,700	\$ 6,700	\$ 6,700	\$ 6,700	\$ 6,700	\$ 6,700	\$ 6,700	\$ 6,700	\$ 6,700	\$ 6,700				Levelized Cost \$1.03 \$/kWh
		O&M (\$/MW)	\$	16,800	\$ 16,800	\$ 16,800	\$ 16,800	\$ 16,800	\$ 16,800	\$ 16,800	\$ 16,800	\$ 16,800	\$ 16,800				
		Lump sum (\$)	\$	319,554	\$ 320,270	\$ 320,987	\$ 321,703	\$ 322,419	\$ 323,135	\$ 323,851	\$ 324,567	\$ 325,283	\$ 326,000	\$ 326,716	\$ 327,432	\$ 328,148	\$ 328,864
Biomass	Industrial	MW		6.59	7.47	8.36	9.25	10.13	10.89	11.53	11.91	12.29	12.67				
		aMW		5.27	5.98	6.69	7.40	8.11	8.71	9.22	9.52	9.83	10.13				Capacity Factor 80%
		Inst costs (\$/kW)	\$	1,600	\$ 1,600	\$ 1,600	\$ 1,600	\$ 1,600	\$ 1,600	\$ 1,600	\$ 1,600	\$ 1,600	\$ 1,600				Levelized Cost \$0.04 \$/kWh
		O&M (\$/MW)	\$	111,600	\$ 111,600	\$ 111,600	\$ 111,600	\$ 111,600	\$ 111,600	\$ 111,600	\$ 111,600	\$ 111,600	\$ 111,600				
		Lump sum (\$)	\$	2,295,332	\$ 2,394,273	\$ 2,493,213	\$ 2,592,153	\$ 2,691,093	\$ 2,789,992	\$ 2,888,892	\$ 2,987,792	\$ 3,086,692	\$ 3,185,592	\$ 3,284,492	\$ 3,383,392	\$ 3,482,292	\$ 3,581,192
	Anaerobic Digester	MW		3.94	4.47	5.00	5.53	6.06	6.51	6.89	7.12	7.34	7.57				
		aMW		3.15	3.57	4.00	4.42	4.85	5.21	5.51	5.69	5.88	6.06				Capacity Factor 80%
		Inst costs (\$/kW)	\$	3,906	\$ 3,906	\$ 3,906	\$ 3,906	\$ 3,906	\$ 3,906	\$ 3,906	\$ 3,906	\$ 3,906	\$ 3,906				Levelized Cost \$0.10 \$/kWh
		O&M (\$/MW)	\$	96,013	\$ 96,013	\$ 96,013	\$ 96,013	\$ 96,013	\$ 96,013	\$ 96,013	\$ 96,013	\$ 96,013	\$ 96,013				
		Lump sum (\$)	\$	2,655,332	\$ 2,706,223	\$ 2,757,115	\$ 2,808,006	\$ 2,858,897	\$ 2,909,788	\$ 2,960,679	\$ 3,011,570	\$ 3,062,461	\$ 3,113,352	\$ 3,164,243	\$ 3,215,134	\$ 3,266,025	\$ 3,316,916

NOTE: Red indicates levelized cost is less than cost of generic resource; all admin. costs are 10%.

**Distributed Generation Base Case Economic Market Potential and Cost**

	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
MW	0.1	0.4	1.0	2.1	4.2	7.2	10.1	13.1	16.1	19.0
aMW	0.1	0.3	0.8	1.8	3.6	6.1	8.6	11.2	13.7	16.2
Total Cost	\$ 277,140	\$ 585,748	\$ 1,384,151	\$ 2,622,883	\$ 5,201,787	\$ 7,496,205	\$ 8,257,319	\$ 9,027,130	\$ 9,813,232	\$ 10,709,415
Fuel (\$/MMBTU)	\$ 7.87	\$ 7.59	\$ 7.36	\$ 7.00	\$ 6.64	\$ 6.28	\$ 5.92	\$ 5.56	\$ 5.20	\$ 4.84

	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027
MW	22.0	24.9	27.9	30.8	33.8	36.3	38.4	39.7	41.0	42.2
aMW	18.7	21.2	23.8	26.3	28.8	31.0	32.8	33.8	34.9	36.0
Total Cost	\$ 11,530,715	\$ 12,463,790	\$ 13,449,163	\$ 14,322,675	\$ 15,314,648	\$ 15,502,722	\$ 15,596,778	\$ 14,811,957	\$ 15,749,841	\$ 17,126,101
Fuel (\$/MMBTU)	\$ 7.89	\$ 8.17	\$ 8.49	\$ 8.56	\$ 8.80	\$ 9.04	\$ 9.28	\$ 9.53	\$ 9.73	\$ 9.93

Table E-3. Distributed Generation + Emerging Technologies Base Case Scenario: CHP (Natural Gas)

CHP (Natural gas)	% Penetration (by MW)			2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
	Res	Com	Ind										
Recip Engine	5%	63%	32%										
	MW			0.07	0.20	0.51	1.08	2.20	3.74	5.28	6.82	8.36	9.90
	aMW			0.06	0.18	0.46	0.97	1.98	3.37	4.75	6.14	7.53	8.91
	Inst costs (\$/kW)			\$ 1,087	\$ 1,087	\$ 1,087	\$ 1,087	\$ 1,087	\$ 1,087	\$ 1,087	\$ 1,087	\$ 1,087	\$ 1,087
	O&M (\$/MW)			\$ 101,345	\$ 101,345	\$ 101,345	\$ 101,345	\$ 101,345	\$ 101,345	\$ 101,345	\$ 101,345	\$ 101,345	\$ 101,345
	Fuel (\$/kW)			\$ 312	\$ 301	\$ 292	\$ 277	\$ 285	\$ 287	\$ 289	\$ 292	\$ 296	\$ 309
Lump sum (\$)			\$ 106,249	\$ 237,544	\$ 567,394	\$ 1,092,595	\$ 2,191,755	\$ 3,294,699	\$ 3,905,981	\$ 4,525,960	\$ 5,162,231	\$ 5,908,582	
Microturbine	5%	63%	32%										
	MW			0.01	0.04	0.10	0.21	0.43	0.74	1.04	1.34	1.64	1.95
	aMW			0.01	0.04	0.09	0.20	0.41	0.70	0.99	1.27	1.56	1.85
	Inst costs (\$/kW)			\$ 1,634	\$ 1,634	\$ 1,634	\$ 1,634	\$ 1,634	\$ 1,634	\$ 1,634	\$ 1,634	\$ 1,634	\$ 1,634
	O&M (\$/MW)			\$ 108,135	\$ 108,135	\$ 108,135	\$ 108,135	\$ 108,135	\$ 108,135	\$ 108,135	\$ 108,135	\$ 108,135	\$ 108,135
	Fuel (\$/kW)			\$ 487	\$ 469	\$ 455	\$ 432	\$ 444	\$ 447	\$ 451	\$ 455	\$ 461	\$ 482
Lump sum (\$)			\$ 31,043	\$ 69,114	\$ 164,857	\$ 316,715	\$ 635,300	\$ 952,684	\$ 1,124,904	\$ 1,299,789	\$ 1,479,666	\$ 1,693,277	
Fuel Cell	5%	63%	32%										
	MW			0.01	0.02	0.05	0.10	0.21	0.35	0.50	0.64	0.79	0.93
	aMW			0.01	0.02	0.05	0.10	0.20	0.33	0.47	0.61	0.75	0.89
	Inst costs (\$/kW)			\$ 5,314	\$ 5,314	\$ 5,314	\$ 5,314	\$ 5,314	\$ 5,314	\$ 5,314	\$ 5,314	\$ 5,314	\$ 5,314
	O&M (\$/MW)			\$ 14,403	\$ 14,403	\$ 14,403	\$ 14,403	\$ 14,403	\$ 14,403	\$ 14,403	\$ 14,403	\$ 14,403	\$ 14,403
	Fuel (\$/kW)			\$ 380	\$ 366	\$ 355	\$ 338	\$ 347	\$ 349	\$ 352	\$ 356	\$ 360	\$ 377
Lump sum (\$)			\$ 38,798	\$ 79,792	\$ 187,234	\$ 350,758	\$ 692,721	\$ 976,247	\$ 1,030,547	\$ 1,085,844	\$ 1,143,010	\$ 1,212,802	

CHP (Natural gas)		2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	Levelized Cost	
												Gen SS Resource	\$/kWh
Recip Engine	MW	11.44	12.98	14.52	16.06	17.61	18.93	20.03	20.69	21.35	22.01		
	aMW	10.30	11.69	13.07	14.46	15.84	17.03	18.02	18.62	19.21	19.81		
	Inst costs (\$/kW)	\$ 1,087	\$ 1,087	\$ 1,087	\$ 1,087	\$ 1,087	\$ 1,087	\$ 1,087	\$ 1,087	\$ 1,087	\$ 1,087		
	O&M (\$/MW)	\$ 101,345	\$ 101,345	\$ 101,345	\$ 101,345	\$ 101,345	\$ 101,345	\$ 101,345	\$ 101,345	\$ 101,345	\$ 101,345		
	Fuel (\$/kW)	\$ 313	\$ 324	\$ 336	\$ 339	\$ 349	\$ 358	\$ 368	\$ 378	\$ 386	\$ 394		
	Lump sum (\$)	\$ 6,580,051	\$ 7,363,294	\$ 8,198,835	\$ 8,922,516	\$ 9,764,658	\$ 10,274,939	\$ 10,712,607	\$ 10,699,778	\$ 11,183,057	\$ 11,681,788		
												Levelized Cost	\$0.11 \$/kWh
Microturbine	MW	2.25	2.55	2.85	3.16	3.46	3.72	3.94	4.07	4.20	4.32		
	aMW	2.14	2.42	2.71	3.00	3.29	3.53	3.74	3.86	3.99	4.11		
	Inst costs (\$/kW)	\$ 1,053	\$ 1,053	\$ 1,053	\$ 1,053	\$ 1,053	\$ 1,053	\$ 1,053	\$ 1,053	\$ 1,053	\$ 1,053		
	O&M (\$/MW)	\$ 108,135	\$ 108,135	\$ 108,135	\$ 108,135	\$ 108,135	\$ 108,135	\$ 108,135	\$ 108,135	\$ 108,135	\$ 108,135		
	Fuel (\$/kW)	\$ 488	\$ 505	\$ 524	\$ 529	\$ 544	\$ 558	\$ 574	\$ 589	\$ 601	\$ 614		
	Lump sum (\$)	\$ 1,690,201	\$ 1,915,117	\$ 2,156,060	\$ 2,362,724	\$ 2,605,690	\$ 2,794,714	\$ 2,963,644	\$ 3,054,451	\$ 3,256,171	\$ 3,527,731		
												Levelized Cost	\$0.08 \$/kWh
Fuel Cell	MW	1.08	1.22	1.37	1.51	1.66	1.78	1.89	1.95	2.01	2.07		
	aMW	1.02	1.16	1.30	1.44	1.58	1.69	1.79	1.85	1.91	1.97		
	Inst costs (\$/kW)	\$ 3,423	\$ 3,423	\$ 3,423	\$ 3,423	\$ 3,423	\$ 3,423	\$ 3,423	\$ 3,423	\$ 3,423	\$ 3,423		
	O&M (\$/MW)	\$ 14,403	\$ 14,403	\$ 14,403	\$ 14,403	\$ 14,403	\$ 14,403	\$ 14,403	\$ 14,403	\$ 14,403	\$ 14,403		
	Fuel (\$/kW)	\$ 381	\$ 394	\$ 410	\$ 413	\$ 425	\$ 436	\$ 448	\$ 460	\$ 470	\$ 479		
	Lump sum (\$)	\$ 995,550	\$ 1,092,983	\$ 1,235,430	\$ 1,396,257	\$ 1,672,111	\$ 1,817,500	\$ 1,808,565	\$ 1,704,636	\$ 1,753,292	\$ 1,803,720		
												Level Cost	\$0.16 \$/kWh

NOTES: Red indicates levelized cost is less than cost of generic resource; all admin. costs are 10%.

**Table E-4. Distributed Generation + Emerging Technologies Base Case Scenario: Renewables**

Renewable	% Penetration (by MW)					2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	
	Res	Com	Ind													
Small Wind	30%	70%	0%													
				MW		0.00	0.00	0.01	0.01	0.03	0.04	0.06	0.08	0.10	0.12	
				aMW		0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.01	0.01	0.02	
				Inst costs (\$/kW)	\$	2,598	2,598	2,598	2,598	2,598	2,598	2,598	2,598	2,598	2,598	2,598
				O&M (\$/MW)	\$	87,600	87,600	87,600	87,600	87,600	87,600	87,600	87,600	87,600	87,600	87,600
PV	50%	50%	0%													
				Lump sum (\$)	\$	2,263	4,592	10,760	20,124	39,562	55,036	56,606	58,176	59,747	61,317	
				MW		0.00	0.01	0.01	0.03	0.06	0.10	0.15	0.19	0.23	0.27	
				aMW		0.00	0.00	0.00	0.00	0.01	0.01	0.02	0.02	0.03	0.03	
				Inst costs (\$/kW)	\$	6,700	6,700	6,700	6,700	6,700	6,700	6,700	6,700	6,700	6,700	
Biomass				O&M (\$/MW)	\$	16,800	16,800	16,800	16,800	16,800	16,800	16,800	16,800	16,800	16,800	
				Lump sum (\$)	\$	13,498	27,026	63,082	117,217	229,964	315,973	316,689	317,405	318,121	318,838	
	Industrial	0%	0%	100%												
					MW		0.04	0.11	0.29	0.62	1.27	2.15	3.04	3.93	4.81	5.70
					aMW		0.03	0.09	0.23	0.50	1.01	1.72	2.43	3.14	3.85	4.56
				Inst costs (\$/kW)	\$	1,600	1,600	1,600	1,600	1,600	1,600	1,600	1,600	1,600	1,600	
				O&M (\$/MW)	\$	111,600	111,600	111,600	111,600	111,600	111,600	111,600	111,600	111,600	111,600	
Anaerobic Digester	0%	100%	0%													
				Lump sum (\$)	\$	71,112	146,465	344,578	648,816	1,278,168	1,800,631	1,899,571	1,998,512	2,097,452	2,196,392	
				MW		0.02	0.07	0.17	0.37	0.76	1.29	1.82	2.35	2.88	3.41	
				aMW		0.02	0.05	0.14	0.30	0.61	1.03	1.45	1.88	2.30	2.73	
				Inst costs (\$/kW)	\$	3,906	3,906	3,906	3,906	3,906	3,906	3,906	3,906	3,906	3,906	
			O&M (\$/MW)	\$	96,013	96,013	96,013	96,013	96,013	96,013	96,013	96,013	96,013	96,013		
			Lump sum (\$)	\$	99,779	201,739	472,178	881,471	1,731,864	2,400,875	2,451,766	2,502,658	2,553,549	2,604,441		

Renewable						2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	Levelized Cost
Small Wind	MW		0.13	0.15	0.17	0.19	0.20	0.22	0.23	0.24	0.25	0.26	0.26	0.26	0.26	
	aMW		0.02	0.03	0.03	0.03	0.04	0.04	0.04	0.05	0.05	0.05	0.05	0.05	0.05	Capacity Factor 15%
	Inst costs (\$/kW)	\$	2,598	2,598	2,598	2,598	2,598	2,598	2,598	2,598	2,598	2,598	2,598	2,598	2,598	CF after Year 10 23%
	O&M (\$/MW)	\$	87,600	87,600	87,600	87,600	87,600	87,600	87,600	87,600	87,600	87,600	87,600	87,600	87,600	Levelized Cost \$0.30 \$/kWh
	Lump sum (\$)	\$	62,888	64,458	66,028	67,599	69,169	70,740	72,310	73,881	75,451	77,021	78,591	80,161	81,731	44,386
PV	MW		0.32	0.36	0.40	0.44	0.49	0.52	0.55	0.57	0.59	0.61	0.61	0.61	0.61	
	aMW		0.04	0.04	0.05	0.05	0.06	0.06	0.07	0.07	0.07	0.07	0.07	0.07	0.07	Capacity Factor 12%
	Inst costs (\$/kW)	\$	4,315	4,315	4,315	4,315	4,315	4,315	4,315	4,315	4,315	4,315	4,315	4,315	4,315	4,315
	O&M (\$/MW)	\$	16,800	16,800	16,800	16,800	16,800	16,800	16,800	16,800	16,800	16,800	16,800	16,800	16,800	16,800
	Lump sum (\$)	\$	207,705	208,421	209,137	209,854	210,570	211,286	212,002	212,718	213,434	214,150	214,866	215,582	216,298	96,969
Biomass	Industrial	MW		6.59	7.47	8.36	9.25	10.13	10.89	11.53	11.91	12.29	12.67	12.67	12.67	
		aMW		5.27	5.98	6.69	7.40	8.11	8.71	9.22	9.52	9.83	10.13	10.13	10.13	Capacity Factor 80%
		Inst costs (\$/kW)	\$	1,600	1,600	1,600	1,600	1,600	1,600	1,600	1,600	1,600	1,600	1,600	1,600	1,600
		O&M (\$/MW)	\$	111,600	111,600	111,600	111,600	111,600	111,600	111,600	111,600	111,600	111,600	111,600	111,600	111,600
		Lump sum (\$)	\$	2,295,332	2,394,273	2,493,213	2,592,153	2,691,093	2,789,933	2,888,873	2,987,813	3,086,753	3,185,693	3,284,633	3,383,573	3,482,513
Anaerobic Digester	MW		3.94	4.47	5.00	5.53	6.06	6.51	6.89	7.12	7.34	7.57	7.57	7.57		
	aMW		3.15	3.57	4.00	4.42	4.85	5.21	5.51	5.69	5.88	6.06	6.06	6.06	Capacity Factor 80%	
	Inst costs (\$/kW)	\$	3,354	3,354	3,354	3,354	3,354	3,354	3,354	3,354	3,354	3,354	3,354	3,354	3,354	
	O&M (\$/MW)	\$	96,013	96,013	96,013	96,013	96,013	96,013	96,013	96,013	96,013	96,013	96,013	96,013	96,013	
	Lump sum (\$)	\$	2,333,647	2,384,539	2,435,430	2,486,321	2,537,213	2,588,104	2,638,995	2,689,886	2,740,777	2,791,668	2,842,559	2,893,450	2,944,341	2,989,925

NOTE: Red indicates levelized cost is less than cost of generic resource; all admin. costs are 10%.

**Distributed Generation + Emerging Technologies Base Case Economic Market Potential and Cost**

	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
MW	0.1	0.4	1.1	2.3	4.7	7.9	11.2	14.4	17.7	21.0
aMW	0.1	0.4	0.9	2.0	4.0	6.8	9.6	12.4	15.2	18.0
Total Cost	\$ 308,183	\$ 654,862	\$ 1,549,007	\$ 2,939,598	\$ 5,837,087	\$ 8,448,889	\$ 9,382,223	\$ 10,326,919	\$ 11,292,898	\$ 12,402,692
Fuel (\$/MMBTU)	\$ 7.87	\$ 7.59	\$ 7.36	\$ 7.00	\$ 6.63	\$ 6.27	\$ 5.91	\$ 5.55	\$ 5.19	\$ 4.83

	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027
MW	24.2	27.5	30.7	34.0	37.3	40.0	42.4	43.8	45.2	46.6
aMW	20.9	23.7	26.5	29.3	32.1	34.5	36.5	37.7	38.9	40.1
Total Cost	\$ 12,899,231	\$ 14,057,222	\$ 15,283,538	\$ 16,363,714	\$ 17,598,653	\$ 18,007,919	\$ 18,303,074	\$ 17,664,205	\$ 18,748,665	\$ 20,281,597
Fuel (\$/MMBTU)	\$ 7.89	\$ 8.17	\$ 8.49	\$ 8.56	\$ 8.80	\$ 9.04	\$ 9.28	\$ 9.53	\$ 9.73	\$ 9.93

Table E-5. Distributed Generation Base Case -10% Scenario: CHP (Natural Gas)

CHP (Natural gas)	% Penetration (by MW)					2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	
	Res	Com	Ind													
Recip Engine	0%	65%	35%	MW		0.07	0.20	0.51	1.08	2.20	3.74	5.28	6.82	8.36	9.90	
				aMW		0.06	0.18	0.46	0.97	1.98	3.37	4.75	6.14	7.53	8.91	
				Inst costs (\$/kW)	\$	1,087	1,087	1,087	1,087	1,087	1,087	1,087	1,087	1,087	1,087	1,087
				O&M (\$/MW)	\$	101,345	101,345	101,345	101,345	101,345	101,345	101,345	101,345	101,345	101,345	101,345
				Fuel (\$/kW)	\$	312	301	292	277	285	287	289	292	292	309	309
				Lump sum (\$)	\$	104,189	231,588	552,631	1,062,694	2,129,110	3,187,378	3,753,143	4,326,736	4,914,991	5,602,319	
Microturbine	0%	65%	35%	MW		0.01	0.04	0.10	0.21	0.43	0.74	1.04	1.34	1.64	1.95	
				aMW		0.01	0.04	0.09	0.20	0.41	0.70	0.99	1.27	1.56	1.85	
				Inst costs (\$/kW)	\$	1,634	1,634	1,634	1,634	1,634	1,634	1,634	1,634	1,634	1,634	
				O&M (\$/MW)	\$	108,135	108,135	108,135	108,135	108,135	108,135	108,135	108,135	108,135	108,135	
				Fuel (\$/kW)	\$	487	469	455	432	444	447	451	455	461	482	
				Lump sum (\$)	\$	30,412	67,289	160,333	307,552	616,103	919,796	1,078,067	1,238,738	1,403,901	1,599,425	
Fuel Cell	0%	65%	35%	MW		0.01	0.02	0.05	0.10	0.21	0.35	0.50	0.64	0.79	0.93	
				aMW		0.01	0.02	0.05	0.10	0.20	0.33	0.47	0.61	0.75	0.89	
				Inst costs (\$/kW)	\$	5,314	5,314	5,314	5,314	5,314	5,314	5,314	5,314	5,314	5,314	
				O&M (\$/MW)	\$	14,403	14,403	14,403	14,403	14,403	14,403	14,403	14,403	14,403	14,403	
				Fuel (\$/kW)	\$	380	366	355	338	347	349	352	356	360	377	
				Lump sum (\$)	\$	38,562	79,109	185,541	347,328	685,535	963,937	1,013,015	1,062,992	1,114,650	1,177,672	

CHP (Natural gas)													Levelized Cost		
													2018	2019	2020
Recip Engine	MW	11.44	12.98	14.52	16.06	17.61	18.93	20.03	20.69	21.35	22.01				
	aMW	10.30	11.69	13.07	14.46	15.84	17.03	18.02	18.62	19.21	19.81				
	Inst costs (\$/kW)	\$ 1,087	\$ 1,087	\$ 1,087	\$ 1,087	\$ 1,087	\$ 1,087	\$ 1,087	\$ 1,087	\$ 1,087	\$ 1,087			90%	
	O&M (\$/MW)	\$ 101,345	\$ 101,345	\$ 101,345	\$ 101,345	\$ 101,345	\$ 101,345	\$ 101,345	\$ 101,345	\$ 101,345	\$ 101,345				
	Fuel (\$/kW)	\$ 313	\$ 324	\$ 336	\$ 339	\$ 349	\$ 358	\$ 368	\$ 378	\$ 386	\$ 394				
	Lump sum (\$)	\$ 6,222,253	\$ 6,942,783	\$ 7,710,382	\$ 8,377,307	\$ 9,150,846	\$ 9,597,162	\$ 9,975,895	\$ 9,918,401	\$ 10,360,043	\$ 10,815,592				Levelized Cost
Microturbine	MW	2.25	2.55	2.85	3.16	3.46	3.72	3.94	4.07	4.20	4.32				
	aMW	2.14	2.42	2.71	3.00	3.29	3.53	3.74	3.86	3.99	4.11				
	Inst costs (\$/kW)	\$ 1,053	\$ 1,053	\$ 1,053	\$ 1,053	\$ 1,053	\$ 1,053	\$ 1,053	\$ 1,053	\$ 1,053	\$ 1,053			95%	
	O&M (\$/MW)	\$ 108,135	\$ 108,135	\$ 108,135	\$ 108,135	\$ 108,135	\$ 108,135	\$ 108,135	\$ 108,135	\$ 108,135	\$ 108,135				
	Fuel (\$/kW)	\$ 488	\$ 505	\$ 524	\$ 529	\$ 544	\$ 558	\$ 574	\$ 589	\$ 601	\$ 614				
	Lump sum (\$)	\$ 1,774,296	\$ 1,979,994	\$ 2,200,117	\$ 2,389,388	\$ 2,611,330	\$ 2,761,379	\$ 2,892,874	\$ 2,936,781	\$ 3,158,955	\$ 3,486,475				Levelized Cost
Fuel Cell	MW	1.08	1.22	1.37	1.51	1.66	1.78	1.89	1.95	2.01	2.07				
	aMW	1.02	1.16	1.30	1.44	1.58	1.69	1.79	1.85	1.91	1.97				
	Inst costs (\$/kW)	\$ 3,423	\$ 3,423	\$ 3,423	\$ 3,423	\$ 3,423	\$ 3,423	\$ 3,423	\$ 3,423	\$ 3,423	\$ 3,423			95%	
	O&M (\$/MW)	\$ 14,403	\$ 14,403	\$ 14,403	\$ 14,403	\$ 14,403	\$ 14,403	\$ 14,403	\$ 14,403	\$ 14,403	\$ 14,403				
	Fuel (\$/kW)	\$ 381	\$ 394	\$ 410	\$ 413	\$ 425	\$ 436	\$ 448	\$ 460	\$ 470	\$ 479				
	Lump sum (\$)	\$ 1,269,310	\$ 1,372,487	\$ 1,541,639	\$ 1,747,704	\$ 2,123,498	\$ 2,300,361	\$ 2,241,543	\$ 2,046,242	\$ 2,090,122	\$ 2,135,597				Levelized Cost

NOTE: Red indicates levelized cost is less than cost of generic resource; all admin. costs are 10%.

**Table E-6. Distributed Generation Base Case -10% Scenario: Renewables**

Renewable	% Penetration (by MW)					2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	
	Res	Com	Ind													
Small Wind	30%	70%	0%													
	MW					0.00	0.00	0.01	0.01	0.03	0.04	0.06	0.08	0.10	0.12	
	aMW					0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.01	0.02	
	Inst costs (\$/kW)					\$ 2,598	\$ 2,598	\$ 2,598	\$ 2,598	\$ 2,598	\$ 2,598	\$ 2,598	\$ 2,598	\$ 2,598	\$ 2,598	
	O&M (\$/MW)					\$ 87,600	\$ 87,600	\$ 87,600	\$ 87,600	\$ 87,600	\$ 87,600	\$ 87,600	\$ 87,600	\$ 87,600	\$ 87,600	
	Lump sum (\$)					\$ 2,263	\$ 4,592	\$ 10,760	\$ 20,124	\$ 39,562	\$ 55,036	\$ 56,606	\$ 58,176	\$ 59,747	\$ 61,317	
	PV	50%	50%	0%												
		MW					0.00	0.01	0.01	0.03	0.06	0.10	0.15	0.19	0.23	0.27
		aMW					0.00	0.00	0.00	0.00	0.01	0.01	0.02	0.02	0.03	0.03
		Inst costs (\$/kW)					\$ 6,700	\$ 6,700	\$ 6,700	\$ 6,700	\$ 6,700	\$ 6,700	\$ 6,700	\$ 6,700	\$ 6,700	\$ 6,700
O&M (\$/MW)						\$ 16,800	\$ 16,800	\$ 16,800	\$ 16,800	\$ 16,800	\$ 16,800	\$ 16,800	\$ 16,800	\$ 16,800	\$ 16,800	
Lump sum (\$)						\$ 13,498	\$ 27,026	\$ 63,082	\$ 117,217	\$ 229,964	\$ 315,973	\$ 316,689	\$ 317,405	\$ 318,121	\$ 318,838	
Biomass		0%	0%	100%												
		MW					0.04	0.11	0.29	0.62	1.27	2.15	3.04	3.93	4.81	5.70
		aMW					0.03	0.09	0.23	0.50	1.01	1.72	2.43	3.14	3.85	4.56
		Inst costs (\$/kW)					\$ 1,600	\$ 1,600	\$ 1,600	\$ 1,600	\$ 1,600	\$ 1,600	\$ 1,600	\$ 1,600	\$ 1,600	\$ 1,600
	O&M (\$/MW)					\$ 111,600	\$ 111,600	\$ 111,600	\$ 111,600	\$ 111,600	\$ 111,600	\$ 111,600	\$ 111,600	\$ 111,600	\$ 111,600	
	Lump sum (\$)					\$ 71,112	\$ 146,465	\$ 344,578	\$ 648,816	\$ 1,278,168	\$ 1,800,631	\$ 1,899,571	\$ 1,998,512	\$ 2,097,452	\$ 2,196,392	
	Industrial	0%	0%	100%												
		MW					0.02	0.07	0.17	0.37	0.76	1.29	1.82	2.35	2.88	3.41
		aMW					0.02	0.05	0.14	0.30	0.61	1.03	1.45	1.88	2.30	2.73
		Inst costs (\$/kW)					\$ 3,906	\$ 3,906	\$ 3,906	\$ 3,906	\$ 3,906	\$ 3,906	\$ 3,906	\$ 3,906	\$ 3,906	\$ 3,906
O&M (\$/MW)						\$ 96,013	\$ 96,013	\$ 96,013	\$ 96,013	\$ 96,013	\$ 96,013	\$ 96,013	\$ 96,013	\$ 96,013	\$ 96,013	
Lump sum (\$)						\$ 99,779	\$ 201,739	\$ 472,178	\$ 881,471	\$ 1,731,864	\$ 2,400,875	\$ 2,451,766	\$ 2,502,658	\$ 2,553,549	\$ 2,604,441	
Anaerobic Digester		0%	100%	0%												
		MW					0.02	0.07	0.17	0.37	0.76	1.29	1.82	2.35	2.88	3.41
		aMW					0.02	0.05	0.14	0.30	0.61	1.03	1.45	1.88	2.30	2.73
		Inst costs (\$/kW)					\$ 3,906	\$ 3,906	\$ 3,906	\$ 3,906	\$ 3,906	\$ 3,906	\$ 3,906	\$ 3,906	\$ 3,906	\$ 3,906
	O&M (\$/MW)					\$ 96,013	\$ 96,013	\$ 96,013	\$ 96,013	\$ 96,013	\$ 96,013	\$ 96,013	\$ 96,013	\$ 96,013	\$ 96,013	
	Lump sum (\$)					\$ 99,779	\$ 201,739	\$ 472,178	\$ 881,471	\$ 1,731,864	\$ 2,400,875	\$ 2,451,766	\$ 2,502,658	\$ 2,553,549	\$ 2,604,441	

Renewable		2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	Levelized Cost			
Small Wind	MW	0.13	0.15	0.17	0.19	0.20	0.22	0.23	0.24	0.25	0.26				
	aMW	0.02	0.03	0.03	0.03	0.04	0.04	0.04	0.05	0.05	0.05	Capacity Factor	15%		
	Inst costs (\$/kW)	\$ 2,598	\$ 2,598	\$ 2,598	\$ 2,598	\$ 2,598	\$ 2,598	\$ 2,598	\$ 2,598	\$ 2,598	\$ 2,598	CF after Year 10	23%		
	O&M (\$/MW)	\$ 87,600	\$ 87,600	\$ 87,600	\$ 87,600	\$ 87,600	\$ 87,600	\$ 87,600	\$ 87,600	\$ 87,600	\$ 87,600	Levelized Cost	\$0.30 \$/kWh		
	Lump sum (\$)	\$ 62,888	\$ 64,458	\$ 66,028	\$ 67,599	\$ 69,169	\$ 70,740	\$ 72,310	\$ 73,881	\$ 75,451	\$ 77,021				
	PV	MW	0.32	0.36	0.40	0.44	0.49	0.52	0.55	0.57	0.59	0.61			
		aMW	0.04	0.04	0.05	0.05	0.06	0.06	0.07	0.07	0.07	0.07	Capacity Factor	12%	
		Inst costs (\$/kW)	\$ 4,315	\$ 4,315	\$ 4,315	\$ 4,315	\$ 4,315	\$ 4,315	\$ 4,315	\$ 4,315	\$ 4,315	\$ 4,315			
		O&M (\$/MW)	\$ 16,800	\$ 16,800	\$ 16,800	\$ 16,800	\$ 16,800	\$ 16,800	\$ 16,800	\$ 16,800	\$ 16,800	\$ 16,800	Levelized Cost	\$0.97 \$/kWh	
		Lump sum (\$)	\$ 319,554	\$ 320,270	\$ 320,987	\$ 321,703	\$ 322,419	\$ 323,135	\$ 323,851	\$ 324,567	\$ 325,283	\$ 325,999			
Biomass		Industrial	MW	6.59	7.47	8.36	9.25	10.13	10.89	11.53	11.91	12.29	12.67		
			aMW	5.27	5.98	6.69	7.40	8.11	8.71	9.22	9.52	9.83	10.13	Capacity Factor	80%
			Inst costs (\$/kW)	\$ 1,600	\$ 1,600	\$ 1,600	\$ 1,600	\$ 1,600	\$ 1,600	\$ 1,600	\$ 1,600	\$ 1,600	\$ 1,600		
			O&M (\$/MW)	\$ 111,600	\$ 111,600	\$ 111,600	\$ 111,600	\$ 111,600	\$ 111,600	\$ 111,600	\$ 111,600	\$ 111,600	\$ 111,600		
			Lump sum (\$)	\$ 2,295,332	\$ 2,394,273	\$ 2,493,213	\$ 2,592,153	\$ 2,691,093	\$ 2,789,993	\$ 2,888,893	\$ 2,987,793	\$ 3,086,693	\$ 3,185,593	Levelized Cost	\$0.04 \$/kWh
	Anaerobic Digester	MW	3.94	4.47	5.00	5.53	6.06	6.51	6.89	7.12	7.34	7.57			
		aMW	3.15	3.57	4.00	4.42	4.85	5.21	5.51	5.69	5.88	6.06	Capacity Factor	80%	
		Inst costs (\$/kW)	\$ 3,354	\$ 3,354	\$ 3,354	\$ 3,354	\$ 3,354	\$ 3,354	\$ 3,354	\$ 3,354	\$ 3,354	\$ 3,354			
		O&M (\$/MW)	\$ 96,013	\$ 96,013	\$ 96,013	\$ 96,013	\$ 96,013	\$ 96,013	\$ 96,013	\$ 96,013	\$ 96,013	\$ 96,013			
		Lump sum (\$)	\$ 2,655,332	\$ 2,706,223	\$ 2,757,115	\$ 2,808,006	\$ 2,858,897	\$ 2,909,788	\$ 2,960,679	\$ 3,011,570	\$ 3,062,461	\$ 3,113,352	Levelized Cost	\$0.10 \$/kWh	

NOTE: Red indicates levelized cost is less than cost of generic resource; all admin. costs are 10%.

**Distributed Generation Base Case -10% Economic Market Potential and Cost**

	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
MW	0.1	0.4	1.0	2.1	4.2	7.2	10.1	13.1	16.1	19.0
aMW	0.1	0.3	0.8	1.8	3.6	6.1	8.6	11.2	13.7	16.2
Total Cost	\$ 275,080	\$ 579,792	\$ 1,369,388	\$ 2,592,981	\$ 5,139,142	\$ 7,388,884	\$ 8,104,481	\$ 8,827,906	\$ 9,565,993	\$ 10,403,152
Fuel (\$/MMBTU)	\$ 7.09	\$ 6.83	\$ 6.62	\$ 6.30	\$ 6.46	\$ 6.51	\$ 6.57	\$ 6.63	\$ 6.71	\$ 7.02

	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027
MW	22.0	24.9	27.9	30.8	33.8	36.3	38.4	39.7	41.0	42.2
aMW	18.7	21.2	23.8	26.3	28.8	31.0	32.8	33.8	34.9	36.0
Total Cost	\$ 11,172,917	\$ 12,043,279	\$ 12,960,710	\$ 13,777,466	\$ 14,700,837	\$ 14,824,944	\$ 14,860,066	\$ 14,030,580	\$ 14,926,827	\$ 16,259,904
Fuel (\$/MMBTU)	\$ 7.10	\$ 7.36	\$ 7.64	\$ 7.71	\$ 7.92	\$ 8.13	\$ 8.35	\$ 8.58	\$ 8.76	\$ 8.94

Table E-7. Distributed Generation + Emerging Technologies Base Case -10% Scenario: CHP (Natural Gas)

CHP (Natural gas)	% Penetration (by MW)			Ind		2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	
	Res	Com	32%													
Recip Engine	5%	63%	32%		MW	0.07	0.20	0.51	1.08	2.20	3.74	5.28	6.82	8.36	9.90	
					aMW	0.06	0.18	0.46	0.97	1.98	3.37	4.75	6.14	7.53	8.91	
					Inst costs (\$/kW)	\$ 1,087	\$ 1,087	\$ 1,087	\$ 1,087	\$ 1,087	\$ 1,087	\$ 1,087	\$ 1,087	\$ 1,087	\$ 1,087	\$ 1,087
					O&M (\$/MW)	\$ 101,345	\$ 101,345	\$ 101,345	\$ 101,345	\$ 101,345	\$ 101,345	\$ 101,345	\$ 101,345	\$ 101,345	\$ 101,345	\$ 101,345
					Fuel (\$/kW)	\$ 281	\$ 271	\$ 263	\$ 250	\$ 256	\$ 258	\$ 260	\$ 263	\$ 266	\$ 278	
					Lump sum (\$)	\$ 104,189	\$ 231,588	\$ 552,631	\$ 1,062,694	\$ 2,129,110	\$ 3,187,378	\$ 3,753,143	\$ 4,326,736	\$ 4,914,991	\$ 5,602,319	
Microturbine	5%	63%	32%		MW	0.01	0.04	0.10	0.21	0.43	0.74	1.04	1.34	1.64	1.95	
					aMW	0.01	0.04	0.09	0.20	0.41	0.70	0.99	1.27	1.56	1.85	
					Inst costs (\$/kW)	\$ 1,634	\$ 1,634	\$ 1,634	\$ 1,634	\$ 1,634	\$ 1,634	\$ 1,634	\$ 1,634	\$ 1,634	\$ 1,634	
					O&M (\$/MW)	\$ 108,135	\$ 108,135	\$ 108,135	\$ 108,135	\$ 108,135	\$ 108,135	\$ 108,135	\$ 108,135	\$ 108,135	\$ 108,135	
					Fuel (\$/kW)	\$ 438	\$ 422	\$ 409	\$ 389	\$ 399	\$ 403	\$ 406	\$ 410	\$ 415	\$ 434	
					Lump sum (\$)	\$ 30,412	\$ 67,289	\$ 160,333	\$ 307,552	\$ 616,103	\$ 919,796	\$ 1,078,067	\$ 1,238,738	\$ 1,403,901	\$ 1,599,425	
Fuel Cell	5%	63%	32%		MW	0.01	0.02	0.05	0.10	0.21	0.35	0.50	0.64	0.79	0.93	
					aMW	0.01	0.02	0.05	0.10	0.20	0.33	0.47	0.61	0.75	0.89	
					Inst costs (\$/kW)	\$ 5,314	\$ 5,314	\$ 5,314	\$ 5,314	\$ 5,314	\$ 5,314	\$ 5,314	\$ 5,314	\$ 5,314	\$ 5,314	
					O&M (\$/MW)	\$ 14,403	\$ 14,403	\$ 14,403	\$ 14,403	\$ 14,403	\$ 14,403	\$ 14,403	\$ 14,403	\$ 14,403	\$ 14,403	
					Fuel (\$/kW)	\$ 342	\$ 330	\$ 320	\$ 304	\$ 312	\$ 314	\$ 317	\$ 320	\$ 324	\$ 339	
					Lump sum (\$)	\$ 38,562	\$ 79,109	\$ 185,541	\$ 347,328	\$ 685,535	\$ 963,937	\$ 1,013,015	\$ 1,062,992	\$ 1,114,650	\$ 1,177,672	

CHP (Natural gas)		2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	Levelized Cost	
													Gen SS Resource
Recip Engine	MW	11.44	12.98	14.52	16.06	17.61	18.93	20.03	20.69	21.35	22.01		
	aMW	10.30	11.69	13.07	14.46	15.84	17.03	18.02	18.62	19.21	19.81		
	Inst costs (\$/kW)	\$ 1,087	\$ 1,087	\$ 1,087	\$ 1,087	\$ 1,087	\$ 1,087	\$ 1,087	\$ 1,087	\$ 1,087	\$ 1,087		90%
	O&M (\$/MW)	\$ 101,345	\$ 101,345	\$ 101,345	\$ 101,345	\$ 101,345	\$ 101,345	\$ 101,345	\$ 101,345	\$ 101,345	\$ 101,345		
	Fuel (\$/kW)	\$ 281	\$ 291	\$ 303	\$ 305	\$ 314	\$ 322	\$ 331	\$ 340	\$ 347	\$ 354		
	Lump sum (\$)	\$ 6,222,253	\$ 6,942,783	\$ 7,710,382	\$ 8,377,307	\$ 9,150,846	\$ 9,597,162	\$ 9,975,895	\$ 9,918,401	\$ 10,360,043	\$ 10,815,592		Levelized Cost
Microturbine	MW	2.25	2.55	2.85	3.16	3.46	3.72	3.94	4.07	4.20	4.32		
	aMW	2.14	2.42	2.71	3.00	3.29	3.53	3.74	3.86	3.99	4.11		
	Inst costs (\$/kW)	\$ 1,053	\$ 1,053	\$ 1,053	\$ 1,053	\$ 1,053	\$ 1,053	\$ 1,053	\$ 1,053	\$ 1,053	\$ 1,053		95%
	O&M (\$/MW)	\$ 108,135	\$ 108,135	\$ 108,135	\$ 108,135	\$ 108,135	\$ 108,135	\$ 108,135	\$ 108,135	\$ 108,135	\$ 108,135		
	Fuel (\$/kW)	\$ 439	\$ 455	\$ 472	\$ 476	\$ 489	\$ 503	\$ 516	\$ 530	\$ 541	\$ 552		
	Lump sum (\$)	\$ 1,580,556	\$ 1,786,254	\$ 2,006,377	\$ 2,195,648	\$ 2,417,591	\$ 2,587,013	\$ 2,737,883	\$ 2,815,002	\$ 3,003,964	\$ 3,262,290		Levelized Cost
Fuel Cell	MW	1.08	1.22	1.37	1.51	1.66	1.78	1.89	1.95	2.01	2.07		
	aMW	1.02	1.16	1.30	1.44	1.58	1.69	1.79	1.85	1.91	1.97		
	Inst costs (\$/kW)	\$ 3,423	\$ 3,423	\$ 3,423	\$ 3,423	\$ 3,423	\$ 3,423	\$ 3,423	\$ 3,423	\$ 3,423	\$ 3,423		95%
	O&M (\$/MW)	\$ 14,403	\$ 14,403	\$ 14,403	\$ 14,403	\$ 14,403	\$ 14,403	\$ 14,403	\$ 14,403	\$ 14,403	\$ 14,403		
	Fuel (\$/kW)	\$ 343	\$ 355	\$ 369	\$ 372	\$ 382	\$ 393	\$ 403	\$ 414	\$ 423	\$ 431		
	Lump sum (\$)	\$ 954,508	\$ 1,044,748	\$ 1,179,402	\$ 1,333,719	\$ 1,601,703	\$ 1,739,755	\$ 1,724,060	\$ 1,615,007	\$ 1,658,887	\$ 1,704,362		Levelized Cost

NOTE: Red indicates levelized cost is less than cost of generic resource; all admin. costs are 10%.



**Table E-8. Distributed Generation + Emerging Technologies Base Case -10% Scenario: Renewables**

Renewable	% Penetration (by MW)					2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	
	Res	Com	Ind	0%												
Small Wind	30%		70%	0%	MW	0.00	0.00	0.01	0.01	0.03	0.04	0.06	0.08	0.10	0.12	
					aMW	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.01	0.01	0.02	
					Inst costs (\$/kW)	\$ 2,598	\$ 2,598	\$ 2,598	\$ 2,598	\$ 2,598	\$ 2,598	\$ 2,598	\$ 2,598	\$ 2,598	\$ 2,598	\$ 2,598
					O&M (\$/MW)	\$ 87,600	\$ 87,600	\$ 87,600	\$ 87,600	\$ 87,600	\$ 87,600	\$ 87,600	\$ 87,600	\$ 87,600	\$ 87,600	\$ 87,600
					Lump sum (\$)	\$ 2,263	\$ 4,592	\$ 10,760	\$ 20,124	\$ 39,562	\$ 55,036	\$ 56,606	\$ 58,176	\$ 59,747	\$ 61,317	
PV	50%		50%	0%	MW	0.00	0.01	0.01	0.03	0.06	0.10	0.15	0.19	0.23	0.27	
					aMW	0.00	0.00	0.00	0.00	0.01	0.01	0.02	0.02	0.03	0.03	
					Inst costs (\$/kW)	\$ 6,700	\$ 6,700	\$ 6,700	\$ 6,700	\$ 6,700	\$ 6,700	\$ 6,700	\$ 6,700	\$ 6,700	\$ 6,700	
					O&M (\$/MW)	\$ 16,800	\$ 16,800	\$ 16,800	\$ 16,800	\$ 16,800	\$ 16,800	\$ 16,800	\$ 16,800	\$ 16,800	\$ 16,800	
					Lump sum (\$)	\$ 13,498	\$ 27,026	\$ 63,082	\$ 117,217	\$ 229,964	\$ 315,973	\$ 316,689	\$ 317,405	\$ 318,121	\$ 318,838	
Biomass	Industrial	0%		100%	MW	0.04	0.11	0.29	0.62	1.27	2.15	3.04	3.93	4.81	5.70	
					aMW	0.03	0.09	0.23	0.50	1.01	1.72	2.43	3.14	3.85	4.56	
					Inst costs (\$/kW)	\$ 1,600	\$ 1,600	\$ 1,600	\$ 1,600	\$ 1,600	\$ 1,600	\$ 1,600	\$ 1,600	\$ 1,600	\$ 1,600	
					O&M (\$/MW)	\$ 111,600	\$ 111,600	\$ 111,600	\$ 111,600	\$ 111,600	\$ 111,600	\$ 111,600	\$ 111,600	\$ 111,600	\$ 111,600	
					Lump sum (\$)	\$ 71,112	\$ 146,465	\$ 344,578	\$ 648,816	\$ 1,278,168	\$ 1,800,631	\$ 1,899,571	\$ 1,998,512	\$ 2,097,452	\$ 2,196,392	
Anaerobic Digester	0%		100%	0%	MW	0.02	0.07	0.17	0.37	0.76	1.29	1.82	2.35	2.88	3.41	
					aMW	0.02	0.05	0.14	0.30	0.61	1.03	1.45	1.88	2.30	2.73	
					Inst costs (\$/kW)	\$ 3,906	\$ 3,906	\$ 3,906	\$ 3,906	\$ 3,906	\$ 3,906	\$ 3,906	\$ 3,906	\$ 3,906	\$ 3,906	
					O&M (\$/MW)	\$ 96,013	\$ 96,013	\$ 96,013	\$ 96,013	\$ 96,013	\$ 96,013	\$ 96,013	\$ 96,013	\$ 96,013	\$ 96,013	
					Lump sum (\$)	\$ 99,779	\$ 201,739	\$ 472,178	\$ 881,471	\$ 1,731,864	\$ 2,400,875	\$ 2,451,766	\$ 2,502,658	\$ 2,553,549	\$ 2,604,441	

Renewable		2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	Levelized Cost	
Small Wind	MW	0.13	0.15	0.17	0.19	0.20	0.22	0.23	0.24	0.25	0.26		
	aMW	0.02	0.03	0.03	0.03	0.04	0.04	0.04	0.05	0.05	0.05	Capacity Factor 15%	
	Inst costs (\$/kW)	\$ 2,598	\$ 2,598	\$ 2,598	\$ 2,598	\$ 2,598	\$ 2,598	\$ 2,598	\$ 2,598	\$ 2,598	\$ 2,598		
	O&M (\$/MW)	\$ 87,600	\$ 87,600	\$ 87,600	\$ 87,600	\$ 87,600	\$ 87,600	\$ 87,600	\$ 87,600	\$ 87,600	\$ 87,600		
	Lump sum (\$)	\$ 62,888	\$ 64,458	\$ 66,028	\$ 67,599	\$ 69,169	\$ 70,740	\$ 72,310	\$ 73,881	\$ 75,451	\$ 77,021	\$ 78,591	Levelized Cost \$0.30 \$/kWh
PV	MW	0.32	0.36	0.40	0.44	0.49	0.52	0.55	0.57	0.59	0.61		
	aMW	0.04	0.04	0.05	0.05	0.06	0.06	0.07	0.07	0.07	0.07	Capacity Factor 12%	
	Inst costs (\$/kW)	\$ 4,315	\$ 4,315	\$ 4,315	\$ 4,315	\$ 4,315	\$ 4,315	\$ 4,315	\$ 4,315	\$ 4,315	\$ 4,315		
	O&M (\$/MW)	\$ 16,800	\$ 16,800	\$ 16,800	\$ 16,800	\$ 16,800	\$ 16,800	\$ 16,800	\$ 16,800	\$ 16,800	\$ 16,800		
	Lump sum (\$)	\$ 207,705	\$ 208,421	\$ 209,137	\$ 209,854	\$ 210,570	\$ 211,286	\$ 212,002	\$ 212,718	\$ 213,434	\$ 214,150	\$ 214,866	Levelized Cost \$0.79 \$/kWh
Biomass	Industrial	MW	6.59	7.47	8.36	9.25	10.13	10.89	11.53	11.91	12.29	12.67	
		aMW	5.27	5.98	6.69	7.40	8.11	8.71	9.22	9.52	9.83	10.13	Capacity Factor 80%
		Inst costs (\$/kW)	\$ 1,600	\$ 1,600	\$ 1,600	\$ 1,600	\$ 1,600	\$ 1,600	\$ 1,600	\$ 1,600	\$ 1,600	\$ 1,600	
		O&M (\$/MW)	\$ 111,600	\$ 111,600	\$ 111,600	\$ 111,600	\$ 111,600	\$ 111,600	\$ 111,600	\$ 111,600	\$ 111,600	\$ 111,600	
		Lump sum (\$)	\$ 2,295,332	\$ 2,394,273	\$ 2,493,213	\$ 2,592,153	\$ 2,691,093	\$ 2,789,993	\$ 2,888,893	\$ 2,987,793	\$ 3,086,693	\$ 3,185,593	\$ 3,284,493
Anaerobic Digester	MW	3.94	4.47	5.00	5.53	6.06	6.51	6.89	7.12	7.34	7.57		
	aMW	3.15	3.57	4.00	4.42	4.85	5.21	5.51	5.69	5.88	6.06	Capacity Factor 80%	
	Inst costs (\$/kW)	\$ 3,354	\$ 3,354	\$ 3,354	\$ 3,354	\$ 3,354	\$ 3,354	\$ 3,354	\$ 3,354	\$ 3,354	\$ 3,354		
	O&M (\$/MW)	\$ 96,013	\$ 96,013	\$ 96,013	\$ 96,013	\$ 96,013	\$ 96,013	\$ 96,013	\$ 96,013	\$ 96,013	\$ 96,013		
	Lump sum (\$)	\$ 2,333,647	\$ 2,384,539	\$ 2,435,430	\$ 2,486,321	\$ 2,537,212	\$ 2,588,103	\$ 2,638,994	\$ 2,689,885	\$ 2,740,776	\$ 2,791,667	\$ 2,842,558	Levelized Cost \$0.09 \$/kWh

NOTE: Red indicates levelized cost is less than cost of generic resource; all admin. costs are 10%.

**Distributed Generation + Emerging Technologies Base Case -10% Economic Market Potential and Cost**

	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
MW	0.1	0.4	1.1	2.3	4.7	7.9	11.2	14.4	17.7	21.0
aMW	0.1	0.4	0.9	2.0	4.0	6.8	9.6	12.4	15.2	18.0
Total Cost	\$ 305,492	\$ 647,081	\$ 1,529,720	\$ 2,900,534	\$ 5,755,245	\$ 8,308,680	\$ 9,182,549	\$ 10,066,644	\$ 10,969,894	\$ 12,002,577
Fuel (\$/MMBTU)	\$ 7.09	\$ 6.83	\$ 6.62	\$ 6.30	\$ 6.46	\$ 6.51	\$ 6.57	\$ 6.63	\$ 6.71	\$ 7.02

	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027
MW	24.2	27.5	30.7	34.0	37.3	40.0	42.4	43.8	45.2	46.6
aMW	20.9	23.7	26.5	29.3	32.1	34.5	36.5	37.7	38.9	40.1
Total Cost	\$ 12,431,788	\$ 13,507,849	\$ 14,645,402	\$ 15,651,429	\$ 16,796,743	\$ 17,122,441	\$ 17,340,600	\$ 16,643,380	\$ 17,673,443	\$ 19,149,959
Fuel (\$/MMBTU)	\$ 7.10	\$ 7.36	\$ 7.64	\$ 7.71	\$ 7.92	\$ 8.13	\$ 8.35	\$ 8.58	\$ 8.76	\$ 8.94

Table E-9. Distributed Generation Base Case + 25% Scenario: CHP (Natural Gas)

CHP (Natural gas)	% Penetration (by MW)					2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	
	Res	Com	Ind													
Recip Engine	0%	65%	35%	MW		0.07	0.20	0.51	1.08	2.20	3.74	5.28	6.82	8.36	9.90	
				aMW		0.06	0.18	0.46	0.97	1.98	3.37	4.75	6.14	7.53	8.91	
				Inst costs (\$/kW)	\$	1,087	1,087	1,087	1,087	1,087	1,087	1,087	1,087	1,087	1,087	1,087
				O&M (\$/MW)	\$	101,345	101,345	101,345	101,345	101,345	101,345	101,345	101,345	101,345	101,345	101,345
				Fuel (\$/kW)	\$	390	376	365	347	356	359	362	365	370	387	
				Lump sum (\$)	\$	111,399	252,433	604,302	1,167,349	2,348,367	3,563,003	4,288,076	5,024,021	5,780,329	6,674,239	
Microturbine	0%	65%	35%	MW		0.01	0.04	0.10	0.21	0.43	0.74	1.04	1.34	1.64	1.95	
				aMW		0.01	0.04	0.09	0.20	0.41	0.70	0.99	1.27	1.56	1.85	
				Inst costs (\$/kW)	\$	1,634	1,634	1,634	1,634	1,634	1,634	1,634	1,634	1,634	1,634	
				O&M (\$/MW)	\$	108,135	108,135	108,135	108,135	108,135	108,135	108,135	108,135	108,135	108,135	
				Fuel (\$/kW)	\$	608	586	568	540	555	559	564	569	576	603	
				Lump sum (\$)	\$	32,621	73,677	176,167	339,623	683,293	1,034,904	1,241,994	1,452,416	1,669,079	1,927,908	
Fuel Cell	0%	65%	35%	MW		0.01	0.02	0.05	0.10	0.21	0.35	0.50	0.64	0.79	0.93	
				aMW		0.01	0.02	0.05	0.10	0.20	0.33	0.47	0.61	0.75	0.89	
				Inst costs (\$/kW)	\$	5,314	5,314	5,314	5,314	5,314	5,314	5,314	5,314	5,314	5,314	
				O&M (\$/MW)	\$	14,403	14,403	14,403	14,403	14,403	14,403	14,403	14,403	14,403	14,403	
				Fuel (\$/kW)	\$	475	458	444	422	433	437	441	445	450	471	
				Lump sum (\$)	\$	39,389	81,500	191,468	359,333	710,686	1,007,023	1,074,375	1,142,974	1,213,909	1,300,628	

CHP (Natural gas)													Levelized Cost		
													2018	2019	2020
Recip Engine	MW	11.44	12.98	14.52	16.06	17.61	18.93	20.03	20.69	21.35	22.01				
	aMW	10.30	11.69	13.07	14.46	15.84	17.03	18.02	18.62	19.21	19.81				
	Inst costs (\$/kW)	\$ 1,087	\$ 1,087	\$ 1,087	\$ 1,087	\$ 1,087	\$ 1,087	\$ 1,087	\$ 1,087	\$ 1,087	\$ 1,087			90%	
	O&M (\$/MW)	\$ 101,345	\$ 101,345	\$ 101,345	\$ 101,345	\$ 101,345	\$ 101,345	\$ 101,345	\$ 101,345	\$ 101,345	\$ 101,345				
	Fuel (\$/kW)	\$ 391	\$ 405	\$ 420	\$ 424	\$ 436	\$ 448	\$ 460	\$ 472	\$ 482	\$ 492				
	Lump sum (\$)	\$ 7,474,545	\$ 8,414,570	\$ 9,419,967	\$ 10,285,539	\$ 11,299,187	\$ 11,969,383	\$ 12,554,388	\$ 12,653,220	\$ 13,240,593	\$ 13,847,280				Levelized Cost
Microturbine	MW	2.25	2.55	2.85	3.16	3.46	3.72	3.94	4.07	4.20	4.32				
	aMW	2.14	2.42	2.71	3.00	3.29	3.53	3.74	3.86	3.99	4.11				
	Inst costs (\$/kW)	\$ 1,634	\$ 1,634	\$ 1,634	\$ 1,634	\$ 1,634	\$ 1,634	\$ 1,634	\$ 1,634	\$ 1,634	\$ 1,634			95%	
	O&M (\$/MW)	\$ 108,135	\$ 108,135	\$ 108,135	\$ 108,135	\$ 108,135	\$ 108,135	\$ 108,135	\$ 108,135	\$ 108,135	\$ 108,135				
	Fuel (\$/kW)	\$ 609	\$ 631	\$ 655	\$ 661	\$ 680	\$ 698	\$ 717	\$ 736	\$ 751	\$ 767				
	Lump sum (\$)	\$ 2,158,053	\$ 2,431,015	\$ 2,724,009	\$ 2,974,154	\$ 3,269,677	\$ 3,488,332	\$ 3,683,038	\$ 3,774,851	\$ 4,041,683	\$ 4,415,518				Levelized Cost
Fuel Cell	MW	1.08	1.22	1.37	1.51	1.66	1.78	1.89	1.95	2.01	2.07				
	aMW	1.02	1.16	1.30	1.44	1.58	1.69	1.79	1.85	1.91	1.97				
	Inst costs (\$/kW)	\$ 5,314	\$ 5,314	\$ 5,314	\$ 5,314	\$ 5,314	\$ 5,314	\$ 5,314	\$ 5,314	\$ 5,314	\$ 5,314			95%	
	O&M (\$/MW)	\$ 14,403	\$ 14,403	\$ 14,403	\$ 14,403	\$ 14,403	\$ 14,403	\$ 14,403	\$ 14,403	\$ 14,403	\$ 14,403				
	Fuel (\$/kW)	\$ 476	\$ 493	\$ 512	\$ 517	\$ 531	\$ 545	\$ 560	\$ 575	\$ 587	\$ 599				
	Lump sum (\$)	\$ 1,412,955	\$ 1,541,309	\$ 1,737,738	\$ 1,966,590	\$ 2,369,925	\$ 2,572,469	\$ 2,537,311	\$ 2,359,942	\$ 2,420,538	\$ 2,483,349				Levelized Cost

NOTE: Red indicates levelized cost is less than cost of generic resource; all admin. costs are 10%.

**Table E-10. Distributed Generation Base Case + 25% Scenario: Renewables**

Renewable	% Penetration (by MW)					2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
	Res	Com	Ind												
Small Wind	30%	70%	0%												
	MW					0.00	0.00	0.01	0.01	0.03	0.04	0.06	0.08	0.10	0.12
	aMW					0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.01	0.02
	Inst costs (\$/kW)					\$ 2,598	\$ 2,598	\$ 2,598	\$ 2,598	\$ 2,598	\$ 2,598	\$ 2,598	\$ 2,598	\$ 2,598	\$ 2,598
	Lump sum (\$)					\$ 87,600	\$ 87,600	\$ 87,600	\$ 87,600	\$ 87,600	\$ 87,600	\$ 87,600	\$ 87,600	\$ 87,600	\$ 87,600
PV	50%	50%	0%												
	MW					0.00	0.01	0.01	0.03	0.06	0.10	0.15	0.19	0.23	0.27
	aMW					0.00	0.00	0.00	0.00	0.01	0.01	0.02	0.02	0.03	0.03
	Inst costs (\$/kW)					\$ 6,700	\$ 6,700	\$ 6,700	\$ 6,700	\$ 6,700	\$ 6,700	\$ 6,700	\$ 6,700	\$ 6,700	\$ 6,700
	Lump sum (\$)					\$ 16,800	\$ 16,800	\$ 16,800	\$ 16,800	\$ 16,800	\$ 16,800	\$ 16,800	\$ 16,800	\$ 16,800	\$ 16,800
Biomass	0%	0%	100%												
	MW					0.04	0.11	0.29	0.62	1.27	2.15	3.04	3.93	4.81	5.70
	aMW					0.03	0.09	0.23	0.50	1.01	1.72	2.43	3.14	3.85	4.56
	Inst costs (\$/kW)					\$ 1,600	\$ 1,600	\$ 1,600	\$ 1,600	\$ 1,600	\$ 1,600	\$ 1,600	\$ 1,600	\$ 1,600	\$ 1,600
	Lump sum (\$)					\$ 111,600	\$ 111,600	\$ 111,600	\$ 111,600	\$ 111,600	\$ 111,600	\$ 111,600	\$ 111,600	\$ 111,600	\$ 111,600
Anaerobic Digester	0%	100%	0%												
	MW					0.02	0.07	0.17	0.37	0.76	1.29	1.82	2.35	2.88	3.41
	aMW					0.02	0.05	0.14	0.30	0.61	1.03	1.45	1.88	2.30	2.73
	Inst costs (\$/kW)					\$ 3,906	\$ 3,906	\$ 3,906	\$ 3,906	\$ 3,906	\$ 3,906	\$ 3,906	\$ 3,906	\$ 3,906	\$ 3,906
	Lump sum (\$)					\$ 99,779	\$ 201,739	\$ 472,178	\$ 881,471	\$ 1,731,864	\$ 2,400,875	\$ 2,451,766	\$ 2,502,658	\$ 2,553,549	\$ 2,604,441

Renewable		2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	Levelized Cost	
Small Wind	MW	0.13	0.15	0.17	0.19	0.20	0.22	0.23	0.24	0.25	0.26		
	aMW	0.02	0.02	0.03	0.03	0.03	0.03	0.03	0.04	0.04	0.04	Capacity Factor 15%	
	Inst costs (\$/kW)	\$ 2,598	\$ 2,598	\$ 2,598	\$ 2,598	\$ 2,598	\$ 2,598	\$ 2,598	\$ 2,598	\$ 2,598	\$ 2,598		
	O&M (\$/MW)	\$ 87,600	\$ 87,600	\$ 87,600	\$ 87,600	\$ 87,600	\$ 87,600	\$ 87,600	\$ 87,600	\$ 87,600	\$ 87,600		
	Lump sum (\$)	\$ 62,888	\$ 64,458	\$ 66,028	\$ 67,599	\$ 69,169	\$ 70,739	\$ 72,309	\$ 73,879	\$ 75,449	\$ 77,019	\$ 78,589	Levelized Cost \$0.30 \$/kWh
PV	MW	0.32	0.36	0.40	0.44	0.49	0.52	0.55	0.57	0.59	0.61		
	aMW	0.04	0.04	0.05	0.05	0.06	0.06	0.07	0.07	0.07	0.07	Capacity Factor 12%	
	Inst costs (\$/kW)	\$ 6,700	\$ 6,700	\$ 6,700	\$ 6,700	\$ 6,700	\$ 6,700	\$ 6,700	\$ 6,700	\$ 6,700	\$ 6,700		
	O&M (\$/MW)	\$ 16,800	\$ 16,800	\$ 16,800	\$ 16,800	\$ 16,800	\$ 16,800	\$ 16,800	\$ 16,800	\$ 16,800	\$ 16,800		
	Lump sum (\$)	\$ 319,554	\$ 320,270	\$ 320,987	\$ 321,703	\$ 322,419	\$ 323,135	\$ 323,851	\$ 324,567	\$ 325,283	\$ 326,000	\$ 326,716	Levelized Cost \$0.97 \$/kWh
Biomass	Industrial	MW	6.59	7.47	8.36	9.25	10.13	10.89	11.53	11.91	12.29	12.67	
		aMW	5.27	5.98	6.69	7.40	8.11	8.71	9.22	9.52	9.83	10.13	Capacity Factor 80%
		Inst costs (\$/kW)	\$ 1,600	\$ 1,600	\$ 1,600	\$ 1,600	\$ 1,600	\$ 1,600	\$ 1,600	\$ 1,600	\$ 1,600	\$ 1,600	
		O&M (\$/MW)	\$ 111,600	\$ 111,600	\$ 111,600	\$ 111,600	\$ 111,600	\$ 111,600	\$ 111,600	\$ 111,600	\$ 111,600	\$ 111,600	
		Lump sum (\$)	\$ 2,295,332	\$ 2,394,273	\$ 2,493,213	\$ 2,592,153	\$ 2,691,093	\$ 2,789,993	\$ 2,888,893	\$ 2,987,793	\$ 3,086,693	\$ 3,185,593	\$ 3,284,493
Anaerobic Digester	MW	3.94	4.47	5.00	5.53	6.06	6.51	6.89	7.12	7.34	7.57		
	aMW	3.15	3.57	4.00	4.42	4.85	5.21	5.51	5.69	5.88	6.06	Capacity Factor 80%	
	Inst costs (\$/kW)	\$ 3,906	\$ 3,906	\$ 3,906	\$ 3,906	\$ 3,906	\$ 3,906	\$ 3,906	\$ 3,906	\$ 3,906	\$ 3,906		
	O&M (\$/MW)	\$ 96,013	\$ 96,013	\$ 96,013	\$ 96,013	\$ 96,013	\$ 96,013	\$ 96,013	\$ 96,013	\$ 96,013	\$ 96,013		
	Lump sum (\$)	\$ 2,655,332	\$ 2,706,223	\$ 2,757,115	\$ 2,808,006	\$ 2,858,897	\$ 2,909,788	\$ 2,960,679	\$ 3,011,570	\$ 3,062,461	\$ 3,113,352	\$ 3,164,243	Levelized Cost \$0.10 \$/kWh

NOTE: Red indicates levelized cost is less than cost of generic resource; all admin. costs are 10%.

**Distributed Generation Base Case + 25% Economic Market Potential and Cost**

	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
MW	0.1	0.4	1.1	2.3	4.7	7.9	11.2	14.4	17.7	21.0
aMW	0.1	0.4	0.9	2.0	4.0	6.8	9.6	12.4	15.2	18.0
Total Cost	\$ 314,911	\$ 674,313	\$ 1,597,225	\$ 3,037,259	\$ 6,041,693	\$ 8,799,413	\$ 9,881,408	\$ 10,977,606	\$ 12,100,409	\$ 13,402,979
Fuel (\$/MMBTU)	\$ 9.84	\$ 9.48	\$ 9.20	\$ 8.75	\$ 8.98	\$ 9.05	\$ 9.13	\$ 9.21	\$ 9.33	\$ 9.75

	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027
MW	24.2	27.5	30.7	34.0	37.3	40.0	42.4	43.8	45.2	46.6
aMW	20.9	23.7	26.5	29.3	32.1	34.5	36.5	37.7	38.9	40.1
Total Cost	\$ 14,583,263	\$ 15,946,080	\$ 17,394,304	\$ 18,659,852	\$ 20,118,854	\$ 20,685,498	\$ 21,121,597	\$ 20,540,250	\$ 21,849,060	\$ 23,707,110
Fuel (\$/MMBTU)	\$ 9.86	\$ 10.22	\$ 10.61	\$ 10.70	\$ 11.00	\$ 11.30	\$ 11.60	\$ 11.91	\$ 12.16	\$ 12.42

**Table E-11. Distributed Generation + Emerging Technologies Base Case + 25% Scenario: CHP (Natural Gas)**

CHP (Natural gas)	% Penetration (by MW)			Ind		2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	
	Res	Com														
Recip Engine	5%		63%	32%												
					MW	0.07	0.20	0.51	1.08	2.20	3.74	5.28	6.82	8.36	9.90	
					aMW	0.06	0.18	0.46	0.97	1.98	3.37	4.75	6.14	7.53	8.91	
					Inst costs (\$/kW)	\$ 1,087	\$ 1,087	\$ 1,087	\$ 1,087	\$ 1,087	\$ 1,087	\$ 1,087	\$ 1,087	\$ 1,087	\$ 1,087	\$ 1,087
					O&M (\$/MW)	\$ 101,345	\$ 101,345	\$ 101,345	\$ 101,345	\$ 101,345	\$ 101,345	\$ 101,345	\$ 101,345	\$ 101,345	\$ 101,345	\$ 101,345
					Fuel (\$/kW)	\$ 390	\$ 376	\$ 365	\$ 347	\$ 356	\$ 359	\$ 362	\$ 365	\$ 370	\$ 387	
Microturbine	5%		63%	32%												
					Lump sum (\$)	\$ 111,399	\$ 252,433	\$ 604,302	\$ 1,167,349	\$ 2,348,367	\$ 3,563,003	\$ 4,288,076	\$ 5,024,021	\$ 5,780,329	\$ 6,674,239	
					MW	0.01	0.04	0.10	0.21	0.43	0.74	1.04	1.34	1.64	1.95	
					aMW	0.01	0.04	0.09	0.20	0.41	0.70	0.99	1.27	1.56	1.85	
					Inst costs (\$/kW)	\$ 1,634	\$ 1,634	\$ 1,634	\$ 1,634	\$ 1,634	\$ 1,634	\$ 1,634	\$ 1,634	\$ 1,634	\$ 1,634	
					O&M (\$/MW)	\$ 108,135	\$ 108,135	\$ 108,135	\$ 108,135	\$ 108,135	\$ 108,135	\$ 108,135	\$ 108,135	\$ 108,135	\$ 108,135	
Fuel Cell	5%		63%	32%												
					Fuel (\$/kW)	\$ 608	\$ 586	\$ 568	\$ 540	\$ 555	\$ 559	\$ 564	\$ 569	\$ 576	\$ 603	
					Lump sum (\$)	\$ 32,621	\$ 73,677	\$ 176,167	\$ 339,623	\$ 683,293	\$ 1,034,904	\$ 1,241,994	\$ 1,452,416	\$ 1,669,079	\$ 1,927,908	
					MW	0.01	0.02	0.05	0.10	0.21	0.35	0.50	0.64	0.79	0.93	
					aMW	0.01	0.02	0.05	0.10	0.20	0.33	0.47	0.61	0.75	0.89	
					Inst costs (\$/kW)	\$ 5,314	\$ 5,314	\$ 5,314	\$ 5,314	\$ 5,314	\$ 5,314	\$ 5,314	\$ 5,314	\$ 5,314	\$ 5,314	
				O&M (\$/MW)	\$ 14,403	\$ 14,403	\$ 14,403	\$ 14,403	\$ 14,403	\$ 14,403	\$ 14,403	\$ 14,403	\$ 14,403	\$ 14,403		
				Fuel (\$/kW)	\$ 475	\$ 458	\$ 444	\$ 422	\$ 433	\$ 437	\$ 441	\$ 445	\$ 450	\$ 471		
				Lump sum (\$)	\$ 39,389	\$ 81,500	\$ 191,468	\$ 359,333	\$ 710,686	\$ 1,007,023	\$ 1,074,375	\$ 1,142,974	\$ 1,213,909	\$ 1,300,628		

CHP (Natural gas)		2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	Levelized Cost		
Recip Engine	MW	11.44	12.98	14.52	16.06	17.61	18.93	20.03	20.69	21.35	22.01	Gen SS Resource	\$0.14	\$/kWh
	aMW	10.30	11.69	13.07	14.46	15.84	17.03	18.02	18.62	19.21	19.81	Capacity Factor	90%	
	Inst costs (\$/kW)	\$ 1,087	\$ 1,087	\$ 1,087	\$ 1,087	\$ 1,087	\$ 1,087	\$ 1,087	\$ 1,087	\$ 1,087	\$ 1,087			
	O&M (\$/MW)	\$ 101,345	\$ 101,345	\$ 101,345	\$ 101,345	\$ 101,345	\$ 101,345	\$ 101,345	\$ 101,345	\$ 101,345	\$ 101,345			
	Fuel (\$/kW)	\$ 391	\$ 405	\$ 420	\$ 424	\$ 436	\$ 448	\$ 460	\$ 472	\$ 482	\$ 492			
	Lump sum (\$)	\$ 7,474,545	\$ 8,414,570	\$ 9,419,967	\$ 10,285,539	\$ 11,299,187	\$ 11,969,383	\$ 12,554,388	\$ 12,653,220	\$ 13,240,593	\$ 13,847,280	Levelized Cost	\$0.10	\$/kWh
Microturbine	MW	2.25	2.55	2.85	3.16	3.46	3.72	3.94	4.07	4.20	4.32			
	aMW	2.14	2.42	2.71	3.00	3.29	3.53	3.74	3.86	3.99	4.11	Capacity Factor	95%	
	Inst costs (\$/kW)	\$ 1,053	\$ 1,053	\$ 1,053	\$ 1,053	\$ 1,053	\$ 1,053	\$ 1,053	\$ 1,053	\$ 1,053	\$ 1,053			
	O&M (\$/MW)	\$ 108,135	\$ 108,135	\$ 108,135	\$ 108,135	\$ 108,135	\$ 108,135	\$ 108,135	\$ 108,135	\$ 108,135	\$ 108,135			
	Fuel (\$/kW)	\$ 609	\$ 631	\$ 655	\$ 661	\$ 680	\$ 698	\$ 717	\$ 736	\$ 751	\$ 767			
	Lump sum (\$)	\$ 1,964,314	\$ 2,237,275	\$ 2,530,269	\$ 2,780,414	\$ 3,075,937	\$ 3,313,966	\$ 3,528,047	\$ 3,653,071	\$ 3,886,691	\$ 4,191,333	Levelized Cost	\$0.13	\$/kWh
Fuel Cell	MW	1.08	1.22	1.37	1.51	1.66	1.78	1.89	1.95	2.01	2.07			
	aMW	1.02	1.16	1.30	1.44	1.58	1.69	1.79	1.85	1.91	1.97	Capacity Factor	95%	
	Inst costs (\$/kW)	\$ 3,423	\$ 3,423	\$ 3,423	\$ 3,423	\$ 3,423	\$ 3,423	\$ 3,423	\$ 3,423	\$ 3,423	\$ 3,423			
	O&M (\$/MW)	\$ 14,403	\$ 14,403	\$ 14,403	\$ 14,403	\$ 14,403	\$ 14,403	\$ 14,403	\$ 14,403	\$ 14,403	\$ 14,403			
	Fuel (\$/kW)	\$ 476	\$ 493	\$ 512	\$ 517	\$ 531	\$ 545	\$ 560	\$ 575	\$ 587	\$ 599			
	Lump sum (\$)	\$ 1,098,154	\$ 1,213,571	\$ 1,375,501	\$ 1,552,604	\$ 1,848,130	\$ 2,011,863	\$ 2,019,828	\$ 1,928,707	\$ 1,989,303	\$ 2,052,114	Levelized Cost	\$0.18	\$/kWh

NOTE: Red indicates levelized cost is less than cost of generic resource; all admin. costs are 10%.

**Table E-12. Distributed Generation + Emerging Technologies Base Case + 25% Scenario: Renewables**

Renewable	% Penetration (by MW)				2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	
	Res	Com	Ind												
Small Wind	30%	70%	0%												
				MW	0.00	0.00	0.01	0.01	0.03	0.04	0.06	0.08	0.10	0.12	
				aMW	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.01	0.01	0.02	
				Inst costs (\$/kW)	\$ 2,598	\$ 2,598	\$ 2,598	\$ 2,598	\$ 2,598	\$ 2,598	\$ 2,598	\$ 2,598	\$ 2,598	\$ 2,598	
				O&M (\$/MW)	\$ 87,600	\$ 87,600	\$ 87,600	\$ 87,600	\$ 87,600	\$ 87,600	\$ 87,600	\$ 87,600	\$ 87,600	\$ 87,600	
PV	50%	50%	0%												
				Lump sum (\$)	\$ 2,263	\$ 4,592	\$ 10,760	\$ 20,124	\$ 39,562	\$ 55,036	\$ 56,606	\$ 58,176	\$ 59,747	\$ 61,317	
				MW	0.00	0.01	0.01	0.03	0.06	0.10	0.15	0.19	0.23	0.27	
				aMW	0.00	0.00	0.00	0.00	0.01	0.01	0.02	0.02	0.03	0.03	
				Inst costs (\$/kW)	\$ 6,700	\$ 6,700	\$ 6,700	\$ 6,700	\$ 6,700	\$ 6,700	\$ 6,700	\$ 6,700	\$ 6,700	\$ 6,700	
Biomass	Industrial	0%	0%	100%											
					MW	0.04	0.11	0.29	0.62	1.27	2.15	3.04	3.93	4.81	5.70
					aMW	0.03	0.09	0.23	0.50	1.01	1.72	2.43	3.14	3.85	4.56
					Inst costs (\$/kW)	\$ 1,600	\$ 1,600	\$ 1,600	\$ 1,600	\$ 1,600	\$ 1,600	\$ 1,600	\$ 1,600	\$ 1,600	\$ 1,600
					O&M (\$/MW)	\$ 111,600	\$ 111,600	\$ 111,600	\$ 111,600	\$ 111,600	\$ 111,600	\$ 111,600	\$ 111,600	\$ 111,600	
Anaerobic Digester	0%	100%	0%												
				Lump sum (\$)	\$ 71,112	\$ 146,465	\$ 344,578	\$ 648,816	\$ 1,278,168	\$ 1,800,631	\$ 1,899,571	\$ 1,998,512	\$ 2,097,452	\$ 2,196,392	
				MW	0.02	0.07	0.17	0.37	0.76	1.29	1.82	2.35	2.88	3.41	
				aMW	0.02	0.05	0.14	0.30	0.61	1.03	1.45	1.89	2.30	2.73	
				Inst costs (\$/kW)	\$ 3,906	\$ 3,906	\$ 3,906	\$ 3,906	\$ 3,906	\$ 3,906	\$ 3,906	\$ 3,906	\$ 3,906	\$ 3,906	
			O&M (\$/MW)	\$ 96,013	\$ 96,013	\$ 96,013	\$ 96,013	\$ 96,013	\$ 96,013	\$ 96,013	\$ 96,013	\$ 96,013	\$ 96,013		
			Lump sum (\$)	\$ 99,779	\$ 201,739	\$ 472,178	\$ 881,471	\$ 1,731,864	\$ 2,400,875	\$ 2,451,766	\$ 2,502,658	\$ 2,553,549	\$ 2,604,441		

Renewable					2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	Levelized Cost		
Small Wind	MW	0.13	0.15	0.17	0.19	0.20	0.22	0.23	0.24	0.24	0.25	0.26	0.26	0.26			
	aMW	0.02	0.03	0.03	0.03	0.04	0.04	0.04	0.05	0.05	0.05	0.05	0.05	0.05	Capacity Factor	15%	
	Inst costs (\$/kW)	\$ 2,598	\$ 2,598	\$ 2,598	\$ 2,598	\$ 2,598	\$ 2,598	\$ 2,598	\$ 2,598	\$ 2,598	\$ 2,598	\$ 2,598	\$ 2,598	\$ 2,598	CF after Year 10	23%	
	O&M (\$/MW)	\$ 87,600	\$ 87,600	\$ 87,600	\$ 87,600	\$ 87,600	\$ 87,600	\$ 87,600	\$ 87,600	\$ 87,600	\$ 87,600	\$ 87,600	\$ 87,600	\$ 87,600	Levelized Cost	\$0.30 \$/kWh	
	Lump sum (\$)	\$ 62,888	\$ 64,458	\$ 66,028	\$ 67,599	\$ 69,169	\$ 70,740	\$ 72,311	\$ 73,882	\$ 75,453	\$ 77,024	\$ 78,595	\$ 80,166	\$ 81,737			
PV	MW	0.32	0.36	0.40	0.44	0.49	0.52	0.55	0.57	0.59	0.61	0.61	0.61	0.61			
	aMW	0.04	0.04	0.05	0.05	0.06	0.06	0.07	0.07	0.07	0.07	0.07	0.07	0.07	Capacity Factor	12%	
	Inst costs (\$/kW)	\$ 4,315	\$ 4,315	\$ 4,315	\$ 4,315	\$ 4,315	\$ 4,315	\$ 4,315	\$ 4,315	\$ 4,315	\$ 4,315	\$ 4,315	\$ 4,315	\$ 4,315			
	O&M (\$/MW)	\$ 16,800	\$ 16,800	\$ 16,800	\$ 16,800	\$ 16,800	\$ 16,800	\$ 16,800	\$ 16,800	\$ 16,800	\$ 16,800	\$ 16,800	\$ 16,800	\$ 16,800	Levelized Cost	\$0.79 \$/kWh	
	Lump sum (\$)	\$ 207,705	\$ 208,421	\$ 209,137	\$ 209,854	\$ 210,570	\$ 211,286	\$ 212,002	\$ 212,718	\$ 213,434	\$ 214,150	\$ 214,866	\$ 215,582	\$ 216,298			
Biomass	Industrial	MW	6.59	7.47	8.36	9.25	10.13	10.89	11.53	11.91	12.29	12.67	13.05	13.43	13.81		
		aMW	5.27	5.98	6.69	7.40	8.11	8.71	9.22	9.52	9.83	10.13	10.43	10.73	11.03	Capacity Factor	80%
		Inst costs (\$/kW)	\$ 1,600	\$ 1,600	\$ 1,600	\$ 1,600	\$ 1,600	\$ 1,600	\$ 1,600	\$ 1,600	\$ 1,600	\$ 1,600	\$ 1,600	\$ 1,600	\$ 1,600		
		O&M (\$/MW)	\$ 111,600	\$ 111,600	\$ 111,600	\$ 111,600	\$ 111,600	\$ 111,600	\$ 111,600	\$ 111,600	\$ 111,600	\$ 111,600	\$ 111,600	\$ 111,600	\$ 111,600	Levelized Cost	\$0.04 \$/kWh
		Lump sum (\$)	\$ 2,295,332	\$ 2,394,273	\$ 2,493,213	\$ 2,592,153	\$ 2,691,093	\$ 2,789,992	\$ 2,888,892	\$ 2,987,792	\$ 3,086,692	\$ 3,185,592	\$ 3,284,492	\$ 3,383,392	\$ 3,482,292		
Anaerobic Digester	MW	3.94	4.47	5.00	5.53	6.06	6.51	6.89	7.12	7.34	7.57	7.79	8.01	8.23			
	aMW	3.15	3.57	4.00	4.42	4.85	5.21	5.51	5.69	5.88	6.06	6.25	6.43	6.61	Capacity Factor	80%	
	Inst costs (\$/kW)	\$ 3,354	\$ 3,354	\$ 3,354	\$ 3,354	\$ 3,354	\$ 3,354	\$ 3,354	\$ 3,354	\$ 3,354	\$ 3,354	\$ 3,354	\$ 3,354	\$ 3,354			
	O&M (\$/MW)	\$ 96,013	\$ 96,013	\$ 96,013	\$ 96,013	\$ 96,013	\$ 96,013	\$ 96,013	\$ 96,013	\$ 96,013	\$ 96,013	\$ 96,013	\$ 96,013	\$ 96,013	Levelized Cost	\$0.09 \$/kWh	
	Lump sum (\$)	\$ 2,333,647	\$ 2,384,539	\$ 2,435,430	\$ 2,486,321	\$ 2,537,213	\$ 2,588,104	\$ 2,638,995	\$ 2,689,886	\$ 2,740,777	\$ 2,791,668	\$ 2,842,559	\$ 2,893,450	\$ 2,944,341			

NOTE: Red indicates levelized cost is less than cost of generic resource; all admin. costs are 10%.

**Distributed Generation + Emerging Technologies Base Case + 25% Economic Market Potential and Cost**

	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
MW	0.1	0.4	1.1	2.3	4.7	7.9	11.2	14.4	17.7	21.0
aMW	0.1	0.4	0.9	2.0	4.0	6.8	9.6	12.4	15.2	18.0
Total Cost	\$ 314,911	\$ 674,313	\$ 1,597,225	\$ 3,037,259	\$ 6,041,693	\$ 8,799,413	\$ 9,881,408	\$ 10,977,606	\$ 12,100,409	\$ 13,402,979
Fuel (\$/MMBTU)	\$ 9.84	\$ 9.48	\$ 9.20	\$ 8.75	\$ 8.98	\$ 9.05	\$ 9.13	\$ 9.21	\$ 9.33	\$ 9.75

	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027
MW	24.2	27.5	30.7	34.0	37.3	40.0	42.4	43.8	45.2	46.6
aMW	20.9	23.7	26.5	29.3	32.1	34.5	36.5	37.7	38.9	40.1
Total Cost	\$ 14,067,838	\$ 15,430,656	\$ 16,878,879	\$ 18,144,428	\$ 19,603,430	\$ 20,221,615	\$ 20,709,257	\$ 20,216,269	\$ 21,436,720	\$ 23,110,690
Fuel (\$/MMBTU)	\$ 9.86	\$ 10.22	\$ 10.61	\$ 10.70	\$ 11.00	\$ 11.30	\$ 11.60	\$ 11.91	\$ 12.16	\$ 12.42

Table E-13. Distributed Generation Green World Scenario: CHP (Natural Gas)

CHP (Natural gas)	% Penetration (by MW)					2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	
	Res	Com	Ind													
Recip Engine	0%	65%	35%	MW		0.07	0.20	0.51	1.08	2.20	3.74	5.28	6.82	8.36	9.90	
				aMW		0.06	0.18	0.46	0.97	1.98	3.37	4.75	6.14	7.53	8.91	
				Inst costs (\$/kW)	\$	1,087	1,087	1,087	1,087	1,087	1,087	1,087	1,087	1,087	1,087	1,087
				O&M (\$/MW)	\$	101,345	101,345	101,345	101,345	101,345	101,345	101,345	101,345	101,345	101,345	101,345
				Fuel (\$/kW)	\$	312	301	334	331	325	333	343	353	363	382	
				Lump sum (\$)	\$	106,248	237,545	588,747	1,150,135	2,280,520	3,468,772	4,190,175	4,939,233	5,721,855	6,633,651	
Microturbine	0%	65%	35%	MW		0.01	0.04	0.10	0.21	0.43	0.74	1.04	1.34	1.64	1.95	
				aMW		0.01	0.04	0.09	0.20	0.41	0.70	0.99	1.27	1.56	1.85	
				Inst costs (\$/kW)	\$	1,634	1,634	1,634	1,634	1,634	1,634	1,634	1,634	1,634	1,634	
				O&M (\$/MW)	\$	108,135	108,135	108,135	108,135	108,135	108,135	108,135	108,135	108,135	108,135	
				Fuel (\$/kW)	\$	487	469	521	516	507	520	535	550	565	596	
				Lump sum (\$)	\$	31,043	69,114	171,400	334,348	662,502	1,006,027	1,211,993	1,426,434	1,651,160	1,915,470	
Fuel Cell	0%	65%	35%	MW		0.01	0.02	0.05	0.10	0.21	0.35	0.50	0.64	0.79	0.93	
				aMW		0.01	0.02	0.05	0.10	0.20	0.33	0.47	0.61	0.75	0.89	
				Inst costs (\$/kW)	\$	5,314	5,314	5,314	5,314	5,314	5,314	5,314	5,314	5,314	5,314	
				O&M (\$/MW)	\$	14,403	14,403	14,403	14,403	14,403	14,403	14,403	14,403	14,403	14,403	
				Fuel (\$/kW)	\$	380	366	407	403	396	406	418	429	442	466	
				Lump sum (\$)	\$	38,798	79,792	189,684	357,358	702,903	996,214	1,063,145	1,133,249	1,207,202	1,295,972	

CHP (Natural gas)													Levelized Cost		
													2018	2019	2020
Recip Engine	MW	11.44	12.98	14.52	16.06	17.61	18.93	20.03	20.69	21.35	22.01				
	aMW	10.30	11.69	13.07	14.46	15.84	17.03	18.02	18.62	19.21	19.81				
	Inst costs (\$/kW)	\$ 1,087	\$ 1,087	\$ 1,087	\$ 1,087	\$ 1,087	\$ 1,087	\$ 1,087	\$ 1,087	\$ 1,087	\$ 1,087			90%	
	O&M (\$/MW)	\$ 101,345	\$ 101,345	\$ 101,345	\$ 101,345	\$ 101,345	\$ 101,345	\$ 101,345	\$ 101,345	\$ 101,345	\$ 101,345				
	Fuel (\$/kW)	\$ 394	\$ 413	\$ 433	\$ 444	\$ 456	\$ 469	\$ 481	\$ 494	\$ 508	\$ 521				
	Lump sum (\$)	\$ 7,512,415	\$ 8,520,763	\$ 9,597,735	\$ 10,611,149	\$ 11,660,157	\$ 12,368,431	\$ 12,982,927	\$ 13,109,421	\$ 13,786,583	\$ 14,487,847				
Microturbine	MW	2.25	2.55	2.85	3.16	3.46	3.72	3.94	4.07	4.20	4.32				
	aMW	2.14	2.42	2.71	3.00	3.29	3.53	3.74	3.86	3.99	4.11				
	Inst costs (\$/kW)	\$ 1,634	\$ 1,634	\$ 1,634	\$ 1,634	\$ 1,634	\$ 1,634	\$ 1,634	\$ 1,634	\$ 1,634	\$ 1,634			95%	
	O&M (\$/MW)	\$ 108,135	\$ 108,135	\$ 108,135	\$ 108,135	\$ 108,135	\$ 108,135	\$ 108,135	\$ 108,135	\$ 108,135	\$ 108,135				
	Fuel (\$/kW)	\$ 615	\$ 644	\$ 675	\$ 693	\$ 712	\$ 731	\$ 750	\$ 771	\$ 791	\$ 813				
	Lump sum (\$)	\$ 2,169,658	\$ 2,463,557	\$ 2,778,485	\$ 3,073,935	\$ 3,380,294	\$ 3,610,618	\$ 3,814,362	\$ 3,914,651	\$ 4,208,998	\$ 4,611,816				
Fuel Cell	MW	1.08	1.22	1.37	1.51	1.66	1.78	1.89	1.95	2.01	2.07				
	aMW	1.02	1.16	1.30	1.44	1.58	1.69	1.79	1.85	1.91	1.97				
	Inst costs (\$/kW)	\$ 5,314	\$ 5,314	\$ 5,314	\$ 5,314	\$ 5,314	\$ 5,314	\$ 5,314	\$ 5,314	\$ 5,314	\$ 5,314			95%	
	O&M (\$/MW)	\$ 14,403	\$ 14,403	\$ 14,403	\$ 14,403	\$ 14,403	\$ 14,403	\$ 14,403	\$ 14,403	\$ 14,403	\$ 14,403				
	Fuel (\$/kW)	\$ 480	\$ 503	\$ 527	\$ 541	\$ 556	\$ 571	\$ 586	\$ 602	\$ 618	\$ 635				
	Lump sum (\$)	\$ 1,417,299	\$ 1,553,490	\$ 1,758,129	\$ 2,003,939	\$ 2,411,330	\$ 2,618,242	\$ 2,586,466	\$ 2,412,271	\$ 2,483,166	\$ 2,556,826				

NOTE: Red indicates levelized cost is less than cost of generic resource; all admin. costs are 10%.

**Table E-14. Distributed Generation Green World Scenario: Renewables**

Renewable	% Penetration (by MW)					2008	2009	2010	2011	2012	2013	2014	2015	2016	2017			
	Res	Com	Ind															
Small Wind	30%	70%	0%	MW		0.00	0.00	0.01	0.01	0.03	0.04	0.06	0.08	0.10	0.12			
				aMW		0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.01	0.01	0.02			
				Inst costs (\$/kW)	\$	2,598	\$	2,598	\$	2,598	\$	2,598	\$	2,598	\$	2,598	\$	2,598
				O&M (\$/MW)	\$	87,600	\$	87,600	\$	87,600	\$	87,600	\$	87,600	\$	87,600	\$	87,600
				Lump sum (\$)	\$	2,263	\$	4,592	\$	10,760	\$	20,124	\$	39,562	\$	55,036	\$	61,317
	50%	50%	0%	MW		0.00	0.01	0.01	0.03	0.06	0.10	0.15	0.19	0.23	0.27			
				aMW		0.00	0.00	0.00	0.00	0.01	0.02	0.02	0.03	0.03				
				Inst costs (\$/kW)	\$	6,700	\$	6,700	\$	6,700	\$	6,700	\$	6,700	\$	6,700		
				O&M (\$/MW)	\$	16,800	\$	16,800	\$	16,800	\$	16,800	\$	16,800	\$	16,800		
				Lump sum (\$)	\$	13,498	\$	27,026	\$	63,082	\$	117,217	\$	229,964	\$	315,973	\$	318,121
	Biomass	0%	0%	100%	MW		0.04	0.11	0.29	0.62	1.27	2.15	3.04	3.93	4.81	5.70		
					aMW		0.03	0.09	0.23	0.50	1.01	1.72	2.43	3.14	3.85	4.56		
Inst costs (\$/kW)					\$	1,600	\$	1,600	\$	1,600	\$	1,600	\$	1,600	\$	1,600		
O&M (\$/MW)					\$	111,600	\$	111,600	\$	111,600	\$	111,600	\$	111,600	\$	111,600		
Lump sum (\$)					\$	71,112	\$	146,465	\$	344,578	\$	648,816	\$	1,278,168	\$	1,800,631	\$	1,899,571
0%		100%	0%	MW		0.02	0.07	0.17	0.37	0.76	1.29	1.82	2.35	2.88	3.41			
				aMW		0.02	0.05	0.14	0.30	0.61	1.03	1.45	1.88	2.30	2.73			
				Inst costs (\$/kW)	\$	3,906	\$	3,906	\$	3,906	\$	3,906	\$	3,906	\$	3,906		
				O&M (\$/MW)	\$	96,013	\$	96,013	\$	96,013	\$	96,013	\$	96,013	\$	96,013		
				Lump sum (\$)	\$	99,779	\$	201,739	\$	472,178	\$	881,471	\$	1,731,864	\$	2,400,875	\$	2,451,766

Renewable		2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	Levelized Cost		
Small Wind	MW	0.13	0.15	0.17	0.19	0.20	0.22	0.23	0.24	0.25	0.26			
		aMW	0.02	0.02	0.03	0.03	0.03	0.03	0.03	0.04	0.04	0.04	Capacity Factor 15%	
		Inst costs (\$/kW)	\$ 2,598	\$ 2,598	\$ 2,598	\$ 2,598	\$ 2,598	\$ 2,598	\$ 2,598	\$ 2,598	\$ 2,598	\$ 2,598	Levelized Cost \$0.30 \$/kWh	
		O&M (\$/MW)	\$ 87,600	\$ 87,600	\$ 87,600	\$ 87,600	\$ 87,600	\$ 87,600	\$ 87,600	\$ 87,600	\$ 87,600	\$ 87,600		
		Lump sum (\$)	\$ 62,888	\$ 64,458	\$ 66,028	\$ 67,599	\$ 69,169	\$ 70,740	\$ 72,311	\$ 73,882	\$ 75,453	\$ 77,024	\$ 78,595	
	PV	MW	0.32	0.36	0.40	0.44	0.49	0.52	0.55	0.57	0.59	0.61		
		aMW	0.04	0.04	0.05	0.05	0.06	0.06	0.07	0.07	0.07	0.07	Capacity Factor 12%	
		Inst costs (\$/kW)	\$ 6,700	\$ 6,700	\$ 6,700	\$ 6,700	\$ 6,700	\$ 6,700	\$ 6,700	\$ 6,700	\$ 6,700	\$ 6,700	Levelized Cost \$0.97 \$/kWh	
		O&M (\$/MW)	\$ 16,800	\$ 16,800	\$ 16,800	\$ 16,800	\$ 16,800	\$ 16,800	\$ 16,800	\$ 16,800	\$ 16,800	\$ 16,800		
		Lump sum (\$)	\$ 319,554	\$ 320,270	\$ 320,987	\$ 321,703	\$ 322,419	\$ 323,135	\$ 323,851	\$ 324,567	\$ 325,283	\$ 326,000	\$ 326,716	
	Biomass	Industrial	MW	6.59	7.47	8.36	9.25	10.13	10.89	11.53	11.91	12.29	12.67	
			aMW	5.27	5.98	6.69	7.40	8.11	8.71	9.22	9.52	9.83	10.13	Capacity Factor 80%
Inst costs (\$/kW)			\$ 1,600	\$ 1,600	\$ 1,600	\$ 1,600	\$ 1,600	\$ 1,600	\$ 1,600	\$ 1,600	\$ 1,600	\$ 1,600	Levelized Cost \$0.04 \$/kWh	
O&M (\$/MW)			\$ 111,600	\$ 111,600	\$ 111,600	\$ 111,600	\$ 111,600	\$ 111,600	\$ 111,600	\$ 111,600	\$ 111,600	\$ 111,600		
Lump sum (\$)			\$ 2,295,332	\$ 2,394,273	\$ 2,493,213	\$ 2,592,153	\$ 2,691,093	\$ 2,790,033	\$ 2,888,973	\$ 2,987,913	\$ 3,086,853	\$ 3,185,793	\$ 3,284,733	
Anaerobic Digester		MW	3.94	4.47	5.00	5.53	6.06	6.51	6.89	7.12	7.34	7.57		
		aMW	3.15	3.57	4.00	4.42	4.85	5.21	5.51	5.69	5.88	6.06	Capacity Factor 80%	
		Inst costs (\$/kW)	\$ 3,906	\$ 3,906	\$ 3,906	\$ 3,906	\$ 3,906	\$ 3,906	\$ 3,906	\$ 3,906	\$ 3,906	\$ 3,906	Levelized Cost \$0.10 \$/kWh	
		O&M (\$/MW)	\$ 96,013	\$ 96,013	\$ 96,013	\$ 96,013	\$ 96,013	\$ 96,013	\$ 96,013	\$ 96,013	\$ 96,013	\$ 96,013		
		Lump sum (\$)	\$ 2,655,332	\$ 2,706,223	\$ 2,757,115	\$ 2,808,006	\$ 2,858,897	\$ 2,909,788	\$ 2,960,679	\$ 3,011,570	\$ 3,062,461	\$ 3,113,352	\$ 3,164,243	

NOTE: Red indicates levelized cost is less than cost of generic resource; all admin. costs are 10%.

**Distributed Generation Green World Economic Market Potential and Cost**

	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
MW	0.1	0.4	1.0	2.1	4.2	7.2	10.1	13.1	16.1	19.0
aMW	0.1	0.3	0.8	1.8	3.6	6.1	8.6	11.2	13.7	16.2
Total Cost	\$ 277,139	\$ 585,748	\$ 1,405,503	\$ 2,680,422	\$ 5,290,552	\$ 7,670,279	\$ 8,541,513	\$ 9,440,403	\$ 10,372,856	\$ 11,434,484
Fuel (\$/MMBTU)	\$ 7.87	\$ 7.59	\$ 8.42	\$ 8.34	\$ 8.20	\$ 8.41	\$ 8.66	\$ 8.90	\$ 9.15	\$ 9.65

	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027
MW	22.0	24.9	27.9	30.8	33.8	36.3	38.4	39.7	41.0	42.2
aMW	18.7	21.2	23.8	26.3	28.8	31.0	32.8	33.8	34.9	36.0
Total Cost	\$ 12,463,080	\$ 13,621,259	\$ 14,848,063	\$ 16,011,308	\$ 17,210,148	\$ 17,596,214	\$ 17,867,097	\$ 17,221,600	\$ 18,353,366	\$ 19,932,159
Fuel (\$/MMBTU)	\$ 9.95	\$ 10.42	\$ 10.92	\$ 11.22	\$ 11.51	\$ 11.83	\$ 12.14	\$ 12.47	\$ 12.81	\$ 13.15

Table E-15. Distributed Generation + Emerging Technologies Green World Scenario: CHP (Natural Gas)

CHP (Natural gas)	% Penetration (by MW)			Ind		2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	
	Res	Com														
Recip Engine	5%		63%	32%												
					MW	0.07	0.20	0.51	1.08	2.20	3.74	5.28	6.82	8.36	9.90	
					aMW	0.06	0.18	0.46	0.97	1.98	3.37	4.75	6.14	7.53	8.91	
					Inst costs (\$/kW)	\$ 1,087	\$ 1,087	\$ 1,087	\$ 1,087	\$ 1,087	\$ 1,087	\$ 1,087	\$ 1,087	\$ 1,087	\$ 1,087	\$ 1,087
					O&M (\$/MW)	\$ 101,345	\$ 101,345	\$ 101,345	\$ 101,345	\$ 101,345	\$ 101,345	\$ 101,345	\$ 101,345	\$ 101,345	\$ 101,345	\$ 101,345
					Fuel (\$/kW)	\$ 312	\$ 301	\$ 334	\$ 331	\$ 325	\$ 333	\$ 343	\$ 353	\$ 363	\$ 382	
Microturbine	5%		63%	32%												
					MW	0.01	0.04	0.10	0.21	0.43	0.74	1.04	1.34	1.64	1.95	
					aMW	0.01	0.04	0.09	0.20	0.41	0.70	0.99	1.27	1.56	1.85	
					Inst costs (\$/kW)	\$ 1,634	\$ 1,634	\$ 1,634	\$ 1,634	\$ 1,634	\$ 1,634	\$ 1,634	\$ 1,634	\$ 1,634	\$ 1,634	
					O&M (\$/MW)	\$ 108,135	\$ 108,135	\$ 108,135	\$ 108,135	\$ 108,135	\$ 108,135	\$ 108,135	\$ 108,135	\$ 108,135	\$ 108,135	
					Fuel (\$/kW)	\$ 487	\$ 469	\$ 521	\$ 516	\$ 507	\$ 520	\$ 535	\$ 550	\$ 565	\$ 596	
Fuel Cell	5%		63%	32%												
					MW	0.01	0.02	0.05	0.10	0.21	0.35	0.50	0.64	0.79	0.93	
					aMW	0.01	0.02	0.05	0.10	0.20	0.33	0.47	0.61	0.75	0.89	
					Inst costs (\$/kW)	\$ 5,314	\$ 5,314	\$ 5,314	\$ 5,314	\$ 5,314	\$ 5,314	\$ 5,314	\$ 5,314	\$ 5,314	\$ 5,314	
					O&M (\$/MW)	\$ 14,403	\$ 14,403	\$ 14,403	\$ 14,403	\$ 14,403	\$ 14,403	\$ 14,403	\$ 14,403	\$ 14,403	\$ 14,403	
					Fuel (\$/kW)	\$ 380	\$ 366	\$ 407	\$ 403	\$ 396	\$ 406	\$ 418	\$ 429	\$ 442	\$ 466	
				Lump sum (\$)	\$ 38,798	\$ 79,792	\$ 189,684	\$ 357,358	\$ 702,903	\$ 996,214	\$ 1,063,145	\$ 1,133,249	\$ 1,207,202	\$ 1,295,972		

CHP (Natural gas)		2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	Levelized Cost		
Recip Engine	MW	11.44	12.98	14.52	16.06	17.61	18.93	20.03	20.69	21.35	22.01	Gen SS Resource	\$0.13	\$/kWh
	aMW	10.30	11.69	13.07	14.46	15.84	17.03	18.02	18.62	19.21	19.81	Capacity Factor	90%	
	Inst costs (\$/kW)	\$ 1,087	\$ 1,087	\$ 1,087	\$ 1,087	\$ 1,087	\$ 1,087	\$ 1,087	\$ 1,087	\$ 1,087	\$ 1,087			
	O&M (\$/MW)	\$ 101,345	\$ 101,345	\$ 101,345	\$ 101,345	\$ 101,345	\$ 101,345	\$ 101,345	\$ 101,345	\$ 101,345	\$ 101,345			
	Fuel (\$/kW)	\$ 394	\$ 413	\$ 433	\$ 444	\$ 456	\$ 469	\$ 481	\$ 494	\$ 508	\$ 521			
	Lump sum (\$)	\$ 7,512,415	\$ 8,520,763	\$ 9,597,735	\$ 10,611,149	\$ 11,660,157	\$ 12,368,431	\$ 12,982,327	\$ 13,109,421	\$ 13,786,583	\$ 14,487,847	Levelized Cost	\$0.10	\$/kWh
Microturbine	MW	2.25	2.55	2.85	3.16	3.46	3.72	3.94	4.07	4.20	4.32			
	aMW	2.14	2.42	2.71	3.00	3.29	3.53	3.74	3.86	3.99	4.11	Capacity Factor	95%	
	Inst costs (\$/kW)	\$ 1,053	\$ 1,053	\$ 1,053	\$ 1,053	\$ 1,053	\$ 1,053	\$ 1,053	\$ 1,053	\$ 1,053	\$ 1,053			
	O&M (\$/MW)	\$ 108,135	\$ 108,135	\$ 108,135	\$ 108,135	\$ 108,135	\$ 108,135	\$ 108,135	\$ 108,135	\$ 108,135	\$ 108,135			
	Fuel (\$/kW)	\$ 615	\$ 644	\$ 675	\$ 693	\$ 712	\$ 731	\$ 750	\$ 771	\$ 791	\$ 813			
	Lump sum (\$)	\$ 1,975,919	\$ 2,269,817	\$ 2,584,745	\$ 2,880,196	\$ 3,186,554	\$ 3,436,252	\$ 3,659,370	\$ 3,792,872	\$ 4,054,007	\$ 4,387,631	Levelized Cost	\$0.13	\$/kWh
Fuel Cell	MW	1.08	1.22	1.37	1.51	1.66	1.78	1.89	1.95	2.01	2.07			
	aMW	1.02	1.16	1.30	1.44	1.58	1.69	1.79	1.85	1.91	1.97	Capacity Factor	95%	
	Inst costs (\$/kW)	\$ 3,423	\$ 3,423	\$ 3,423	\$ 3,423	\$ 3,423	\$ 3,423	\$ 3,423	\$ 3,423	\$ 3,423	\$ 3,423			
	O&M (\$/MW)	\$ 14,403	\$ 14,403	\$ 14,403	\$ 14,403	\$ 14,403	\$ 14,403	\$ 14,403	\$ 14,403	\$ 14,403	\$ 14,403			
	Fuel (\$/kW)	\$ 480	\$ 503	\$ 527	\$ 541	\$ 556	\$ 571	\$ 586	\$ 602	\$ 618	\$ 635			
	Lump sum (\$)	\$ 1,102,498	\$ 1,225,752	\$ 1,395,892	\$ 1,589,953	\$ 1,889,535	\$ 2,057,636	\$ 2,068,984	\$ 1,981,036	\$ 2,051,931	\$ 2,125,591	Levelized Cost	\$0.18	\$/kWh

NOTE: Red indicates levelized cost is less than cost of generic resource; all admin. costs are 10%.



**Table E-16. Distributed Generation + Emerging Technologies Green World Scenario: Renewables**

Renewable	% Penetration (by MW)				2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	
	Res	Com	Ind												
Small Wind	30%	70%	0%												
				MW	0.00	0.00	0.01	0.01	0.03	0.04	0.06	0.08	0.10	0.12	
				aMW	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.01	0.01	0.02	
				Inst costs (\$/kW)	\$ 2,598	\$ 2,598	\$ 2,598	\$ 2,598	\$ 2,598	\$ 2,598	\$ 2,598	\$ 2,598	\$ 2,598	\$ 2,598	
				O&M (\$/MW)	\$ 87,600	\$ 87,600	\$ 87,600	\$ 87,600	\$ 87,600	\$ 87,600	\$ 87,600	\$ 87,600	\$ 87,600	\$ 87,600	
PV	50%	50%	0%												
				Lump sum (\$)	\$ 2,263	\$ 4,592	\$ 10,760	\$ 20,124	\$ 39,562	\$ 55,036	\$ 56,606	\$ 58,176	\$ 59,747	\$ 61,317	
				MW	0.00	0.01	0.01	0.03	0.06	0.10	0.15	0.19	0.23	0.27	
				aMW	0.00	0.00	0.00	0.00	0.01	0.01	0.02	0.02	0.03	0.03	
				Inst costs (\$/kW)	\$ 6,700	\$ 6,700	\$ 6,700	\$ 6,700	\$ 6,700	\$ 6,700	\$ 6,700	\$ 6,700	\$ 6,700	\$ 6,700	
Biomass				O&M (\$/MW)	\$ 16,800	\$ 16,800	\$ 16,800	\$ 16,800	\$ 16,800	\$ 16,800	\$ 16,800	\$ 16,800	\$ 16,800	\$ 16,800	
				Lump sum (\$)	\$ 13,498	\$ 27,026	\$ 63,082	\$ 117,217	\$ 229,964	\$ 315,973	\$ 316,689	\$ 317,405	\$ 318,121	\$ 318,838	
	Industrial	0%	0%	100%											
					MW	0.04	0.11	0.29	0.62	1.27	2.15	3.04	3.93	4.81	5.70
					aMW	0.03	0.09	0.23	0.50	1.01	1.72	2.43	3.14	3.85	4.56
				Inst costs (\$/kW)	\$ 1,600	\$ 1,600	\$ 1,600	\$ 1,600	\$ 1,600	\$ 1,600	\$ 1,600	\$ 1,600	\$ 1,600	\$ 1,600	
				O&M (\$/MW)	\$ 111,600	\$ 111,600	\$ 111,600	\$ 111,600	\$ 111,600	\$ 111,600	\$ 111,600	\$ 111,600	\$ 111,600	\$ 111,600	
Anaerobic Digester	0%	100%	0%												
				Lump sum (\$)	\$ 71,112	\$ 146,465	\$ 344,578	\$ 648,816	\$ 1,278,168	\$ 1,800,631	\$ 1,899,571	\$ 1,998,512	\$ 2,097,452	\$ 2,196,392	
				MW	0.02	0.07	0.17	0.37	0.76	1.29	1.82	2.35	2.88	3.41	
				aMW	0.02	0.05	0.14	0.30	0.61	1.03	1.45	1.89	2.30	2.73	
				Inst costs (\$/kW)	\$ 3,906	\$ 3,906	\$ 3,906	\$ 3,906	\$ 3,906	\$ 3,906	\$ 3,906	\$ 3,906	\$ 3,906	\$ 3,906	
			O&M (\$/MW)	\$ 96,013	\$ 96,013	\$ 96,013	\$ 96,013	\$ 96,013	\$ 96,013	\$ 96,013	\$ 96,013	\$ 96,013	\$ 96,013		
			Lump sum (\$)	\$ 99,779	\$ 201,739	\$ 472,178	\$ 881,471	\$ 1,731,864	\$ 2,400,875	\$ 2,451,766	\$ 2,502,658	\$ 2,553,549	\$ 2,604,441		

Renewable					2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	Levelized Cost			
Small Wind	MW	0.13	0.15	0.17	0.19	0.20	0.22	0.23	0.24	0.25	0.26	0.26	0.26	0.26	0.26	Capacity Factor	15%	
	aMW	0.02	0.03	0.03	0.03	0.04	0.04	0.04	0.05	0.05	0.05	0.05	0.05	0.05	0.05	CF after Year 10	23%	
	Inst costs (\$/kW)	\$ 2,598	\$ 2,598	\$ 2,598	\$ 2,598	\$ 2,598	\$ 2,598	\$ 2,598	\$ 2,598	\$ 2,598	\$ 2,598	\$ 2,598	\$ 2,598	\$ 2,598	\$ 2,598	Levelized Cost	\$0.30 \$/kWh	
	O&M (\$/MW)	\$ 87,600	\$ 87,600	\$ 87,600	\$ 87,600	\$ 87,600	\$ 87,600	\$ 87,600	\$ 87,600	\$ 87,600	\$ 87,600	\$ 87,600	\$ 87,600	\$ 87,600	\$ 87,600			
	Lump sum (\$)	\$ 62,888	\$ 64,458	\$ 66,028	\$ 67,599	\$ 69,169	\$ 70,740	\$ 72,311	\$ 73,882	\$ 75,453	\$ 77,024	\$ 78,595	\$ 80,166	\$ 81,737	\$ 83,308			
PV	MW	0.32	0.36	0.40	0.44	0.49	0.52	0.55	0.57	0.59	0.61	0.61	0.61	0.61	0.61	Capacity Factor	12%	
	aMW	0.04	0.04	0.05	0.05	0.06	0.06	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07			
	Inst costs (\$/kW)	\$ 4,315	\$ 4,315	\$ 4,315	\$ 4,315	\$ 4,315	\$ 4,315	\$ 4,315	\$ 4,315	\$ 4,315	\$ 4,315	\$ 4,315	\$ 4,315	\$ 4,315	\$ 4,315	Levelized Cost	\$0.79 \$/kWh	
	O&M (\$/MW)	\$ 16,800	\$ 16,800	\$ 16,800	\$ 16,800	\$ 16,800	\$ 16,800	\$ 16,800	\$ 16,800	\$ 16,800	\$ 16,800	\$ 16,800	\$ 16,800	\$ 16,800	\$ 16,800			
	Lump sum (\$)	\$ 207,705	\$ 208,421	\$ 209,137	\$ 209,854	\$ 210,570	\$ 211,286	\$ 212,002	\$ 212,718	\$ 213,434	\$ 214,150	\$ 214,866	\$ 215,582	\$ 216,298	\$ 217,014			
Biomass	Industrial	MW	6.59	7.47	8.36	9.25	10.13	10.89	11.53	11.91	12.29	12.67	13.05	13.43	13.81	14.19	Capacity Factor	80%
		aMW	5.27	5.98	6.69	7.40	8.11	8.71	9.22	9.52	9.83	10.13	10.43	10.73	11.03	11.33		
		Inst costs (\$/kW)	\$ 1,600	\$ 1,600	\$ 1,600	\$ 1,600	\$ 1,600	\$ 1,600	\$ 1,600	\$ 1,600	\$ 1,600	\$ 1,600	\$ 1,600	\$ 1,600	\$ 1,600	\$ 1,600	Levelized Cost	\$0.04 \$/kWh
		O&M (\$/MW)	\$ 111,600	\$ 111,600	\$ 111,600	\$ 111,600	\$ 111,600	\$ 111,600	\$ 111,600	\$ 111,600	\$ 111,600	\$ 111,600	\$ 111,600	\$ 111,600	\$ 111,600	\$ 111,600		
		Lump sum (\$)	\$ 2,295,332	\$ 2,394,273	\$ 2,493,213	\$ 2,592,153	\$ 2,691,093	\$ 2,790,033	\$ 2,888,973	\$ 2,987,913	\$ 3,086,853	\$ 3,185,793	\$ 3,284,733	\$ 3,383,673	\$ 3,482,613	\$ 3,581,553		
Anaerobic Digester	MW	3.94	4.47	5.00	5.53	6.06	6.51	6.89	7.12	7.34	7.57	7.79	8.01	8.23	8.45	Capacity Factor	80%	
	aMW	3.15	3.57	4.00	4.42	4.85	5.21	5.51	5.69	5.88	6.06	6.25	6.43	6.61	6.79			
	Inst costs (\$/kW)	\$ 3,354	\$ 3,354	\$ 3,354	\$ 3,354	\$ 3,354	\$ 3,354	\$ 3,354	\$ 3,354	\$ 3,354	\$ 3,354	\$ 3,354	\$ 3,354	\$ 3,354	\$ 3,354	Levelized Cost	\$0.09 \$/kWh	
	O&M (\$/MW)	\$ 96,013	\$ 96,013	\$ 96,013	\$ 96,013	\$ 96,013	\$ 96,013	\$ 96,013	\$ 96,013	\$ 96,013	\$ 96,013	\$ 96,013	\$ 96,013	\$ 96,013	\$ 96,013			
	Lump sum (\$)	\$ 2,333,647	\$ 2,384,539	\$ 2,435,430	\$ 2,486,321	\$ 2,537,213	\$ 2,588,104	\$ 2,638,995	\$ 2,689,886	\$ 2,740,777	\$ 2,791,668	\$ 2,842,559	\$ 2,893,450	\$ 2,944,341	\$ 2,995,232			

NOTE: Red indicates levelized cost is less than cost of generic resource; all admin. costs are 10%.

**Distributed Generation + Emerging Technologies Green World Economic Market Potential and Cost**

	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
MW	0.1	0.4	1.0	2.1	4.2	7.2	10.1	13.1	16.1	19.0
aMW	0.1	0.3	0.8	1.8	3.6	6.1	8.6	11.2	13.7	16.2
Total Cost	\$ 277,139	\$ 585,748	\$ 1,405,503	\$ 2,680,422	\$ 5,290,552	\$ 7,670,279	\$ 8,541,513	\$ 9,440,403	\$ 10,372,856	\$ 11,434,484
Fuel (\$/MMBTU)	\$ 7.87	\$ 7.59	\$ 8.42	\$ 8.34	\$ 8.20	\$ 8.41	\$ 8.66	\$ 8.90	\$ 9.15	\$ 9.65

	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027
MW	22.0	24.9	27.9	30.8	33.8	36.3	38.4	39.7	41.0	42.2
aMW	18.7	21.2	23.8	26.3	28.8	31.0	32.8	33.8	34.9	36.0
Total Cost	\$ 12,141,395	\$ 13,299,574	\$ 14,526,378	\$ 15,689,623	\$ 16,888,463	\$ 17,306,697	\$ 17,609,750	\$ 17,019,398	\$ 18,096,019	\$ 19,559,924
Fuel (\$/MMBTU)	\$ 9.95	\$ 10.42	\$ 10.92	\$ 11.22	\$ 11.51	\$ 11.83	\$ 12.14	\$ 12.47	\$ 12.81	\$ 13.15

Table E-17. Distributed Generation Low Growth Scenario: CHP (Natural Gas)

CHP (Natural gas)	% Penetration (by MW)					2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	
	Res	Com	Ind													
Recip Engine	0%	65%	35%	MW		0.07	0.20	0.51	1.08	2.20	3.74	5.28	6.82	8.36	9.90	
				aMW		0.06	0.18	0.46	0.97	1.98	3.37	4.75	6.14	7.53	8.91	
				Inst costs (\$/kW)	\$	1,087	1,087	1,087	1,087	1,087	1,087	1,087	1,087	1,087	1,087	1,087
				O&M (\$/MW)	\$	101,345	101,345	101,345	101,345	101,345	101,345	101,345	101,345	101,345	101,345	101,345
				Fuel (\$/kW)	\$	312	301	292	277	242	238	235	236	235	237	
				Lump sum (\$)	\$	106,248	237,545	567,395	1,092,591	2,097,499	3,113,148	3,620,269	4,146,790	4,681,398	5,194,099	
Microturbine	0%	65%	35%	MW		0.01	0.04	0.10	0.21	0.43	0.74	1.04	1.34	1.64	1.95	
				aMW		0.01	0.04	0.09	0.20	0.41	0.70	0.99	1.27	1.56	1.85	
				Inst costs (\$/kW)	\$	1,634	1,634	1,634	1,634	1,634	1,634	1,634	1,634	1,634	1,634	
				O&M (\$/MW)	\$	108,135	108,135	108,135	108,135	108,135	108,135	108,135	108,135	108,135	108,135	
				Fuel (\$/kW)	\$	487	469	455	432	377	372	367	369	371	370	
				Lump sum (\$)	\$	31,043	69,114	164,857	316,714	606,416	897,049	1,037,349	1,183,594	1,332,318	1,474,328	
Fuel Cell	0%	65%	35%	MW		0.01	0.02	0.05	0.10	0.21	0.35	0.50	0.64	0.79	0.93	
				aMW		0.01	0.02	0.05	0.10	0.20	0.33	0.47	0.61	0.75	0.89	
				Inst costs (\$/kW)	\$	5,314	5,314	5,314	5,314	5,314	5,314	5,314	5,314	5,314	5,314	
				O&M (\$/MW)	\$	14,403	14,403	14,403	14,403	14,403	14,403	14,403	14,403	14,403	14,403	
				Fuel (\$/kW)	\$	380	366	355	338	295	290	287	288	290	289	
				Lump sum (\$)	\$	38,798	79,792	187,234	350,758	681,909	955,422	997,774	1,042,351	1,087,855	1,130,847	

CHP (Natural gas)													Levelized Cost		
													2018	2019	2020
Recip Engine	MW	11.44	12.98	14.52	16.06	17.61	18.93	20.03	20.69	21.35	22.01				
	aMW	10.30	11.69	13.07	14.46	15.84	17.03	18.02	18.62	19.21	19.81				
	Inst costs (\$/kW)	\$ 1,087	\$ 1,087	\$ 1,087	\$ 1,087	\$ 1,087	\$ 1,087	\$ 1,087	\$ 1,087	\$ 1,087	\$ 1,087			90%	
	O&M (\$/MW)	\$ 101,345	\$ 101,345	\$ 101,345	\$ 101,345	\$ 101,345	\$ 101,345	\$ 101,345	\$ 101,345	\$ 101,345	\$ 101,345				
	Fuel (\$/kW)	\$ 239	\$ 248	\$ 258	\$ 262	\$ 266	\$ 270	\$ 274	\$ 279	\$ 284	\$ 289				
	Lump sum (\$)	\$ 5,734,423	\$ 6,375,180	\$ 7,054,841	\$ 7,674,120	\$ 8,304,047	\$ 8,605,394	\$ 8,841,715	\$ 8,660,757	\$ 9,017,436	\$ 9,383,819			Levelized Cost	\$0.07
Microturbine	MW	2.25	2.55	2.85	3.16	3.46	3.72	3.94	4.07	4.20	4.32				
	aMW	2.14	2.42	2.71	3.00	3.29	3.53	3.74	3.86	3.99	4.11				
	Inst costs (\$/kW)	\$ 1,634	\$ 1,634	\$ 1,634	\$ 1,634	\$ 1,634	\$ 1,634	\$ 1,634	\$ 1,634	\$ 1,634	\$ 1,634			95%	
	O&M (\$/MW)	\$ 108,135	\$ 108,135	\$ 108,135	\$ 108,135	\$ 108,135	\$ 108,135	\$ 108,135	\$ 108,135	\$ 108,135	\$ 108,135				
	Fuel (\$/kW)	\$ 372	\$ 386	\$ 402	\$ 408	\$ 414	\$ 421	\$ 428	\$ 435	\$ 443	\$ 451				
	Lump sum (\$)	\$ 1,624,803	\$ 1,806,055	\$ 1,999,230	\$ 2,173,900	\$ 2,351,834	\$ 2,457,457	\$ 2,545,312	\$ 2,551,384	\$ 2,747,521	\$ 3,047,717			Levelized Cost	\$0.09
Fuel Cell	MW	1.08	1.22	1.37	1.51	1.66	1.78	1.89	1.95	2.01	2.07				
	aMW	1.02	1.16	1.30	1.44	1.58	1.69	1.79	1.85	1.91	1.97				
	Inst costs (\$/kW)	\$ 5,314	\$ 5,314	\$ 5,314	\$ 5,314	\$ 5,314	\$ 5,314	\$ 5,314	\$ 5,314	\$ 5,314	\$ 5,314			95%	
	O&M (\$/MW)	\$ 14,403	\$ 14,403	\$ 14,403	\$ 14,403	\$ 14,403	\$ 14,403	\$ 14,403	\$ 14,403	\$ 14,403	\$ 14,403				
	Fuel (\$/kW)	\$ 291	\$ 302	\$ 314	\$ 319	\$ 324	\$ 329	\$ 334	\$ 340	\$ 346	\$ 352				
	Lump sum (\$)	\$ 1,213,353	\$ 1,307,380	\$ 1,466,445	\$ 1,667,045	\$ 2,026,365	\$ 2,186,600	\$ 2,111,446	\$ 1,901,984	\$ 1,936,118	\$ 1,971,365			Levelized Cost	\$0.18

NOTE: Red indicates levelized cost is less than cost of generic resource; all admin. costs are 10%.

**Table E-18. Distributed Generation Low Growth Scenario: Renewables**

Renewable	% Penetration (by MW)					2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	
	Res	Com	Ind													
Small Wind	30%	70%	0%													
	MW					0.00	0.00	0.01	0.01	0.03	0.04	0.06	0.08	0.10	0.12	
	aMW					0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.01	0.01	0.02	
	Inst costs (\$/kW)					\$ 2,598	\$ 2,598	\$ 2,598	\$ 2,598	\$ 2,598	\$ 2,598	\$ 2,598	\$ 2,598	\$ 2,598	\$ 2,598	
	O&M (\$/MW)					\$ 87,600	\$ 87,600	\$ 87,600	\$ 87,600	\$ 87,600	\$ 87,600	\$ 87,600	\$ 87,600	\$ 87,600	\$ 87,600	
	Lump sum (\$)					\$ 2,263	\$ 4,592	\$ 10,760	\$ 20,124	\$ 39,562	\$ 55,036	\$ 56,606	\$ 58,176	\$ 59,747	\$ 61,317	
	PV	50%	50%	0%												
		MW					0.00	0.01	0.01	0.03	0.06	0.10	0.15	0.19	0.23	0.27
		aMW					0.00	0.00	0.00	0.00	0.01	0.01	0.02	0.02	0.03	0.03
		Inst costs (\$/kW)					\$ 6,700	\$ 6,700	\$ 6,700	\$ 6,700	\$ 6,700	\$ 6,700	\$ 6,700	\$ 6,700	\$ 6,700	\$ 6,700
O&M (\$/MW)						\$ 16,800	\$ 16,800	\$ 16,800	\$ 16,800	\$ 16,800	\$ 16,800	\$ 16,800	\$ 16,800	\$ 16,800	\$ 16,800	
Biomass	Industrial	0%	0%	100%												
		MW					0.04	0.11	0.29	0.62	1.27	2.15	3.04	3.93	4.81	5.70
		aMW					0.03	0.09	0.23	0.50	1.01	1.72	2.43	3.14	3.85	4.56
		Inst costs (\$/kW)					\$ 1,600	\$ 1,600	\$ 1,600	\$ 1,600	\$ 1,600	\$ 1,600	\$ 1,600	\$ 1,600	\$ 1,600	\$ 1,600
		O&M (\$/MW)					\$ 111,600	\$ 111,600	\$ 111,600	\$ 111,600	\$ 111,600	\$ 111,600	\$ 111,600	\$ 111,600	\$ 111,600	\$ 111,600
	Lump sum (\$)					\$ 71,112	\$ 146,465	\$ 344,578	\$ 648,816	\$ 1,278,168	\$ 1,800,631	\$ 1,899,571	\$ 1,998,512	\$ 2,097,452	\$ 2,196,392	
	Anaerobic Digester	0%	100%	0%												
		MW					0.02	0.07	0.17	0.37	0.76	1.29	1.82	2.35	2.88	3.41
		aMW					0.02	0.05	0.14	0.30	0.61	1.03	1.45	1.88	2.30	2.73
		Inst costs (\$/kW)					\$ 3,906	\$ 3,906	\$ 3,906	\$ 3,906	\$ 3,906	\$ 3,906	\$ 3,906	\$ 3,906	\$ 3,906	\$ 3,906
O&M (\$/MW)						\$ 96,013	\$ 96,013	\$ 96,013	\$ 96,013	\$ 96,013	\$ 96,013	\$ 96,013	\$ 96,013	\$ 96,013	\$ 96,013	
Lump sum (\$)					\$ 99,779	\$ 201,739	\$ 472,178	\$ 881,471	\$ 1,731,864	\$ 2,400,875	\$ 2,451,766	\$ 2,502,658	\$ 2,553,549	\$ 2,604,441		

Renewable																	Levelized Cost				
																	2018	2019	2020	2021	2022
Small Wind	MW		0.13	0.15	0.17	0.19	0.20	0.22	0.23	0.24	0.25	0.26									
	aMW		0.02	0.02	0.03	0.03	0.03	0.03	0.03	0.04	0.04	0.04						Capacity Factor	15%		
	Inst costs (\$/kW)	\$	2,598	2,598	2,598	2,598	2,598	2,598	2,598	2,598	2,598	2,598									
	O&M (\$/MW)	\$	87,600	87,600	87,600	87,600	87,600	87,600	87,600	87,600	87,600	87,600									
	Lump sum (\$)	\$	62,888	64,458	66,028	67,599	69,169	70,740	72,311	73,882	75,453	77,024							Levelized Cost	\$0.30 \$/kWh	
	PV	MW		0.32	0.36	0.40	0.44	0.49	0.52	0.55	0.57	0.59	0.61								
		aMW		0.04	0.04	0.05	0.05	0.06	0.06	0.07	0.07	0.07	0.07						Capacity Factor	12%	
		Inst costs (\$/kW)	\$	6,700	6,700	6,700	6,700	6,700	6,700	6,700	6,700	6,700	6,700								
		O&M (\$/MW)	\$	16,800	16,800	16,800	16,800	16,800	16,800	16,800	16,800	16,800	16,800								
		Lump sum (\$)	\$	319,554	320,270	320,987	321,703	322,419	323,135	323,851	324,567	325,283	326,000							Levelized Cost	\$0.97 \$/kWh
Biomass	Industrial	MW		6.59	7.47	8.36	9.25	10.13	10.89	11.53	11.91	12.29	12.67								
		aMW		5.27	5.98	6.69	7.40	8.11	8.71	9.22	9.52	9.83	10.13						Capacity Factor	80%	
		Inst costs (\$/kW)	\$	1,600	1,600	1,600	1,600	1,600	1,600	1,600	1,600	1,600	1,600								
		O&M (\$/MW)	\$	111,600	111,600	111,600	111,600	111,600	111,600	111,600	111,600	111,600	111,600								
		Lump sum (\$)	\$	2,295,332	2,394,273	2,493,213	2,592,153	2,691,093	2,789,993	2,888,893	2,987,793	3,086,693	3,185,593							Levelized Cost	\$0.04 \$/kWh
	Anaerobic Digester	MW		3.94	4.47	5.00	5.53	6.06	6.51	6.89	7.12	7.34	7.57								
		aMW		3.15	3.57	4.00	4.42	4.85	5.21	5.51	5.69	5.88	6.06						Capacity Factor	80%	
		Inst costs (\$/kW)	\$	3,906	3,906	3,906	3,906	3,906	3,906	3,906	3,906	3,906	3,906								
		O&M (\$/MW)	\$	96,013	96,013	96,013	96,013	96,013	96,013	96,013	96,013	96,013	96,013								
		Lump sum (\$)	\$	2,655,332	2,706,223	2,757,115	2,808,006	2,858,897	2,909,788	2,960,679	3,011,570	3,062,461	3,113,352							Levelized Cost	\$0.10 \$/kWh

NOTE: Red indicates levelized cost is less than cost of generic resource; all admin. costs are 10%.

**Distributed Generation Low Growth Economic Market Potential and Cost**

	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
MW	0.1	0.4	0.9	1.9	3.9	6.6	9.4	12.1	14.8	17.5
aMW	0.1	0.3	0.8	1.7	3.4	5.8	8.2	10.6	12.9	15.3
Total Cost	\$ 208,403	\$ 453,124	\$ 1,076,830	\$ 2,058,121	\$ 3,982,083	\$ 5,810,828	\$ 6,557,190	\$ 7,328,895	\$ 8,111,168	\$ 8,864,819
Fuel (\$/MMBTU)	\$ 7.87	\$ 7.59	\$ 7.36	\$ 7.00	\$ 6.10	\$ 6.01	\$ 5.94	\$ 5.97	\$ 6.01	\$ 5.98

	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027
MW	20.3	23.0	25.7	28.5	31.2	33.5	35.5	36.7	37.8	39.0
aMW	17.7	20.1	22.5	24.9	27.2	29.3	31.0	32.0	33.0	34.0
Total Cost	\$ 9,654,558	\$ 10,575,508	\$ 11,547,284	\$ 12,440,173	\$ 13,346,974	\$ 13,615,844	\$ 13,787,784	\$ 13,209,488	\$ 13,804,707	\$ 14,513,688
Fuel (\$/MMBTU)	\$ 6.03	\$ 6.25	\$ 6.50	\$ 6.60	\$ 6.70	\$ 6.81	\$ 6.93	\$ 7.04	\$ 7.17	\$ 7.30

**Table E-19. Distributed Generation + Emerging Technologies Low Growth Scenario: CHP (Natural Gas)**

CHP (Natural gas)	% Penetration (by MW)			Ind		2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
	Res	Com	63%			32%									
Recip Engine		5%		63%	32%										
	MW					0.07	0.20	0.51	1.08	2.20	3.74	5.28	6.82	8.36	9.90
	aMW					0.06	0.18	0.46	0.97	1.98	3.37	4.75	6.14	7.53	8.91
	Inst costs (\$/kW)					\$ 1,087	\$ 1,087	\$ 1,087	\$ 1,087	\$ 1,087	\$ 1,087	\$ 1,087	\$ 1,087	\$ 1,087	\$ 1,087
	O&M (\$/MW)					\$ 101,345	\$ 101,345	\$ 101,345	\$ 101,345	\$ 101,345	\$ 101,345	\$ 101,345	\$ 101,345	\$ 101,345	\$ 101,345
	Fuel (\$/kW)					\$ 312	\$ 301	\$ 292	\$ 277	\$ 242	\$ 238	\$ 235	\$ 236	\$ 238	\$ 237
Lump sum (\$)					\$ 106,248	\$ 237,545	\$ 567,395	\$ 1,092,591	\$ 2,097,499	\$ 3,113,148	\$ 3,620,269	\$ 4,146,790	\$ 4,681,398	\$ 5,194,099	
Microturbine		5%		63%	32%										
	MW					0.01	0.04	0.10	0.21	0.43	0.74	1.04	1.34	1.64	1.95
	aMW					0.01	0.04	0.09	0.20	0.41	0.70	0.99	1.27	1.56	1.85
	Inst costs (\$/kW)					\$ 1,634	\$ 1,634	\$ 1,634	\$ 1,634	\$ 1,634	\$ 1,634	\$ 1,634	\$ 1,634	\$ 1,634	\$ 1,634
	O&M (\$/MW)					\$ 108,135	\$ 108,135	\$ 108,135	\$ 108,135	\$ 108,135	\$ 108,135	\$ 108,135	\$ 108,135	\$ 108,135	\$ 108,135
	Fuel (\$/kW)					\$ 487	\$ 469	\$ 455	\$ 432	\$ 377	\$ 372	\$ 367	\$ 369	\$ 371	\$ 370
Lump sum (\$)					\$ 31,043	\$ 69,114	\$ 164,857	\$ 316,714	\$ 606,416	\$ 897,049	\$ 1,037,349	\$ 1,183,594	\$ 1,332,318	\$ 1,474,328	
Fuel Cell		5%		63%	32%										
	MW					0.01	0.02	0.05	0.10	0.21	0.35	0.50	0.64	0.79	0.93
	aMW					0.01	0.02	0.05	0.10	0.20	0.33	0.47	0.61	0.75	0.89
	Inst costs (\$/kW)					\$ 5,314	\$ 5,314	\$ 5,314	\$ 5,314	\$ 5,314	\$ 5,314	\$ 5,314	\$ 5,314	\$ 5,314	\$ 5,314
	O&M (\$/MW)					\$ 14,403	\$ 14,403	\$ 14,403	\$ 14,403	\$ 14,403	\$ 14,403	\$ 14,403	\$ 14,403	\$ 14,403	\$ 14,403
	Fuel (\$/kW)					\$ 380	\$ 366	\$ 355	\$ 338	\$ 295	\$ 290	\$ 287	\$ 288	\$ 290	\$ 289
Lump sum (\$)					\$ 38,798	\$ 79,792	\$ 187,234	\$ 350,758	\$ 681,909	\$ 955,422	\$ 997,774	\$ 1,042,351	\$ 1,087,855	\$ 1,130,847	

CHP (Natural gas)		2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	Levelized Cost		
Recip Engine	MW	11.44	12.98	14.52	16.06	17.61	18.93	20.03	20.69	21.35	22.01		Gen SS Resource	\$0.09 \$/kWh
	aMW	10.30	11.69	13.07	14.46	15.84	17.03	18.02	18.62	19.21	19.81		Capacity Factor	90%
	Inst costs (\$/kW)	\$ 1,087	\$ 1,087	\$ 1,087	\$ 1,087	\$ 1,087	\$ 1,087	\$ 1,087	\$ 1,087	\$ 1,087	\$ 1,087			
	O&M (\$/MW)	\$ 101,345	\$ 101,345	\$ 101,345	\$ 101,345	\$ 101,345	\$ 101,345	\$ 101,345	\$ 101,345	\$ 101,345	\$ 101,345			
	Fuel (\$/kW)	\$ 239	\$ 248	\$ 258	\$ 262	\$ 266	\$ 270	\$ 274	\$ 279	\$ 284	\$ 289			
	Lump sum (\$)	\$ 5,734,423	\$ 6,375,180	\$ 7,054,841	\$ 7,674,120	\$ 8,304,047	\$ 8,605,394	\$ 8,841,715	\$ 8,660,757	\$ 9,017,436	\$ 9,383,819		Levelized Cost	\$0.07 \$/kWh
Microturbine	MW	2.25	2.55	2.85	3.16	3.46	3.72	3.94	4.07	4.20	4.32			
	aMW	2.14	2.42	2.71	3.00	3.29	3.53	3.74	3.86	3.99	4.11		Capacity Factor	95%
	Inst costs (\$/kW)	\$ 1,053	\$ 1,053	\$ 1,053	\$ 1,053	\$ 1,053	\$ 1,053	\$ 1,053	\$ 1,053	\$ 1,053	\$ 1,053			
	O&M (\$/MW)	\$ 108,135	\$ 108,135	\$ 108,135	\$ 108,135	\$ 108,135	\$ 108,135	\$ 108,135	\$ 108,135	\$ 108,135	\$ 108,135			
	Fuel (\$/kW)	\$ 372	\$ 386	\$ 402	\$ 408	\$ 414	\$ 421	\$ 428	\$ 435	\$ 443	\$ 451			
	Lump sum (\$)	\$ 1,431,063	\$ 1,612,316	\$ 1,805,490	\$ 1,980,160	\$ 2,158,094	\$ 2,283,091	\$ 2,390,320	\$ 2,429,605	\$ 2,592,530	\$ 2,823,532		Levelized Cost	\$0.09 \$/kWh
Fuel Cell	MW	1.08	1.22	1.37	1.51	1.66	1.78	1.89	1.95	2.01	2.07			
	aMW	1.02	1.16	1.30	1.44	1.58	1.69	1.79	1.85	1.91	1.97		Capacity Factor	95%
	Inst costs (\$/kW)	\$ 3,423	\$ 3,423	\$ 3,423	\$ 3,423	\$ 3,423	\$ 3,423	\$ 3,423	\$ 3,423	\$ 3,423	\$ 3,423			
	O&M (\$/MW)	\$ 14,403	\$ 14,403	\$ 14,403	\$ 14,403	\$ 14,403	\$ 14,403	\$ 14,403	\$ 14,403	\$ 14,403	\$ 14,403			
	Fuel (\$/kW)	\$ 291	\$ 302	\$ 314	\$ 319	\$ 324	\$ 329	\$ 334	\$ 340	\$ 346	\$ 352			
	Lump sum (\$)	\$ 898,552	\$ 979,641	\$ 1,104,207	\$ 1,253,059	\$ 1,504,570	\$ 1,625,994	\$ 1,593,963	\$ 1,470,748	\$ 1,504,882	\$ 1,540,129		Levelized Cost	\$0.15 \$/kWh

NOTE: Red indicates levelized cost is less than cost of generic resource; all admin. costs are 10%.

**Table E-20. Distributed Generation + Emerging Technologies Low Growth Scenario: Renewables**

Renewable	% Penetration (by MW)				2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	
	Res	Com	Ind												
Small Wind	30%	70%	0%	MW	0.00	0.00	0.01	0.01	0.03	0.04	0.06	0.08	0.10	0.12	
				aMW	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.01	0.01	0.02	
				Inst costs (\$/kW)	\$ 2,598	\$ 2,598	\$ 2,598	\$ 2,598	\$ 2,598	\$ 2,598	\$ 2,598	\$ 2,598	\$ 2,598	\$ 2,598	
				O&M (\$/MW)	\$ 87,600	\$ 87,600	\$ 87,600	\$ 87,600	\$ 87,600	\$ 87,600	\$ 87,600	\$ 87,600	\$ 87,600	\$ 87,600	
				Lump sum (\$)	\$ 2,263	\$ 4,592	\$ 10,760	\$ 20,124	\$ 39,562	\$ 55,036	\$ 56,606	\$ 58,176	\$ 59,747	\$ 61,317	
PV	50%	50%	0%	MW	0.00	0.01	0.01	0.03	0.06	0.10	0.15	0.19	0.23	0.27	
				aMW	0.00	0.00	0.00	0.00	0.01	0.01	0.02	0.02	0.03	0.03	
				Inst costs (\$/kW)	\$ 6,700	\$ 6,700	\$ 6,700	\$ 6,700	\$ 6,700	\$ 6,700	\$ 6,700	\$ 6,700	\$ 6,700	\$ 6,700	
				O&M (\$/MW)	\$ 16,800	\$ 16,800	\$ 16,800	\$ 16,800	\$ 16,800	\$ 16,800	\$ 16,800	\$ 16,800	\$ 16,800	\$ 16,800	
				Lump sum (\$)	\$ 13,498	\$ 27,026	\$ 63,082	\$ 117,217	\$ 229,964	\$ 315,973	\$ 316,689	\$ 317,405	\$ 318,121	\$ 318,838	
Biomass	Industrial	0%	0%	100%	MW	0.04	0.11	0.29	0.62	1.27	2.15	3.04	3.93	4.81	5.70
					aMW	0.03	0.09	0.23	0.50	1.01	1.72	2.43	3.14	3.85	4.56
					Inst costs (\$/kW)	\$ 1,600	\$ 1,600	\$ 1,600	\$ 1,600	\$ 1,600	\$ 1,600	\$ 1,600	\$ 1,600	\$ 1,600	\$ 1,600
					O&M (\$/MW)	\$ 111,600	\$ 111,600	\$ 111,600	\$ 111,600	\$ 111,600	\$ 111,600	\$ 111,600	\$ 111,600	\$ 111,600	
					Lump sum (\$)	\$ 71,112	\$ 146,465	\$ 344,578	\$ 648,816	\$ 1,278,168	\$ 1,800,631	\$ 1,899,571	\$ 1,998,512	\$ 2,097,452	\$ 2,196,392
Anaerobic Digester	0%	100%	0%	MW	0.02	0.07	0.17	0.37	0.76	1.29	1.82	2.35	2.88	3.41	
				aMW	0.02	0.05	0.14	0.30	0.61	1.03	1.45	1.89	2.30	2.73	
				Inst costs (\$/kW)	\$ 3,906	\$ 3,906	\$ 3,906	\$ 3,906	\$ 3,906	\$ 3,906	\$ 3,906	\$ 3,906	\$ 3,906	\$ 3,906	
				O&M (\$/MW)	\$ 96,013	\$ 96,013	\$ 96,013	\$ 96,013	\$ 96,013	\$ 96,013	\$ 96,013	\$ 96,013	\$ 96,013		
				Lump sum (\$)	\$ 99,779	\$ 201,739	\$ 472,178	\$ 881,471	\$ 1,731,864	\$ 2,400,875	\$ 2,451,766	\$ 2,502,658	\$ 2,553,549	\$ 2,604,441	

Renewable					2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	Levelized Cost		
Small Wind	MW	0.13	0.15	0.17	0.19	0.20	0.22	0.23	0.24	0.25	0.26	0.26	0.26	0.26			
	aMW	0.02	0.03	0.03	0.03	0.04	0.04	0.04	0.05	0.05	0.05	0.05	0.05	0.05	Capacity Factor	15%	
	Inst costs (\$/kW)	\$ 2,598	\$ 2,598	\$ 2,598	\$ 2,598	\$ 2,598	\$ 2,598	\$ 2,598	\$ 2,598	\$ 2,598	\$ 2,598	\$ 2,598	\$ 2,598	\$ 2,598	CF after Year 10	23%	
	O&M (\$/MW)	\$ 87,600	\$ 87,600	\$ 87,600	\$ 87,600	\$ 87,600	\$ 87,600	\$ 87,600	\$ 87,600	\$ 87,600	\$ 87,600	\$ 87,600	\$ 87,600	\$ 87,600			
	Lump sum (\$)	\$ 62,888	\$ 64,458	\$ 66,028	\$ 67,599	\$ 69,169	\$ 70,740	\$ 72,311	\$ 73,882	\$ 75,453	\$ 77,024	\$ 78,595	\$ 80,166	\$ 81,737	Levelized Cost	\$0.30	\$/kWh
PV	MW	0.32	0.36	0.40	0.44	0.49	0.52	0.55	0.57	0.59	0.61	0.61	0.61	0.61			
	aMW	0.04	0.04	0.05	0.05	0.06	0.06	0.07	0.07	0.07	0.07	0.07	0.07	0.07	Capacity Factor	12%	
	Inst costs (\$/kW)	\$ 4,315	\$ 4,315	\$ 4,315	\$ 4,315	\$ 4,315	\$ 4,315	\$ 4,315	\$ 4,315	\$ 4,315	\$ 4,315	\$ 4,315	\$ 4,315	\$ 4,315			
	O&M (\$/MW)	\$ 16,800	\$ 16,800	\$ 16,800	\$ 16,800	\$ 16,800	\$ 16,800	\$ 16,800	\$ 16,800	\$ 16,800	\$ 16,800	\$ 16,800	\$ 16,800	\$ 16,800			
	Lump sum (\$)	\$ 207,705	\$ 208,421	\$ 209,137	\$ 209,854	\$ 210,570	\$ 211,286	\$ 212,002	\$ 212,718	\$ 213,434	\$ 214,150	\$ 214,866	\$ 215,582	\$ 216,298	Levelized Cost	\$0.79	\$/kWh
Biomass	Industrial	MW	6.59	7.47	8.36	9.25	10.13	10.89	11.53	11.91	12.29	12.67	13.05	13.43	13.81		
		aMW	5.27	5.98	6.69	7.40	8.11	8.71	9.22	9.52	9.83	10.13	10.43	10.73	11.03	Capacity Factor	80%
		Inst costs (\$/kW)	\$ 1,600	\$ 1,600	\$ 1,600	\$ 1,600	\$ 1,600	\$ 1,600	\$ 1,600	\$ 1,600	\$ 1,600	\$ 1,600	\$ 1,600	\$ 1,600	\$ 1,600		
		O&M (\$/MW)	\$ 111,600	\$ 111,600	\$ 111,600	\$ 111,600	\$ 111,600	\$ 111,600	\$ 111,600	\$ 111,600	\$ 111,600	\$ 111,600	\$ 111,600	\$ 111,600	\$ 111,600		
		Lump sum (\$)	\$ 2,295,332	\$ 2,394,273	\$ 2,493,213	\$ 2,592,153	\$ 2,691,093	\$ 2,789,992	\$ 2,888,892	\$ 2,987,792	\$ 3,086,692	\$ 3,185,592	\$ 3,284,492	\$ 3,383,392	\$ 3,482,292	Levelized Cost	\$0.04
Anaerobic Digester	MW	3.94	4.47	5.00	5.53	6.06	6.51	6.89	7.12	7.34	7.57	7.79	8.01	8.23			
	aMW	3.15	3.57	4.00	4.42	4.85	5.21	5.51	5.69	5.88	6.06	6.25	6.43	6.61	Capacity Factor	80%	
	Inst costs (\$/kW)	\$ 3,354	\$ 3,354	\$ 3,354	\$ 3,354	\$ 3,354	\$ 3,354	\$ 3,354	\$ 3,354	\$ 3,354	\$ 3,354	\$ 3,354	\$ 3,354	\$ 3,354			
	O&M (\$/MW)	\$ 96,013	\$ 96,013	\$ 96,013	\$ 96,013	\$ 96,013	\$ 96,013	\$ 96,013	\$ 96,013	\$ 96,013	\$ 96,013	\$ 96,013	\$ 96,013	\$ 96,013			
	Lump sum (\$)	\$ 2,333,647	\$ 2,384,539	\$ 2,435,430	\$ 2,486,321	\$ 2,537,213	\$ 2,588,104	\$ 2,638,995	\$ 2,689,886	\$ 2,740,777	\$ 2,791,668	\$ 2,842,559	\$ 2,893,450	\$ 2,944,341	Levelized Cost	\$0.09	\$/kWh

NOTE: Red indicates levelized cost is less than cost of generic resource; all admin. costs are 10%.

**Distributed Generation + Emerging Technologies Low Growth Economic Market Potential and Cost**

	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
MW	0.1	0.4	1.1	2.3	4.7	7.9	11.2	14.4	17.7	21.0
aMW	0.1	0.4	0.9	2.0	4.0	6.8	9.6	12.4	15.2	18.0
Total Cost	\$ 308,182	\$ 654,863	\$ 1,549,008	\$ 2,939,592	\$ 5,713,948	\$ 8,211,703	\$ 9,008,956	\$ 9,831,553	\$ 10,664,717	\$ 11,469,260
Fuel (\$/MMBTU)	\$ 7.87	\$ 7.59	\$ 7.36	\$ 7.00	\$ 6.10	\$ 6.01	\$ 5.94	\$ 5.97	\$ 6.01	\$ 5.98

	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027
MW	24.2	27.5	30.7	34.0	37.3	40.0	42.4	43.8	45.2	46.6
aMW	20.9	23.7	26.5	29.3	32.1	34.5	36.5	37.7	38.9	40.1
Total Cost	\$ 11,794,466	\$ 12,766,307	\$ 13,788,974	\$ 14,732,755	\$ 15,690,447	\$ 15,826,752	\$ 15,858,858	\$ 15,000,339	\$ 15,919,402	\$ 17,279,428
Fuel (\$/MMBTU)	\$ 6.03	\$ 6.25	\$ 6.50	\$ 6.60	\$ 6.70	\$ 6.81	\$ 6.93	\$ 7.04	\$ 7.17	\$ 7.30

## Appendix F: Other Data

---

**Table F-1. Residential Electric: Sales Forecast (MWh)**

Year	Island	Jefferson	King	Kitsap	Kittitas	Pierce	Skagit	Thurston	Whatcom	Total
2007	361,790	207,614	4,955,160	1,337,557	116,127	1,194,076	523,011	1,238,838	808,729	10,742,901
2008	361,587	212,169	4,972,105	1,329,392	118,693	1,213,752	521,716	1,241,452	808,332	10,779,199
2009	364,579	219,604	5,028,433	1,335,697	122,307	1,247,612	524,666	1,251,468	814,392	10,908,758
2010	367,566	228,257	5,048,638	1,342,287	126,499	1,269,741	528,749	1,268,982	824,124	11,004,842
2011	375,221	236,264	5,079,305	1,375,888	131,078	1,287,413	536,487	1,294,647	838,566	11,154,867
2012	383,416	242,918	5,104,852	1,414,970	135,539	1,311,924	544,926	1,332,012	853,741	11,324,298
2013	391,910	249,967	5,155,822	1,452,605	139,252	1,340,557	555,111	1,369,868	870,861	11,525,953
2014	400,300	257,135	5,230,961	1,489,629	142,514	1,370,177	565,760	1,405,502	889,158	11,751,136
2015	408,373	263,352	5,311,631	1,529,289	145,819	1,395,992	573,552	1,439,865	904,129	11,972,002
2016	416,694	268,899	5,394,033	1,570,689	149,301	1,421,463	579,898	1,476,546	916,075	12,193,598
2017	424,839	274,579	5,481,710	1,610,539	151,647	1,448,874	586,849	1,513,707	928,549	12,421,292
2018	432,443	280,225	5,569,323	1,647,819	152,556	1,476,572	593,857	1,547,281	941,118	12,641,195
2019	439,796	285,743	5,655,006	1,684,756	153,299	1,503,908	600,463	1,579,044	953,240	12,855,256
2020	447,852	291,751	5,748,090	1,725,116	154,319	1,533,609	607,866	1,614,148	966,745	13,089,495
2021	455,732	297,660	5,837,183	1,765,595	155,318	1,562,183	614,826	1,649,094	979,758	13,317,349
2022	463,530	302,753	5,937,066	1,795,807	157,975	1,588,915	625,346	1,677,312	996,524	13,545,230
2023	471,553	307,993	6,039,821	1,826,888	160,709	1,616,415	636,169	1,706,342	1,013,771	13,779,661
2024	479,780	313,367	6,145,191	1,858,759	163,513	1,644,614	647,268	1,736,110	1,031,457	14,020,059
2025	488,289	318,924	6,254,182	1,891,726	166,413	1,673,783	658,748	1,766,902	1,049,751	14,268,719
2026	496,973	324,596	6,365,411	1,925,370	169,373	1,703,551	670,463	1,798,326	1,068,420	14,522,484
2027	505,741	330,323	6,477,710	1,959,338	172,361	1,733,605	682,292	1,830,052	1,087,269	14,778,690

**Table F-2. Residential Electric: Housing Type Allocation**

Year	County	Multi_Family	Manufactured	Single_Family
2007	Island	0.108765443	0.111785764	0.779448793
2008	Island	0.108151076	0.110293164	0.78155576
2009	Island	0.107536709	0.108800564	0.783662728
2010	Island	0.106922342	0.107307963	0.785769695
2011	Island	0.106307975	0.105815363	0.787876662
2012	Island	0.105693608	0.104322763	0.789983629
2013	Island	0.105079241	0.102830162	0.792090596
2014	Island	0.104464874	0.101337562	0.794197564
2015	Island	0.103850508	0.099844961	0.796304531
2016	Island	0.103236141	0.098352361	0.798411498
2017	Island	0.102621774	0.096859761	0.800518465
2018	Island	0.102007407	0.09536716	0.802625433
2019	Island	0.10139304	0.09387456	0.8047324
2020	Island	0.100778673	0.09238196	0.806839367
2021	Island	0.100164306	0.090889359	0.808946334
2022	Island	0.09954994	0.089396759	0.811053302
2023	Island	0.098935573	0.087904159	0.813160269
2024	Island	0.098321206	0.086411558	0.815267236
2025	Island	0.097706839	0.084918958	0.817374203
2026	Island	0.097096311	0.083452139	0.819486616
2027	Island	0.096489598	0.082010658	0.821604487
2007	Jefferson	0.074661914	0.179485281	0.745852806
2008	Jefferson	0.074438662	0.177708559	0.74785278
2009	Jefferson	0.07421541	0.175931836	0.749852754
2010	Jefferson	0.073992158	0.174155114	0.751852728
2011	Jefferson	0.073768906	0.172378392	0.753852702
2012	Jefferson	0.073545654	0.17060167	0.755852676
2013	Jefferson	0.073322402	0.168824948	0.75785265
2014	Jefferson	0.07309915	0.167048225	0.759852624
2015	Jefferson	0.072875898	0.165271503	0.761852599
2016	Jefferson	0.072652646	0.163494781	0.763852573
2017	Jefferson	0.072429394	0.161718059	0.765852547
2018	Jefferson	0.072206142	0.159941337	0.767852521
2019	Jefferson	0.07198289	0.158164614	0.769852495
2020	Jefferson	0.071759639	0.156387892	0.771852469
2021	Jefferson	0.071536387	0.15461117	0.773852443
2022	Jefferson	0.071313135	0.152834448	0.775852417
2023	Jefferson	0.071089883	0.151057726	0.777852392
2024	Jefferson	0.070866631	0.149281004	0.779852366
2025	Jefferson	0.070643379	0.147504281	0.78185234
2026	Jefferson	0.07042083	0.145748705	0.783857443
2027	Jefferson	0.070198983	0.144014024	0.785867688
2007	King	0.317806712	0.038269385	0.643923903
2008	King	0.319520124	0.037886344	0.642593532
2009	King	0.321233537	0.037503303	0.64126316
2010	King	0.322946949	0.037120262	0.639932789
2011	King	0.324660362	0.036737221	0.638602418
2012	King	0.326373774	0.03635418	0.637272046
2013	King	0.328087186	0.035971139	0.635941675



Year	County	Multi_Family	Manufactured	Single_Family
2014	King	0.329800599	0.035588097	0.634611304
2015	King	0.331514011	0.035205056	0.633280932
2016	King	0.333227424	0.034822015	0.631950561
2017	King	0.334940836	0.034438974	0.63062019
2018	King	0.336654248	0.034055933	0.629289818
2019	King	0.338367661	0.033672892	0.627959447
2020	King	0.340081073	0.033289851	0.626629076
2021	King	0.341794486	0.03290681	0.625298704
2022	King	0.343507898	0.032523769	0.623968333
2023	King	0.34522131	0.032140728	0.622637962
2024	King	0.346934723	0.031757687	0.621307591
2025	King	0.348648135	0.031374646	0.619977219
2026	King	0.35037001	0.030996224	0.618649697
2027	King	0.352100388	0.030622368	0.617325016
2007	Kitsap	0.188934162	0.105278847	0.705786991
2008	Kitsap	0.18882082	0.105030947	0.706148233
2009	Kitsap	0.188707477	0.104783047	0.706509475
2010	Kitsap	0.188594135	0.104535148	0.706870718
2011	Kitsap	0.188480792	0.104287248	0.70723196
2012	Kitsap	0.188367449	0.104039348	0.707593203
2013	Kitsap	0.188254107	0.103791448	0.707954445
2014	Kitsap	0.188140764	0.103543549	0.708315687
2015	Kitsap	0.188027421	0.103295649	0.70867693
2016	Kitsap	0.187914079	0.103047749	0.709038172
2017	Kitsap	0.187800736	0.102799849	0.709399415
2018	Kitsap	0.187687394	0.10255195	0.709760657
2019	Kitsap	0.187574051	0.10230405	0.710121899
2020	Kitsap	0.187460708	0.10205615	0.710483142
2021	Kitsap	0.187347366	0.10180825	0.710844384
2022	Kitsap	0.187234023	0.10156035	0.711205626
2023	Kitsap	0.187120681	0.101312451	0.711566869
2024	Kitsap	0.187007338	0.101064551	0.711928111
2025	Kitsap	0.186893995	0.100816651	0.712289354
2026	Kitsap	0.186780721	0.100569359	0.712650779
2027	Kitsap	0.186667516	0.100322674	0.713012388
2007	Kittitas	0.055613926	0.205505592	0.738880482
2008	Kittitas	0.055805529	0.206328364	0.737866107
2009	Kittitas	0.055997132	0.207151136	0.736851732
2010	Kittitas	0.056188735	0.207973908	0.735837357
2011	Kittitas	0.056380339	0.20879668	0.734822982
2012	Kittitas	0.056571942	0.209619452	0.733808607
2013	Kittitas	0.056763545	0.210442224	0.732794232
2014	Kittitas	0.056955148	0.211264996	0.731779856
2015	Kittitas	0.057146751	0.212087768	0.730765481
2016	Kittitas	0.057338354	0.212910539	0.729751106
2017	Kittitas	0.057529958	0.213733311	0.728736731
2018	Kittitas	0.057721561	0.214556083	0.727722356
2019	Kittitas	0.057913164	0.215378855	0.726707981
2020	Kittitas	0.058104767	0.216201627	0.725693605
2021	Kittitas	0.05829637	0.217024399	0.72467923
2022	Kittitas	0.058487973	0.217847171	0.723664855

Year	County	Multi_Family	Manufactured	Single_Family
2023	Kittitas	0.058679577	0.218669943	0.72265048
2024	Kittitas	0.05887118	0.219492715	0.721636105
2025	Kittitas	0.059062783	0.220315487	0.72062173
2026	Kittitas	0.05925501	0.221141344	0.71960878
2027	Kittitas	0.059447862	0.221970295	0.718597255
2007	Pierce	0.172345989	0.116429175	0.711224836
2008	Pierce	0.16972604	0.116029065	0.714244896
2009	Pierce	0.16710609	0.115628954	0.717264956
2010	Pierce	0.164486141	0.115228843	0.720285015
2011	Pierce	0.161866192	0.114828733	0.723305075
2012	Pierce	0.159246243	0.114428622	0.726325135
2013	Pierce	0.156626294	0.114028512	0.729345195
2014	Pierce	0.154006344	0.113628401	0.732365254
2015	Pierce	0.151386395	0.113228291	0.735385314
2016	Pierce	0.148766446	0.11282818	0.738405374
2017	Pierce	0.146146497	0.112428069	0.741425434
2018	Pierce	0.143526548	0.112027959	0.744445493
2019	Pierce	0.140906598	0.111627848	0.747465553
2020	Pierce	0.138286649	0.111227738	0.750485613
2021	Pierce	0.1356667	0.110827627	0.753505673
2022	Pierce	0.133046751	0.110427517	0.756525733
2023	Pierce	0.130426802	0.110027406	0.759545792
2024	Pierce	0.127806853	0.109627295	0.762565852
2025	Pierce	0.125186903	0.109227185	0.765585912
2026	Pierce	0.122620661	0.108828535	0.768617932
2027	Pierce	0.120107025	0.108431339	0.771661961
2007	Skagit	0.158953321	0.132543092	0.708503587
2008	Skagit	0.160140236	0.133170256	0.706689508
2009	Skagit	0.161327152	0.133797419	0.704875429
2010	Skagit	0.162514067	0.134424582	0.70306135
2011	Skagit	0.163700983	0.135051746	0.701247271
2012	Skagit	0.164887899	0.135678909	0.699433193
2013	Skagit	0.166074814	0.136306072	0.697619114
2014	Skagit	0.16726173	0.136933235	0.695805035
2015	Skagit	0.168448645	0.137560399	0.693990956
2016	Skagit	0.169635561	0.138187562	0.692176877
2017	Skagit	0.170822476	0.138814725	0.690362798
2018	Skagit	0.172009392	0.139441889	0.68854872
2019	Skagit	0.173196307	0.140069052	0.686734641
2020	Skagit	0.174383223	0.140696215	0.684920562
2021	Skagit	0.175570138	0.141323379	0.683106483
2022	Skagit	0.176757054	0.141950542	0.681292404
2023	Skagit	0.17794397	0.142577705	0.679478325
2024	Skagit	0.179130885	0.143204868	0.677664246
2025	Skagit	0.180317801	0.143832032	0.675850168
2026	Skagit	0.181512581	0.144461942	0.674040945
2027	Skagit	0.182715277	0.14509461	0.672236566
2007	Thurston	0.192496214	0.131222859	0.676280927
2008	Thurston	0.192226823	0.129714718	0.678058458
2009	Thurston	0.191957433	0.128206578	0.67983599
2010	Thurston	0.191688042	0.126698437	0.681613521

Year	County	Multi_Family	Manufactured	Single_Family
2011	Thurston	0.191418652	0.125190296	0.683391053
2012	Thurston	0.191149261	0.123682155	0.685168584
2013	Thurston	0.19087987	0.122174014	0.686946116
2014	Thurston	0.19061048	0.120665873	0.688723647
2015	Thurston	0.190341089	0.119157732	0.690501179
2016	Thurston	0.190071698	0.117649591	0.69227871
2017	Thurston	0.189802308	0.11614145	0.694056242
2018	Thurston	0.189532917	0.114633309	0.695833774
2019	Thurston	0.189263527	0.113125168	0.697611305
2020	Thurston	0.188994136	0.111617027	0.699388837
2021	Thurston	0.188724745	0.110108887	0.701166368
2022	Thurston	0.188455355	0.108600746	0.7029439
2023	Thurston	0.188185964	0.107092605	0.704721431
2024	Thurston	0.187916573	0.105584464	0.706498963
2025	Thurston	0.187647183	0.104076323	0.708276494
2026	Thurston	0.187378178	0.102589724	0.710058498
2027	Thurston	0.18710956	0.101124359	0.711844985
2007	Whatcom	0.248544376	0.129586595	0.621869029
2008	Whatcom	0.251691307	0.129909522	0.618399171
2009	Whatcom	0.254838238	0.130232449	0.614929313
2010	Whatcom	0.257985168	0.130555376	0.611459455
2011	Whatcom	0.261132099	0.130878303	0.607989597
2012	Whatcom	0.26427903	0.131201231	0.60451974
2013	Whatcom	0.26742596	0.131524158	0.601049882
2014	Whatcom	0.270572891	0.131847085	0.597580024
2015	Whatcom	0.273719822	0.132170012	0.594110166
2016	Whatcom	0.276866752	0.132492939	0.590640309
2017	Whatcom	0.280013683	0.132815866	0.587170451
2018	Whatcom	0.283160614	0.133138793	0.583700593
2019	Whatcom	0.286307545	0.13346172	0.580230735
2020	Whatcom	0.289454475	0.133784647	0.576760877
2021	Whatcom	0.292601406	0.134107574	0.57329102
2022	Whatcom	0.295748337	0.134430502	0.569821162
2023	Whatcom	0.298895267	0.134753429	0.566351304
2024	Whatcom	0.302042198	0.135076356	0.562881446
2025	Whatcom	0.305189129	0.135399283	0.559411589
2026	Whatcom	0.308368847	0.135722982	0.555963121
2027	Whatcom	0.311581694	0.136047455	0.55253591

**Table F-3. Residential Electric: Customer Count Forecast**

Year	Island	Jefferson	King	Kitsap	Kittitas	Pierce	Skagit	Thurston	Whatcom	Total
2007	30,080	15,669	447,701	102,153	9,424	93,560	47,473	100,462	81,771	928,292
2008	30,572	16,283	456,860	103,248	9,796	96,715	48,159	102,380	83,118	947,132
2009	31,058	16,981	465,549	104,522	10,171	100,168	48,800	103,987	84,377	965,613
2010	31,636	17,833	472,274	106,125	10,628	103,002	49,690	106,535	86,272	983,996
2011	32,471	18,558	477,749	109,375	11,073	105,008	50,693	109,283	88,264	1,002,474
2012	33,315	19,159	482,141	112,943	11,494	107,449	51,703	112,900	90,233	1,021,337
2013	34,110	19,748	487,790	116,141	11,825	109,981	52,759	116,304	92,199	1,040,858
2014	34,843	20,315	494,975	119,113	12,103	112,427	53,779	119,343	94,151	1,061,050
2015	35,582	20,828	503,176	122,413	12,397	114,673	54,581	122,391	95,843	1,081,883
2016	36,352	21,293	511,743	125,892	12,711	116,934	55,264	125,678	97,251	1,103,117
2017	37,096	21,761	520,535	129,201	12,914	119,297	55,977	128,957	98,664	1,124,401
2018	37,810	22,239	529,567	132,368	13,009	121,741	56,721	131,994	100,134	1,145,583
2019	38,518	22,715	538,624	135,564	13,094	124,205	57,449	134,931	101,595	1,166,694
2020	39,226	23,194	547,536	138,822	13,183	126,668	58,162	137,941	103,043	1,187,776
2021	39,940	23,678	556,346	142,162	13,276	129,103	58,863	141,010	104,491	1,208,867
2022	40,770	24,162	565,226	144,768	13,468	131,725	59,785	143,703	106,653	1,230,259
2023	41,502	24,596	575,370	147,366	13,710	134,089	60,858	146,282	108,567	1,252,339
2024	42,257	25,043	585,835	150,046	13,959	136,528	61,965	148,943	110,542	1,275,117
2025	43,030	25,501	596,547	152,790	14,214	139,024	63,098	151,666	112,563	1,298,433
2026	43,817	25,968	607,464	155,586	14,474	141,568	64,253	154,442	114,623	1,322,194
2027	44,618	26,442	618,566	158,429	14,739	144,156	65,427	157,264	116,718	1,346,360

**Table F-4. Residential Electric: Efficiency Shares**

bName	nName	fName	Stock	Standard	High	Premium	Super_Premium
Manufactured	Central_AC	Electric	0.5	0.4	0.07	0.02	0.01
Manufactured	Cooking	Electric	0.95	0.05			
Manufactured	Cooking	Gas	1				
Manufactured	Freezer	Electric	0.95	0.03	0.02		
Manufactured	Heat_Pump	Electric	0.5	0.4	0.09	0.01	
Manufactured	Lighting	Electric	1				
Manufactured	Other	Electric	1				
Manufactured	Plug_Load	Electric	1				
Manufactured	Refrigeration	Electric	0.6	0.2	0.20		
Manufactured	Room_AC	Electric	0.59	0.34	0.07		
Manufactured	Space_Heat	Electric	1				
Manufactured	Space_Heat	Gas	1				
Manufactured	Water_Heat	Electric	0.1	0.9			
Manufactured	Water_Heat	Gas	1				
Multi_Family	Central_AC	Electric	0.5	0.4	0.07	0.02	0.01
Multi_Family	Cooking	Electric	0.95	0.05			
Multi_Family	Cooking	Gas	1				
Multi_Family	Freezer	Electric	0.95	0.03	0.02		
Multi_Family	Heat_Pump	Electric	0.5	0.4	0.09	0.01	
Multi_Family	Lighting	Electric	1				
Multi_Family	Other	Electric	1				
Multi_Family	Plug_Load	Electric	1				
Multi_Family	Refrigeration	Electric	0.6	0.2	0.20		
Multi_Family	Room_AC	Electric	0.5	0.48	0.02		
Multi_Family	Space_Heat	Electric	1				
Multi_Family	Space_Heat	Gas	1				
Multi_Family	Water_Heat	Electric	0.13	0.87			
Multi_Family	Water_Heat	Gas	1				
Single_Family	Central_AC	Electric	0.5	0.4	0.07	0.02	0.01
Single_Family	Cooking	Electric	0.9	0.1			
Single_Family	Cooking	Gas	1				
Single_Family	Freezer	Electric	0.95	0.03	0.02		
Single_Family	Heat_Pump	Electric	0.5	0.4	0.09	0.01	
Single_Family	Lighting	Electric	1				
Single_Family	Other	Electric	1				
Single_Family	Plug_Load	Electric	1				
Single_Family	Refrigeration	Electric	0.6	0.2	0.20		
Single_Family	Room_AC	Electric	0.59	0.34	0.07		
Single_Family	Space_Heat	Electric	1				
Single_Family	Space_Heat	Gas	1				
Single_Family	Water_Heat	Electric	0.1	0.9			
Single_Family	Water_Heat	Gas	1				
Manufactured	Dryer	Electric	0.65	0.35			
Multi_Family	Dryer	Electric	0.65	0.35			
Single_Family	Dryer	Electric	0.65	0.35			
Manufactured	Dryer	Gas	1				
Multi_Family	Dryer	Gas	1				
Single_Family	Dryer	Gas	1				

**Table F-5. Residential Electric: Price Forecast (\$/kWh)**

<b>Year</b>	<b>Res Price Deflator</b>	<b>Single_Family Average Price</b>	<b>Single_Family Marginal Price</b>	<b>Multi_Family Average Price</b>	<b>Multi_Family Marginal Price</b>	<b>Manufactured Average Price</b>	<b>Manufactured Marginal Price</b>
2007	100.00	0.082077944	0.082077944	0.082077944	0.082077944	0.082077944	0.082077944
2008	102.36	0.084414096	0.084414096	0.084414096	0.084414096	0.084414096	0.084414096
2009	104.88	0.087790591	0.087790591	0.087790591	0.087790591	0.087790591	0.087790591
2010	107.71	0.091554894	0.091554894	0.091554894	0.091554894	0.091554894	0.091554894
2011	110.85	0.093935517	0.093935517	0.093935517	0.093935517	0.093935517	0.093935517
2012	114.08	0.096867362	0.096867362	0.096867362	0.096867362	0.096867362	0.096867362
2013	117.62	0.099707646	0.099707646	0.099707646	0.099707646	0.099707646	0.099707646
2014	121.21	0.102322788	0.102322788	0.102322788	0.102322788	0.102322788	0.102322788
2015	124.71	0.105251369	0.105251369	0.105251369	0.105251369	0.105251369	0.105251369
2016	128.31	0.108591229	0.108591229	0.108591229	0.108591229	0.108591229	0.108591229
2017	132.26	0.110620979	0.110620979	0.110620979	0.110620979	0.110620979	0.110620979
2018	136.58	0.113769415	0.113769415	0.113769415	0.113769415	0.113769415	0.113769415
2019	141.23	0.116712043	0.116712043	0.116712043	0.116712043	0.116712043	0.116712043
2020	146.18	0.119451071	0.119451071	0.119451071	0.119451071	0.119451071	0.119451071
2021	151.34	0.122219831	0.122219831	0.122219831	0.122219831	0.122219831	0.122219831
2022	156.72	0.125117083	0.125117083	0.125117083	0.125117083	0.125117083	0.125117083
2023	162.33	0.127931168	0.127931168	0.127931168	0.127931168	0.127931168	0.127931168
2024	168.17	0.130756568	0.130756568	0.130756568	0.130756568	0.130756568	0.130756568
2025	174.23	0.133600241	0.133600241	0.133600241	0.133600241	0.133600241	0.133600241
2026	180.50	0.136505757	0.136505757	0.136505757	0.136505757	0.136505757	0.136505757
2027	187.00	0.139474462	0.139474462	0.139474462	0.139474462	0.139474462	0.139474462

**Table F-6. Residential Electric: Gas Price Forecast (\$/therm)**

<b>Year</b>	<b>Single_Family Average Price</b>	<b>Single_Family Marginal Price</b>	<b>Multi_Family Average Price</b>	<b>Multi_Family Marginal Price</b>	<b>Manufactured Average Price</b>	<b>Manufactured Marginal Price</b>
2007	1.3307	1.3307	1.3307	1.3307	1.3307	1.3307
2008	1.2888	1.2888	1.2888	1.2888	1.2888	1.2888
2009	1.2620	1.2620	1.2620	1.2620	1.2620	1.2620
2010	1.2547	1.2547	1.2547	1.2547	1.2547	1.2547
2011	1.0679	1.0679	1.0679	1.0679	1.0679	1.0679
2012	1.1019	1.1019	1.1019	1.1019	1.1019	1.1019
2013	1.1765	1.1765	1.1765	1.1765	1.1765	1.1765
2014	1.2432	1.2432	1.2432	1.2432	1.2432	1.2432
2015	1.2686	1.2686	1.2686	1.2686	1.2686	1.2686
2016	1.2059	1.2059	1.2059	1.2059	1.2059	1.2059
2017	1.2473	1.2473	1.2473	1.2473	1.2473	1.2473
2018	1.3553	1.3553	1.3553	1.3553	1.3553	1.3553
2019	1.4501	1.4501	1.4501	1.4501	1.4501	1.4501
2020	1.5398	1.5398	1.5398	1.5398	1.5398	1.5398
2021	1.6220	1.6220	1.6220	1.6220	1.6220	1.6220
2022	1.6560	1.6560	1.6560	1.6560	1.6560	1.6560
2023	1.6911	1.6911	1.6911	1.6911	1.6911	1.6911
2024	1.7260	1.7260	1.7260	1.7260	1.7260	1.7260
2025	1.7435	1.7435	1.7435	1.7435	1.7435	1.7435
2006	1.7611	1.7611	1.7611	1.7611	1.7611	1.7611
2007	1.7790	1.7790	1.7790	1.7790	1.7790	1.7790

**Table F-7. Residential Gas: Sales Forecast (therms)**

Year	King	Kittitas	Lewis	Pierce	Snohomish	Thurston	Total
2007	339,248,910	271,497	3,409,890	104,819,463	87,792,538	30,745,696	566,287,994
2008	347,164,551	277,859	3,489,458	107,263,446	89,839,868	31,462,484	579,497,667
2009	356,582,541	285,418	3,584,131	110,171,621	92,275,280	32,315,469	595,214,459
2010	366,636,961	293,487	3,685,199	113,276,511	94,875,677	33,226,146	611,993,981
2011	376,397,338	301,311	3,783,316	116,290,640	97,399,172	34,110,259	628,282,036
2012	387,395,851	310,107	3,893,893	119,687,289	100,240,998	35,106,696	646,634,833
2013	395,858,363	316,876	3,978,978	122,300,356	102,426,812	35,873,275	660,754,659
2014	403,306,261	322,839	4,053,862	124,599,839	104,350,427	36,547,842	673,181,070
2015	411,705,251	329,568	4,138,304	127,193,086	106,520,455	37,308,551	687,195,214
2016	419,285,057	335,647	4,214,506	129,533,290	108,479,271	37,994,995	699,842,766
2017	425,869,103	340,931	4,280,696	131,566,026	110,181,073	38,591,228	710,829,057
2018	433,619,110	347,142	4,358,612	133,958,905	112,183,582	39,293,152	723,760,503
2019	441,103,850	353,139	4,433,864	136,269,700	114,117,081	39,971,010	736,248,643
2020	446,498,477	357,467	4,488,104	137,934,742	115,510,154	40,459,431	745,248,376
2021	451,553,601	361,526	4,538,930	139,494,920	116,815,719	40,917,075	753,681,771
2022	457,196,757	366,056	4,595,665	141,236,814	118,273,593	41,428,014	763,096,899
2023	463,778,201	371,337	4,661,831	143,268,625	119,974,311	42,023,991	774,078,296
2024	470,035,341	376,360	4,724,736	145,200,266	121,591,270	42,590,578	784,518,551
2025	475,738,269	380,926	4,782,062	146,961,977	123,066,534	43,107,329	794,037,097
2026	480,952,853	385,101	4,834,478	148,572,833	124,415,471	43,579,830	802,740,565
2027	485,329,949	388,606	4,878,476	149,924,977	125,547,762	43,976,445	810,046,215



**Table F-8. Residential Gas: Housing Type Allocation**

Year	County	Multi_Family	Manufactured	Single_Family
2007	King	0.3875	0.0250	0.5876
2008	King	0.3893	0.0246	0.5861
2009	King	0.3912	0.0243	0.5846
2010	King	0.3930	0.0239	0.5831
2011	King	0.3948	0.0236	0.5816
2012	King	0.3967	0.0233	0.5801
2013	King	0.3985	0.0229	0.5785
2014	King	0.4004	0.0226	0.5770
2015	King	0.4022	0.0222	0.5755
2016	King	0.4041	0.0219	0.5740
2017	King	0.4059	0.0215	0.5725
2018	King	0.4078	0.0212	0.5710
2019	King	0.4096	0.0209	0.5695
2020	King	0.4115	0.0205	0.5680
2021	King	0.4133	0.0202	0.5665
2022	King	0.4151	0.0198	0.5650
2023	King	0.4170	0.0195	0.5635
2024	King	0.4188	0.0191	0.5620
2025	King	0.4207	0.0188	0.5605
2026	King	0.4225	0.0185	0.5590
2027	King	0.4244	0.0181	0.5575
2007	Kittitas	0.0556	0.2055	0.7389
2008	Kittitas	0.0558	0.2063	0.7379
2009	Kittitas	0.0560	0.2072	0.7369
2010	Kittitas	0.0562	0.2080	0.7358
2011	Kittitas	0.0564	0.2088	0.7348
2012	Kittitas	0.0566	0.2096	0.7338
2013	Kittitas	0.0568	0.2104	0.7328
2014	Kittitas	0.0570	0.2113	0.7318
2015	Kittitas	0.0571	0.2121	0.7308
2016	Kittitas	0.0573	0.2129	0.7298
2017	Kittitas	0.0575	0.2137	0.7287
2018	Kittitas	0.0577	0.2146	0.7277
2019	Kittitas	0.0579	0.2154	0.7267
2020	Kittitas	0.0581	0.2162	0.7257
2021	Kittitas	0.0583	0.2170	0.7247
2022	Kittitas	0.0585	0.2178	0.7237
2023	Kittitas	0.0587	0.2187	0.7227
2024	Kittitas	0.0589	0.2195	0.7216
2025	Kittitas	0.0591	0.2203	0.7206
2026	Kittitas	0.0593	0.2211	0.7196
2027	Kittitas	0.0594	0.2220	0.7186
2007	Lewis	0.1220	0.1950	0.6830
2008	Lewis	0.1220	0.1950	0.6830
2009	Lewis	0.1220	0.1950	0.6830
2010	Lewis	0.1220	0.1950	0.6830
2011	Lewis	0.1220	0.1950	0.6830
2012	Lewis	0.1220	0.1950	0.6830
2013	Lewis	0.1220	0.1950	0.6830

Year	County	Multi Family	Manufactured	Single Family
2014	Lewis	0.1220	0.1950	0.6830
2015	Lewis	0.1220	0.1950	0.6830
2016	Lewis	0.1220	0.1950	0.6830
2017	Lewis	0.1220	0.1950	0.6830
2018	Lewis	0.1220	0.1950	0.6830
2019	Lewis	0.1220	0.1950	0.6830
2020	Lewis	0.1220	0.1950	0.6830
2021	Lewis	0.1220	0.1950	0.6830
2022	Lewis	0.1220	0.1950	0.6830
2023	Lewis	0.1220	0.1950	0.6830
2024	Lewis	0.1220	0.1950	0.6830
2025	Lewis	0.1220	0.1950	0.6830
2026	Lewis	0.1220	0.1950	0.6830
2027	Lewis	0.1220	0.1950	0.6830
2007	Pierce	0.2383	0.0823	0.6794
2008	Pierce	0.2371	0.0819	0.6810
2009	Pierce	0.2359	0.0815	0.6826
2010	Pierce	0.2347	0.0811	0.6843
2011	Pierce	0.2335	0.0806	0.6859
2012	Pierce	0.2322	0.0802	0.6876
2013	Pierce	0.2310	0.0798	0.6892
2014	Pierce	0.2298	0.0794	0.6908
2015	Pierce	0.2286	0.0789	0.6925
2016	Pierce	0.2274	0.0785	0.6941
2017	Pierce	0.2262	0.0781	0.6957
2018	Pierce	0.2250	0.0777	0.6974
2019	Pierce	0.2238	0.0772	0.6990
2020	Pierce	0.2226	0.0768	0.7006
2021	Pierce	0.2213	0.0764	0.7023
2022	Pierce	0.2201	0.0760	0.7039
2023	Pierce	0.2189	0.0756	0.7055
2024	Pierce	0.2177	0.0751	0.7072
2025	Pierce	0.2165	0.0747	0.7088
2026	Pierce	0.2153	0.0743	0.7104
2027	Pierce	0.2141	0.0739	0.7121
2007	Snohomish	0.2698	0.0695	0.6607
2008	Snohomish	0.2708	0.0674	0.6618
2009	Snohomish	0.2718	0.0653	0.6628
2010	Snohomish	0.2729	0.0632	0.6639
2011	Snohomish	0.2739	0.0612	0.6650
2012	Snohomish	0.2749	0.0591	0.6660
2013	Snohomish	0.2759	0.0570	0.6671
2014	Snohomish	0.2769	0.0549	0.6682
2015	Snohomish	0.2779	0.0528	0.6692
2016	Snohomish	0.2789	0.0508	0.6703
2017	Snohomish	0.2800	0.0487	0.6714
2018	Snohomish	0.2810	0.0466	0.6724
2019	Snohomish	0.2820	0.0445	0.6735
2020	Snohomish	0.2830	0.0424	0.6746
2021	Snohomish	0.2840	0.0403	0.6756
2022	Snohomish	0.2850	0.0383	0.6767

Year	County	Multi Family	Manufactured	Single Family
2023	Snohomish	0.2861	0.0362	0.6778
2024	Snohomish	0.2871	0.0341	0.6788
2025	Snohomish	0.2881	0.0320	0.6799
2026	Snohomish	0.2891	0.0301	0.6810
2027	Snohomish	0.2901	0.0282	0.6820
2007	Thurston	0.1925	0.1312	0.6763
2008	Thurston	0.1922	0.1297	0.6781
2009	Thurston	0.1920	0.1282	0.6798
2010	Thurston	0.1917	0.1267	0.6816
2011	Thurston	0.1914	0.1252	0.6834
2012	Thurston	0.1911	0.1237	0.6852
2013	Thurston	0.1909	0.1222	0.6869
2014	Thurston	0.1906	0.1207	0.6887
2015	Thurston	0.1903	0.1192	0.6905
2016	Thurston	0.1901	0.1176	0.6923
2017	Thurston	0.1898	0.1161	0.6941
2018	Thurston	0.1895	0.1146	0.6958
2019	Thurston	0.1893	0.1131	0.6976
2020	Thurston	0.1890	0.1116	0.6994
2021	Thurston	0.1887	0.1101	0.7012
2022	Thurston	0.1885	0.1086	0.7029
2023	Thurston	0.1882	0.1071	0.7047
2024	Thurston	0.1879	0.1056	0.7065
2025	Thurston	0.1876	0.1041	0.7083
2026	Thurston	0.1874	0.1026	0.7101
2027	Thurston	0.1871	0.1011	0.7118

**Table F-9. Residential Gas: Customer Count Forecast**

Year	King	Kittitas	Lewis	Pierce	Snohomish	Thurston	Total
2007	394,178	462	4,492	125,958	104,809	38,848	668,748
2008	406,022	476	4,627	129,743	107,959	40,016	688,843
2009	417,332	489	4,756	133,357	110,966	41,130	708,030
2010	428,296	502	4,881	136,861	113,882	42,211	726,632
2011	439,235	515	5,006	140,357	116,791	43,289	745,192
2012	450,305	528	5,132	143,893	119,733	44,380	763,971
2013	461,655	541	5,261	147,520	122,751	45,498	783,226
2014	473,269	555	5,394	151,231	125,838	46,643	802,929
2015	484,996	569	5,527	154,978	128,956	47,799	822,825
2016	496,626	582	5,660	158,694	132,049	48,945	842,556
2017	507,816	595	5,788	162,270	135,024	50,048	861,540
2018	518,767	608	5,912	165,769	137,936	51,127	880,120
2019	529,136	620	6,031	169,082	140,693	52,149	897,711
2020	538,823	632	6,141	172,178	143,268	53,103	914,144
2021	547,779	642	6,243	175,040	145,650	53,986	929,339
2022	556,554	652	6,343	177,844	147,983	54,851	944,227
2023	565,749	663	6,448	180,782	150,428	55,757	959,827
2024	575,010	674	6,553	183,741	152,890	56,670	975,540
2025	582,226	713	6,579	187,422	156,341	57,684	990,967
2026	589,000	754	6,598	191,004	159,726	58,664	1,005,747
2027	595,087	797	6,609	194,404	162,973	59,583	1,019,453

**Table F-10. Residential Gas: Efficiency Shares**

<b>bName</b>	<b>nName</b>	<b>fName</b>	<b>Stock</b>	<b>Standard</b>	<b>High</b>	<b>Premium</b>	<b>Super_Premium</b>
Manufactured	Cooking	Gas	0.95	0.05			
Manufactured	Cooking	Electric	1				
Manufactured	Other	Gas	1				
Manufactured	Space_Heat	Gas	0.5	0.385	0.075	0.03	0.01
Manufactured	Space_Heat	Electric	1				
Manufactured	Water_Heat	Gas	0.1	0.68	0.22		
Manufactured	Water_Heat	Electric	1				
Multi_Family	Cooking	Gas	0.95	0.05			
Multi_Family	Cooking	Electric	1				
Multi_Family	Other	Gas	1				
Multi_Family	Space_Heat	Gas	0.5	0.385	0.075	0.03	0.01
Multi_Family	Space_Heat	Electric	1				
Multi_Family	Water_Heat	Gas	0.13	0.76	0.11		
Multi_Family	Water_Heat	Electric	1				
Single_Family	Cooking	Gas	0.9	0.1			
Single_Family	Cooking	Electric	1				
Single_Family	Other	Gas	1				
Single_Family	Space_Heat	Gas	0.5	0.385	0.075	0.03	0.01
Single_Family	Space_Heat	Electric	1				
Single_Family	Water_Heat	Gas	0.1	0.68	0.22		
Single_Family	Water_Heat	Electric	1				
Manufactured	Dryer	Gas	0.48	0.52			
Multi_Family	Dryer	Gas	0.48	0.52			
Single_Family	Dryer	Gas	0.48	0.52			
Manufactured	Dryer	Electric	1				
Multi_Family	Dryer	Electric	1				
Single_Family	Dryer	Electric	1				

**Table F-11. Residential Gas: Price Forecast (\$/therm)**

<b>Year</b>	<b>Single_Family Average Price</b>	<b>Single_Family Marginal Price</b>	<b>Multi_Family Average Price</b>	<b>Multi_Family Marginal Price</b>	<b>Manufactured Average Price</b>	<b>Manufactured Marginal Price</b>
2007	1.3307	1.3307	1.3307	1.3307	1.3307	1.3307
2008	1.2888	1.2888	1.2888	1.2888	1.2888	1.2888
2009	1.2620	1.2620	1.2620	1.2620	1.2620	1.2620
2010	1.2547	1.2547	1.2547	1.2547	1.2547	1.2547
2011	1.0679	1.0679	1.0679	1.0679	1.0679	1.0679
2012	1.1019	1.1019	1.1019	1.1019	1.1019	1.1019
2013	1.1765	1.1765	1.1765	1.1765	1.1765	1.1765
2014	1.2432	1.2432	1.2432	1.2432	1.2432	1.2432
2015	1.2686	1.2686	1.2686	1.2686	1.2686	1.2686
2016	1.2059	1.2059	1.2059	1.2059	1.2059	1.2059
2017	1.2473	1.2473	1.2473	1.2473	1.2473	1.2473
2018	1.3553	1.3553	1.3553	1.3553	1.3553	1.3553
2019	1.4501	1.4501	1.4501	1.4501	1.4501	1.4501
2020	1.5398	1.5398	1.5398	1.5398	1.5398	1.5398
2021	1.6220	1.6220	1.6220	1.6220	1.6220	1.6220
2022	1.6560	1.6560	1.6560	1.6560	1.6560	1.6560
2023	1.6911	1.6911	1.6911	1.6911	1.6911	1.6911
2024	1.7260	1.7260	1.7260	1.7260	1.7260	1.7260
2025	1.7435	1.7435	1.7435	1.7435	1.7435	1.7435
2026	1.7611	1.7611	1.7611	1.7611	1.7611	1.7611
2027	1.7790	1.7790	1.7790	1.7790	1.7790	1.7790

**Table F-12. Residential Gas: Electric Price Forecast (\$/kWh)**

<b>Year</b>	<b>Res Price Deflator</b>	<b>Single_Family Average Price</b>	<b>Single_Family Marginal Price</b>	<b>Multi_Family Average Price</b>	<b>Multi_Family Marginal Price</b>	<b>Manufactured Average Price</b>	<b>Manufactured Marginal Price</b>
2007	100.00	0.082077944	0.082077944	0.082077944	0.082077944	0.082077944	0.082077944
2008	102.36	0.084414096	0.084414096	0.084414096	0.084414096	0.084414096	0.084414096
2009	104.88	0.087790591	0.087790591	0.087790591	0.087790591	0.087790591	0.087790591
2010	107.71	0.091554894	0.091554894	0.091554894	0.091554894	0.091554894	0.091554894
2011	110.85	0.093935517	0.093935517	0.093935517	0.093935517	0.093935517	0.093935517
2012	114.08	0.096867362	0.096867362	0.096867362	0.096867362	0.096867362	0.096867362
2013	117.62	0.099707646	0.099707646	0.099707646	0.099707646	0.099707646	0.099707646
2014	121.21	0.102322788	0.102322788	0.102322788	0.102322788	0.102322788	0.102322788
2015	124.71	0.105251369	0.105251369	0.105251369	0.105251369	0.105251369	0.105251369
2016	128.31	0.108591229	0.108591229	0.108591229	0.108591229	0.108591229	0.108591229
2017	132.26	0.110620979	0.110620979	0.110620979	0.110620979	0.110620979	0.110620979
2018	136.58	0.113769415	0.113769415	0.113769415	0.113769415	0.113769415	0.113769415
2019	141.23	0.116712043	0.116712043	0.116712043	0.116712043	0.116712043	0.116712043
2020	146.18	0.119451071	0.119451071	0.119451071	0.119451071	0.119451071	0.119451071
2021	151.34	0.122219831	0.122219831	0.122219831	0.122219831	0.122219831	0.122219831
2022	156.72	0.125117083	0.125117083	0.125117083	0.125117083	0.125117083	0.125117083
2023	162.33	0.127931168	0.127931168	0.127931168	0.127931168	0.127931168	0.127931168
2024	168.17	0.130756568	0.130756568	0.130756568	0.130756568	0.130756568	0.130756568
2025	174.23	0.133600241	0.133600241	0.133600241	0.133600241	0.133600241	0.133600241
2026	180.50	0.136505757	0.136505757	0.136505757	0.136505757	0.136505757	0.136505757
2027	187.00	0.139474462	0.139474462	0.139474462	0.139474462	0.139474462	0.139474462

**Table F-13. Commercial Electric: Sales Forecast (MWh)**

Year	Island	Jefferson	King	Kitsap	Kittitas	Pierce	Skagit	Thurston	Whatcom	Total
2007	209,272	92,453	5,459,274	731,811	69,111	575,126	512,468	937,332	720,905	9,307,752
2008	215,146	96,479	5,571,389	749,978	71,302	599,356	530,766	968,775	752,670	9,555,862
2009	223,281	102,860	5,728,535	767,170	73,457	625,759	551,035	994,099	787,577	9,853,774
2010	227,206	106,397	5,866,386	774,373	74,409	648,726	559,970	1,013,056	802,333	10,072,856
2011	228,546	108,910	5,963,785	783,195	75,205	668,939	565,193	1,040,656	809,865	10,244,295
2012	233,872	114,050	6,085,516	800,151	77,244	691,534	579,924	1,071,576	833,741	10,487,606
2013	238,263	118,906	6,143,116	833,097	78,297	705,389	591,396	1,120,258	852,779	10,681,503
2014	248,479	124,157	6,275,010	875,219	81,152	735,220	612,984	1,166,946	886,373	11,005,541
2015	258,709	129,315	6,423,014	913,238	83,662	766,490	634,959	1,207,890	919,757	11,337,035
2016	267,203	134,025	6,567,290	945,080	85,681	794,900	654,695	1,243,190	950,915	11,642,979
2017	273,949	137,861	6,696,798	976,571	87,553	816,943	668,884	1,278,880	975,583	11,913,022
2018	281,263	141,179	6,829,612	1,012,051	89,382	837,552	680,400	1,316,074	995,056	12,182,569
2019	289,166	144,655	6,975,958	1,046,384	91,231	860,358	693,057	1,350,350	1,015,532	12,466,691
2020	296,478	148,125	7,122,011	1,079,189	92,855	883,537	705,937	1,384,150	1,036,430	12,748,714
2021	303,820	151,747	7,275,555	1,113,892	94,545	907,856	719,498	1,421,252	1,058,632	13,046,797
2022	312,826	156,147	7,464,368	1,154,845	96,763	936,787	736,509	1,465,160	1,086,018	13,409,424
2023	322,625	160,952	7,670,292	1,199,565	99,237	967,584	755,028	1,512,902	1,115,916	13,804,102
2024	331,763	165,510	7,887,543	1,233,541	102,048	994,989	776,413	1,555,753	1,147,523	14,195,085
2025	340,837	170,037	8,103,270	1,267,279	104,839	1,022,203	797,649	1,598,304	1,178,909	14,583,326
2026	350,059	174,638	8,322,521	1,301,568	107,676	1,049,861	819,231	1,641,549	1,210,806	14,977,908
2027	359,230	179,213	8,540,566	1,335,668	110,497	1,077,366	840,694	1,684,557	1,242,529	15,370,319











**Table F-15. Commercial Electric: Customer Count Forecast**

Year	Island	Jefferson	King	Kitsap	Kittitas	Pierce	Skagit	Thurston	Whatcom	Total
2007	4,121	2,856	52,238	12,448	1,925	10,262	7,985	12,950	11,678	116,463
2008	4,204	2,962	53,640	12,599	1,955	10,668	8,136	13,233	11,929	119,326
2009	4,261	3,055	54,941	12,838	1,991	11,083	8,274	13,695	12,131	122,270
2010	4,359	3,199	56,049	13,113	2,045	11,454	8,488	14,099	12,486	125,291
2011	4,457	3,347	56,787	13,703	2,080	11,727	8,687	14,794	12,818	128,400
2012	4,610	3,466	57,531	14,278	2,138	12,123	8,931	15,284	13,214	131,575
2013	4,764	3,583	58,447	14,787	2,188	12,544	9,182	15,702	13,609	134,805
2014	4,902	3,700	59,536	15,245	2,232	12,960	9,432	16,100	14,017	138,125
2015	5,029	3,808	60,739	15,761	2,282	13,326	9,640	16,571	14,387	141,542
2016	5,169	3,904	62,012	16,352	2,332	13,677	9,818	17,072	14,690	145,026
2017	5,316	4,002	63,362	16,913	2,381	14,054	10,004	17,523	14,998	148,553
2018	5,456	4,102	64,754	17,461	2,426	14,448	10,200	17,979	15,322	152,147
2019	5,592	4,203	66,162	18,026	2,471	14,848	10,398	18,465	15,653	155,817
2020	5,733	4,307	67,592	18,609	2,518	15,256	10,599	18,955	15,990	159,559
2021	5,878	4,413	69,051	19,217	2,567	15,666	10,802	19,458	16,334	163,387
2022	6,024	4,521	70,656	19,740	2,587	16,086	11,075	19,912	16,726	167,327
2023	6,170	4,631	72,374	20,220	2,650	16,478	11,344	20,396	17,133	171,395
2024	6,320	4,744	74,136	20,712	2,715	16,879	11,621	20,893	17,550	175,568
2025	6,474	4,859	75,943	21,217	2,781	17,290	11,904	21,402	17,977	179,847
2026	6,632	4,978	77,795	21,734	2,849	17,712	12,194	21,924	18,416	184,233
2027	6,794	5,099	79,692	22,264	2,918	18,144	12,491	22,458	18,865	188,726

**Table F-16. Commercial Electric: Efficiency Shares**

bName	nName	fName	Stock	Standard	High	Premium
Dry_Goods_Retail	Cooling_Chillers	Electric	0.515	0.456	0.023	0.007
Dry_Goods_Retail	Cooling_DX	Electric	0.515	0.456	0.023	0.007
Dry_Goods_Retail	Cooling_HeatPump	Electric	0.515	0.485		
Dry_Goods_Retail	Lighting	Electric	0.700	0.300		
Dry_Goods_Retail	Other	Electric	1.000			
Dry_Goods_Retail	Plug_Load	Electric	1.000			
Dry_Goods_Retail	Space_Heat	Electric	1.000			
Dry_Goods_Retail	Space_Heat	Gas	1.000			
Dry_Goods_Retail	HVAC_Aux	Electric	0.550	0.450		
Dry_Goods_Retail	Water_Heat	Electric	0.700	0.300		
Dry_Goods_Retail	Water_Heat	Gas	1.000			
Grocery	Cooking	Electric	1.000			
Grocery	Cooking	Gas	1.000			
Grocery	Cooling_Chillers	Electric	0.515	0.456	0.023	0.007
Grocery	Cooling_DX	Electric	0.515	0.456	0.023	0.007
Grocery	Cooling_HeatPump	Electric	0.515	0.485		
Grocery	Lighting	Electric	0.700	0.300		
Grocery	Other	Electric	1.000			
Grocery	Plug_Load	Electric	1.000			
Grocery	Refrigeration	Electric	0.950	0.050		
Grocery	Space_Heat	Electric	1.000			
Grocery	Space_Heat	Gas	1.000			
Grocery	HVAC_Aux	Electric	0.550	0.450		
Grocery	Water_Heat	Electric	0.700	0.225	0.075	
Grocery	Water_Heat	Gas	1.000			
Hospital	Cooling_Chillers	Electric	0.515	0.456	0.023	0.007
Hospital	Cooling_DX	Electric	0.515	0.456	0.023	0.007
Hospital	Cooling_HeatPump	Electric	0.515	0.485		
Hospital	Lighting	Electric	0.700	0.300		
Hospital	Other	Electric	1.000			
Hospital	Plug_Load	Electric	1.000			
Hospital	Space_Heat	Electric	1.000			
Hospital	Space_Heat	Gas	1.000			
Hospital	HVAC_Aux	Electric	0.550	0.450		
Hospital	Water_Heat	Electric	0.700	0.300		
Hospital	Water_Heat	Gas	1.000			
Hotel_Motel	Cooking	Electric	1.000			
Hotel_Motel	Cooking	Gas	1.000			
Hotel_Motel	Cooling_Chillers	Electric	0.515	0.456	0.023	0.007
Hotel_Motel	Cooling_DX	Electric	0.515	0.456	0.023	0.007
Hotel_Motel	Cooling_HeatPump	Electric	0.515	0.485		
Hotel_Motel	Lighting	Electric	0.700	0.300		
Hotel_Motel	Other	Electric	1.000			
Hotel_Motel	Plug_Load	Electric	1.000			
Hotel_Motel	Space_Heat	Electric	1.000			
Hotel_Motel	Space_Heat	Gas	1.000			
Hotel_Motel	HVAC_Aux	Electric	0.550	0.450		
Hotel_Motel	Water_Heat	Electric	0.700	0.300		
Hotel_Motel	Water_Heat	Gas	1.000			
Office	Cooling_Chillers	Electric	0.515	0.456	0.023	0.007
Office	Cooling_DX	Electric	0.515	0.456	0.023	0.007
Office	Cooling_HeatPump	Electric	0.515	0.485		

<b>bName</b>	<b>nName</b>	<b>fName</b>	<b>Stock</b>	<b>Standard</b>	<b>High</b>	<b>Premium</b>
Office	Lighting	Electric	0.700	0.300		
Office	Other	Electric	1.000			
Office	Plug_Load	Electric	1.000			
Office	Space_Heat	Electric	1.000			
Office	Space_Heat	Gas	1.000			
Office	HVAC_Aux	Electric	0.550	0.450		
Office	Water_Heat	Electric	0.700	0.300		
Office	Water_Heat	Gas	1.000			
Other	Cooling_Chillers	Electric	0.515	0.456	0.023	0.007
Other	Cooling_DX	Electric	0.515	0.456	0.023	0.007
Other	Cooling_HeatPump	Electric	0.515	0.485		
Other	Lighting	Electric	0.700	0.300		
Other	Other	Electric	1.000			
Other	Plug_Load	Electric	1.000			
Other	Space_Heat	Electric	1.000			
Other	Space_Heat	Gas	1.000			
Other	HVAC_Aux	Electric	0.550	0.450		
Other	Water_Heat	Electric	0.700	0.300		
Other	Water_Heat	Gas	1.000			
Restaurant	Cooking	Electric	1.000			
Restaurant	Cooking	Gas	1.000			
Restaurant	Cooling_Chillers	Electric	0.515	0.456	0.023	0.007
Restaurant	Cooling_DX	Electric	0.515	0.456	0.023	0.007
Restaurant	Cooling_HeatPump	Electric	0.515	0.485		
Restaurant	Lighting	Electric	0.700	0.300		
Restaurant	Other	Electric	1.000			
Restaurant	Plug_Load	Electric	1.000			
Restaurant	Refrigeration	Electric	0.950	0.050		
Restaurant	Space_Heat	Electric	1.000			
Restaurant	Space_Heat	Gas	1.000			
Restaurant	HVAC_Aux	Electric	0.550	0.450		
Restaurant	Water_Heat	Electric	0.700	0.300		
Restaurant	Water_Heat	Gas	1.000			
School	Cooking	Electric	1.000			
School	Cooking	Gas	1.000			
School	Cooling_Chillers	Electric	0.515	0.456	0.023	0.007
School	Cooling_DX	Electric	0.515	0.456	0.023	0.007
School	Cooling_HeatPump	Electric	0.515	0.485		
School	Lighting	Electric	0.700	0.300		
School	Other	Electric	1.000			
School	Plug_Load	Electric	1.000			
School	Space_Heat	Electric	1.000			
School	Space_Heat	Gas	1.000			
School	HVAC_Aux	Electric	0.550	0.450		
School	Water_Heat	Electric	0.700	0.300		
School	Water_Heat	Gas	1.000			
University	Cooling_Chillers	Electric	0.515	0.456	0.023	0.007
University	Cooling_DX	Electric	0.515	0.456	0.023	0.007
University	Cooling_HeatPump	Electric	0.515	0.485		
University	Lighting	Electric	0.700	0.300		
University	Other	Electric	1.000			
University	Plug_Load	Electric	1.000			
University	Space_Heat	Electric	1.000			
University	Space_Heat	Gas	1.000			

<b>bName</b>	<b>nName</b>	<b>fName</b>	<b>Stock</b>	<b>Standard</b>	<b>High</b>	<b>Premium</b>
University	HVAC_Aux	Electric	0.550	0.450		
University	Water_Heat	Electric	0.700	0.300		
University	Water_Heat	Gas	1.000			
Warehouse	Cooling_Chillers	Electric	0.515	0.456	0.023	0.007
Warehouse	Cooling_DX	Electric	0.515	0.456	0.023	0.007
Warehouse	Cooling_HeatPump	Electric	0.515	0.485		
Warehouse	Lighting	Electric	0.700	0.300		
Warehouse	Other	Electric	1.000			
Warehouse	Plug_Load	Electric	1.000			
Warehouse	Space_Heat	Electric	1.000			
Warehouse	Space_Heat	Gas	1.000			
Warehouse	HVAC_Aux	Electric	0.550	0.450		
Warehouse	Water_Heat	Electric	0.700	0.300		
Warehouse	Water_Heat	Gas	1.000			



**Table F-17. Commercial Electric: Price Forecast (\$/kWh)**

<b>Year</b>	<b>Price Deflator</b>	<b>Commercial Average Price</b>	<b>Commercial Marginal Price</b>
2007	100.00	0.081388597	0.081388597
2008	102.36	0.082873068	0.082873068
2009	104.88	0.085172869	0.085172869
2010	107.71	0.087751835	0.087751835
2011	110.85	0.090333153	0.090333153
2012	114.08	0.093322358	0.093322358
2013	117.62	0.096312153	0.096312153
2014	121.21	0.09917074	0.09917074
2015	124.71	0.102442729	0.102442729
2016	128.31	0.106263368	0.106263368
2017	132.26	0.108721831	0.108721831
2018	136.58	0.112553447	0.112553447
2019	141.23	0.116251341	0.116251341
2020	146.18	0.119817245	0.119817245
2021	151.34	0.123525091	0.123525091
2022	156.72	0.127512594	0.127512594
2023	162.33	0.131502778	0.131502778
2024	168.17	0.135635484	0.135635484
2025	174.23	0.139906254	0.139906254
2026	180.50	0.144311497	0.144311497
2027	187.00	0.148855449	0.148855449

**Table F-18. Commercial Electric: Gas Price Forecast (\$/therm)**

<b>Year</b>	<b>Commercial Average Price</b>	<b>Commercial Marginal Price</b>
2007	1.2325	1.2325
2008	1.1908	1.1908
2009	1.1603	1.1603
2010	1.1493	1.1493
2011	0.9571	0.9571
2012	0.9885	0.9885
2013	1.0610	1.0610
2014	1.1256	1.1256
2015	1.1474	1.1474
2016	1.0790	1.0790
2017	1.1179	1.1179
2018	1.2239	1.2239
2019	1.3163	1.3163
2020	1.4030	1.4030
2021	1.4800	1.4800
2022	1.5104	1.5104
2023	1.5419	1.5419
2024	1.5731	1.5731
2025	1.5862	1.5862
2026	1.5995	1.5995
2027	1.6129	1.6129

**Table F-19. Commercial Electric: Number of Electric Meters Per Building**

Year	Dry_Goods_Retail	Grocery	Office	Restaurant	Warehouse	Hospital	Hotel_Motel	School	University	Other
2007	1.13694382	1	1.140333321	1.038285929	1.140127233	2.489337961	1.300638839	1.628339	2	1.290374685
2008	1.13694382	1	1.140333321	1.038285929	1.140127233	2.489337961	1.300638839	1.628339	2	1.290374685
2009	1.13694382	1	1.140333321	1.038285929	1.140127233	2.489337961	1.300638839	1.628339	2	1.290374685
2010	1.13694382	1	1.140333321	1.038285929	1.140127233	2.489337961	1.300638839	1.628339	2	1.290374685
2011	1.13694382	1	1.140333321	1.038285929	1.140127233	2.489337961	1.300638839	1.628339	2	1.290374685
2012	1.13694382	1	1.140333321	1.038285929	1.140127233	2.489337961	1.300638839	1.628339	2	1.290374685
2013	1.13694382	1	1.140333321	1.038285929	1.140127233	2.489337961	1.300638839	1.628339	2	1.290374685
2014	1.13694382	1	1.140333321	1.038285929	1.140127233	2.489337961	1.300638839	1.628339	2	1.290374685
2015	1.13694382	1	1.140333321	1.038285929	1.140127233	2.489337961	1.300638839	1.628339	2	1.290374685
2016	1.13694382	1	1.140333321	1.038285929	1.140127233	2.489337961	1.300638839	1.628339	2	1.290374685
2017	1.13694382	1	1.140333321	1.038285929	1.140127233	2.489337961	1.300638839	1.628339	2	1.290374685
2018	1.13694382	1	1.140333321	1.038285929	1.140127233	2.489337961	1.300638839	1.628339	2	1.290374685
2019	1.13694382	1	1.140333321	1.038285929	1.140127233	2.489337961	1.300638839	1.628339	2	1.290374685
2020	1.13694382	1	1.140333321	1.038285929	1.140127233	2.489337961	1.300638839	1.628339	2	1.290374685
2021	1.13694382	1	1.140333321	1.038285929	1.140127233	2.489337961	1.300638839	1.628339	2	1.290374685
2022	1.13694382	1	1.140333321	1.038285929	1.140127233	2.489337961	1.300638839	1.628339	2	1.290374685
2023	1.13694382	1	1.140333321	1.038285929	1.140127233	2.489337961	1.300638839	1.628339	2	1.290374685
2024	1.13694382	1	1.140333321	1.038285929	1.140127233	2.489337961	1.300638839	1.628339	2	1.290374685
2025	1.13694382	1	1.140333321	1.038285929	1.140127233	2.489337961	1.300638839	1.628339	2	1.290374685
2026	1.13694382	1	1.140333321	1.038285929	1.140127233	2.489337961	1.300638839	1.628339	2	1.290374685
2027	1.13694382	1	1.140333321	1.038285929	1.140127233	2.489337961	1.300638839	1.628339	2	1.290374685

**Table F-20. Commercial Electric: Average Square Footage by Building Type**

Year	Dry_Goods_Retail	Grocery	Office	Restaurant	Warehouse	Hospital	Hotel_Motel	School	University	Other
2007	6421	8637	9525	4699	15284	14803	12772	22241	32392	10699
2008	6421	8637	9525	4699	15284	14803	12772	22241	32392	10699
2009	6421	8637	9525	4699	15284	14803	12772	22241	32392	10699
2010	6421	8637	9525	4699	15284	14803	12772	22241	32392	10699
2011	6421	8637	9525	4699	15284	14803	12772	22241	32392	10699
2012	6421	8637	9525	4699	15284	14803	12772	22241	32392	10699
2013	6421	8637	9525	4699	15284	14803	12772	22241	32392	10699
2014	6421	8637	9525	4699	15284	14803	12772	22241	32392	10699
2015	6421	8637	9525	4699	15284	14803	12772	22241	32392	10699
2016	6421	8637	9525	4699	15284	14803	12772	22241	32392	10699
2017	6421	8637	9525	4699	15284	14803	12772	22241	32392	10699
2018	6421	8637	9525	4699	15284	14803	12772	22241	32392	10699
2019	6421	8637	9525	4699	15284	14803	12772	22241	32392	10699
2020	6421	8637	9525	4699	15284	14803	12772	22241	32392	10699
2021	6421	8637	9525	4699	15284	14803	12772	22241	32392	10699
2022	6421	8637	9525	4699	15284	14803	12772	22241	32392	10699
2023	6421	8637	9525	4699	15284	14803	12772	22241	32392	10699
2024	6421	8637	9525	4699	15284	14803	12772	22241	32392	10699
2025	6421	8637	9525	4699	15284	14803	12772	22241	32392	10699
2026	6421	8637	9525	4699	15284	14803	12772	22241	32392	10699
2027	6421	8637	9525	4699	15284	14803	12772	22241	32392	10699

**Table F-21. Commercial Gas: Sales Forecast (therms)**

Year	King	Kittitas	Lewis	Pierce	Snohomish	Thurston	Total
2007	197,758,361	135,648	4,763,833	53,699,238	45,627,047	15,824,539	317,808,666
2008	200,347,590	137,544	4,826,134	54,404,474	46,223,712	16,032,714	321,972,167
2009	201,924,125	138,733	4,864,045	54,834,489	46,586,823	16,159,748	324,507,962
2010	203,384,614	139,820	4,899,180	55,232,599	46,923,258	16,277,315	326,856,786
2011	205,564,142	141,395	4,951,640	55,825,885	47,425,608	16,452,387	330,361,058
2012	209,628,266	144,270	5,049,492	56,931,026	48,362,755	16,778,315	336,894,124
2013	214,143,587	147,453	5,158,205	58,158,600	49,404,108	17,140,313	344,152,266
2014	218,419,363	150,468	5,261,150	59,321,083	50,390,199	17,483,121	351,025,385
2015	222,808,614	153,558	5,366,845	60,514,395	51,402,345	17,835,011	358,080,768
2016	226,875,584	156,418	5,464,781	61,620,037	52,340,183	18,161,041	364,618,043
2017	230,318,873	158,837	5,547,687	62,556,018	53,134,351	18,437,029	370,152,795
2018	233,766,758	161,262	5,630,704	63,493,307	53,929,541	18,713,411	375,694,984
2019	237,483,919	163,876	5,720,209	64,503,790	54,786,810	19,011,373	381,669,976
2020	241,203,028	166,487	5,809,762	65,514,737	55,644,556	19,309,462	387,648,032
2021	244,982,832	169,134	5,900,781	66,542,077	56,516,319	19,612,367	393,723,511
2022	249,418,095	172,228	6,007,593	67,747,350	57,539,319	19,967,699	400,852,284
2023	254,862,007	176,014	6,138,698	69,226,501	58,795,075	20,403,739	409,602,034
2024	260,608,409	180,006	6,277,091	70,787,754	60,120,632	20,863,967	418,837,860
2025	266,325,274	183,955	6,414,789	72,340,597	61,439,475	21,321,652	428,025,743
2026	272,051,662	187,910	6,552,717	73,896,027	62,760,515	21,780,099	437,228,931
2027	277,782,775	191,869	6,690,758	75,452,741	64,082,645	22,238,924	446,439,711





Year	County	Dry_Goods_Retail	Grocery	Office	Restaurant	Warehouse	Hospital	Hotel_Motel	School	University	Other
2025	Snohomish	0.145696974	0.020869955	0.186576654	0.098459064	0.069155103	0.040393462	0.012136739	0.022468863	0.007489621	0.396753562
2026	Snohomish	0.145696974	0.020869955	0.186576654	0.098459064	0.069155103	0.040393462	0.012136739	0.022468863	0.007489621	0.396753562
2027	Snohomish	0.145696974	0.020869955	0.186576654	0.098459064	0.069155103	0.040393462	0.012136739	0.022468863	0.007489621	0.396753562
2007	Thurston	0.145696974	0.020869955	0.186576654	0.098459064	0.069155103	0.040393462	0.012136739	0.022468863	0.007489621	0.396753562
2008	Thurston	0.145696974	0.020869955	0.186576654	0.098459064	0.069155103	0.040393462	0.012136739	0.022468863	0.007489621	0.396753562
2009	Thurston	0.145696974	0.020869955	0.186576654	0.098459064	0.069155103	0.040393462	0.012136739	0.022468863	0.007489621	0.396753562
2010	Thurston	0.145696974	0.020869955	0.186576654	0.098459064	0.069155103	0.040393462	0.012136739	0.022468863	0.007489621	0.396753562
2011	Thurston	0.145696974	0.020869955	0.186576654	0.098459064	0.069155103	0.040393462	0.012136739	0.022468863	0.007489621	0.396753562
2012	Thurston	0.145696974	0.020869955	0.186576654	0.098459064	0.069155103	0.040393462	0.012136739	0.022468863	0.007489621	0.396753562
2013	Thurston	0.145696974	0.020869955	0.186576654	0.098459064	0.069155103	0.040393462	0.012136739	0.022468863	0.007489621	0.396753562
2014	Thurston	0.145696974	0.020869955	0.186576654	0.098459064	0.069155103	0.040393462	0.012136739	0.022468863	0.007489621	0.396753562
2015	Thurston	0.145696974	0.020869955	0.186576654	0.098459064	0.069155103	0.040393462	0.012136739	0.022468863	0.007489621	0.396753562
2016	Thurston	0.145696974	0.020869955	0.186576654	0.098459064	0.069155103	0.040393462	0.012136739	0.022468863	0.007489621	0.396753562
2017	Thurston	0.145696974	0.020869955	0.186576654	0.098459064	0.069155103	0.040393462	0.012136739	0.022468863	0.007489621	0.396753562
2018	Thurston	0.145696974	0.020869955	0.186576654	0.098459064	0.069155103	0.040393462	0.012136739	0.022468863	0.007489621	0.396753562
2019	Thurston	0.145696974	0.020869955	0.186576654	0.098459064	0.069155103	0.040393462	0.012136739	0.022468863	0.007489621	0.396753562
2020	Thurston	0.145696974	0.020869955	0.186576654	0.098459064	0.069155103	0.040393462	0.012136739	0.022468863	0.007489621	0.396753562
2021	Thurston	0.145696974	0.020869955	0.186576654	0.098459064	0.069155103	0.040393462	0.012136739	0.022468863	0.007489621	0.396753562
2022	Thurston	0.145696974	0.020869955	0.186576654	0.098459064	0.069155103	0.040393462	0.012136739	0.022468863	0.007489621	0.396753562
2023	Thurston	0.145696974	0.020869955	0.186576654	0.098459064	0.069155103	0.040393462	0.012136739	0.022468863	0.007489621	0.396753562
2024	Thurston	0.145696974	0.020869955	0.186576654	0.098459064	0.069155103	0.040393462	0.012136739	0.022468863	0.007489621	0.396753562
2025	Thurston	0.145696974	0.020869955	0.186576654	0.098459064	0.069155103	0.040393462	0.012136739	0.022468863	0.007489621	0.396753562
2026	Thurston	0.145696974	0.020869955	0.186576654	0.098459064	0.069155103	0.040393462	0.012136739	0.022468863	0.007489621	0.396753562
2027	Thurston	0.145696974	0.020869955	0.186576654	0.098459064	0.069155103	0.040393462	0.012136739	0.022468863	0.007489621	0.396753562



**Table F-23. Commercial Gas: Customer Count Forecast**

Year	King	Kittitas	Lewis	Pierce	Snohomish	Thurston	Total
2007	32,447	41	914	9,225	7,682	3,161	53,470
2008	33,251	42	936	9,453	7,873	3,239	54,794
2009	34,048	43	959	9,680	8,062	3,317	56,108
2010	34,830	44	981	9,902	8,247	3,393	57,397
2011	35,635	45	1,003	10,131	8,437	3,471	58,722
2012	36,455	46	1,026	10,364	8,631	3,551	60,074
2013	37,295	47	1,050	10,603	8,830	3,633	61,458
2014	38,172	48	1,075	10,852	9,038	3,718	62,904
2015	39,074	50	1,100	11,108	9,251	3,806	64,390
2016	39,977	51	1,126	11,365	9,465	3,894	65,878
2017	40,887	52	1,151	11,624	9,681	3,983	67,377
2018	41,804	53	1,177	11,885	9,898	4,072	68,889
2019	42,722	54	1,203	12,145	10,115	4,162	70,401
2020	43,645	55	1,229	12,408	10,334	4,251	71,923
2021	44,593	57	1,256	12,677	10,558	4,344	73,485
2022	45,583	58	1,284	12,959	10,793	4,440	75,117
2023	46,612	59	1,312	13,251	11,036	4,540	76,811
2024	47,671	60	1,342	13,553	11,287	4,644	78,557
2025	48,650	62	1,364	13,904	11,593	4,775	80,348
2026	49,646	63	1,386	14,264	11,907	4,910	82,176
2027	50,645	64	1,408	14,628	12,226	5,048	84,019

**Table F-24. Commercial Gas: Efficiency Shares**

<b>bName</b>	<b>nName</b>	<b>fName</b>	<b>Stock</b>	<b>Standard</b>	<b>High</b>	<b>Premium</b>
Dry_Goods_Retail	Other	Gas	1.000			
Dry_Goods_Retail	Space_Heat	Electric	1.000			
Dry_Goods_Retail	Space_Heat	Gas	0.370	0.600	0.030	
Dry_Goods_Retail	Water_Heat	Electric	1.000			
Dry_Goods_Retail	Water_Heat	Gas	0.700	0.225	0.045	0.030
Grocery	Other	Gas	1.000			
Grocery	Space_Heat	Electric	1.000			
Grocery	Space_Heat	Gas	0.370	0.600	0.030	
Grocery	Water_Heat	Electric	1.000			
Grocery	Water_Heat	Gas	0.700	0.225	0.045	0.030
Hospital	Cooking	Electric	1.000			
Hospital	Cooking	Gas	0.950	0.050		
Hospital	Other	Gas	1.000			
Hospital	Pool_Heat	Gas	1.000			
Hospital	Space_Heat	Electric	1.000			
Hospital	Space_Heat	Gas	0.370	0.600	0.030	
Hospital	Water_Heat	Electric	1.000			
Hospital	Water_Heat	Gas	0.700	0.225	0.045	0.030
Hotel_Motel	Other	Gas	1.000			
Hotel_Motel	Pool_Heat	Gas	1.000			
Hotel_Motel	Space_Heat	Electric	1.000			
Hotel_Motel	Space_Heat	Gas	0.370	0.600	0.030	
Hotel_Motel	Water_Heat	Electric	1.000			
Hotel_Motel	Water_Heat	Gas	0.700	0.225	0.045	0.030
Office	Other	Gas	1.000			
Office	Space_Heat	Electric	1.000			
Office	Space_Heat	Gas	0.370	0.600	0.030	
Office	Water_Heat	Electric	1.000			
Office	Water_Heat	Gas	0.700	0.225	0.045	0.030
Other	Other	Gas	1.000			
Other	Space_Heat	Electric	1.000			
Other	Space_Heat	Gas	0.370	0.600	0.030	
Other	Water_Heat	Electric	1.000			
Other	Water_Heat	Gas	0.700	0.225	0.045	0.030
Restaurant	Cooking	Electric	1.000			
Restaurant	Cooking	Gas	0.950	0.050		
Restaurant	Other	Gas	1.000			
Restaurant	Space_Heat	Electric	1.000			
Restaurant	Space_Heat	Gas	0.370	0.600	0.030	
Restaurant	Water_Heat	Electric	1.000			
Restaurant	Water_Heat	Gas	0.700	0.225	0.045	0.030
School	Other	Gas	1.000			
School	Pool_Heat	Gas	1.000			
School	Space_Heat	Electric	1.000			
School	Space_Heat	Gas	0.370	0.600	0.030	
School	Water_Heat	Electric	1.000			
School	Water_Heat	Gas	0.700	0.225	0.045	0.030
University	Cooking	Electric	1.000			
University	Cooking	Gas	0.950	0.050		
University	Other	Gas	1.000			
University	Pool_Heat	Gas	1.000			
University	Space_Heat	Electric	1.000			

<b>bName</b>	<b>nName</b>	<b>fName</b>	<b>Stock</b>	<b>Standard</b>	<b>High</b>	<b>Premium</b>
University	Space_Heat	Gas	0.370	0.600	0.030	
University	Water_Heat	Electric	1.000			
University	Water_Heat	Gas	0.700	0.225	0.045	0.030
Warehouse	Other	Gas	1.000			
Warehouse	Space_Heat	Electric	1.000			
Warehouse	Space_Heat	Gas	0.370	0.600	0.030	
Warehouse	Water_Heat	Electric	1.000			
Warehouse	Water_Heat	Gas	0.700	0.225	0.045	0.030
Hotel_Motel	Cooking	Electric	1.000			
Hotel_Motel	Cooking	Gas	0.950	0.050		
School	Cooking	Electric	1.000			
School	Cooking	Gas	0.950	0.050		
Grocery	Cooking	Electric	1.000			
Grocery	Cooking	Gas	0.950	0.050		

**Table F-25. Commercial Gas: Price Forecast (\$/therm)**

<b>Year</b>	<b>Commercial Average Price</b>	<b>Commercial Marginal Price</b>
2007	1.2325	1.2325
2008	1.1908	1.1908
2009	1.1603	1.1603
2010	1.1493	1.1493
2011	0.9571	0.9571
2012	0.9885	0.9885
2013	1.0610	1.0610
2014	1.1256	1.1256
2015	1.1474	1.1474
2016	1.0790	1.0790
2017	1.1179	1.1179
2018	1.2239	1.2239
2019	1.3163	1.3163
2020	1.4030	1.4030
2021	1.4800	1.4800
2022	1.5104	1.5104
2023	1.5419	1.5419
2024	1.5731	1.5731
2025	1.5862	1.5862
2026	1.5995	1.5995
2027	1.6129	1.6129

**Table F-26. Commercial Gas: Electric Price Forecast (\$/kWh)**

<b>Year</b>	<b>Price Deflator</b>	<b>Commercial Average Price</b>	<b>Commercial Marginal Price</b>
2007	100.00	0.081388597	0.081388597
2008	102.36	0.082873068	0.082873068
2009	104.88	0.085172869	0.085172869
2010	107.71	0.087751835	0.087751835
2011	110.85	0.090333153	0.090333153
2012	114.08	0.093322358	0.093322358
2013	117.62	0.096312153	0.096312153
2014	121.21	0.09917074	0.09917074
2015	124.71	0.102442729	0.102442729
2016	128.31	0.106263368	0.106263368
2017	132.26	0.108721831	0.108721831
2018	136.58	0.112553447	0.112553447
2019	141.23	0.116251341	0.116251341
2020	146.18	0.119817245	0.119817245
2021	151.34	0.123525091	0.123525091
2022	156.72	0.127512594	0.127512594
2023	162.33	0.131502778	0.131502778
2024	168.17	0.135635484	0.135635484
2025	174.23	0.139906254	0.139906254
2026	180.50	0.144311497	0.144311497
2027	187.00	0.148855449	0.148855449

**Table F-27. Commercial Gas: Number of Gas Meters Per Building**

Year	Dry_Goods_Retail	Grocery	Office	Restaurant	Warehouse	Hospital	Hotel_Motel	School	University	Other
2007	1	1	1	1	1	1	1	1	1	1
2008	1	1	1	1	1	1	1	1	1	1
2009	1	1	1	1	1	1	1	1	1	1
2010	1	1	1	1	1	1	1	1	1	1
2011	1	1	1	1	1	1	1	1	1	1
2012	1	1	1	1	1	1	1	1	1	1
2013	1	1	1	1	1	1	1	1	1	1
2014	1	1	1	1	1	1	1	1	1	1
2015	1	1	1	1	1	1	1	1	1	1
2016	1	1	1	1	1	1	1	1	1	1
2017	1	1	1	1	1	1	1	1	1	1
2018	1	1	1	1	1	1	1	1	1	1
2019	1	1	1	1	1	1	1	1	1	1
2020	1	1	1	1	1	1	1	1	1	1
2021	1	1	1	1	1	1	1	1	1	1
2022	1	1	1	1	1	1	1	1	1	1
2023	1	1	1	1	1	1	1	1	1	1
2024	1	1	1	1	1	1	1	1	1	1
2025	1	1	1	1	1	1	1	1	1	1
2026	1	1	1	1	1	1	1	1	1	1
2027	1	1	1	1	1	1	1	1	1	1

**Table F-28. Commercial Gas: Average Square Footage by Building Type**

Year	Dry_Goods_Retail	Grocery	Office	Restaurant	Warehouse	Hospital	Hotel_Motel	School	University	Other
2007	33000	16000	30000	5000	66000	9000	26000	39000	66000	18000
2008	33000	16000	30000	5000	66000	9000	26000	39000	66000	18000
2009	33000	16000	30000	5000	66000	9000	26000	39000	66000	18000
2010	33000	16000	30000	5000	66000	9000	26000	39000	66000	18000
2011	33000	16000	30000	5000	66000	9000	26000	39000	66000	18000
2012	33000	16000	30000	5000	66000	9000	26000	39000	66000	18000
2013	33000	16000	30000	5000	66000	9000	26000	39000	66000	18000
2014	33000	16000	30000	5000	66000	9000	26000	39000	66000	18000
2015	33000	16000	30000	5000	66000	9000	26000	39000	66000	18000
2016	33000	16000	30000	5000	66000	9000	26000	39000	66000	18000
2017	33000	16000	30000	5000	66000	9000	26000	39000	66000	18000
2018	33000	16000	30000	5000	66000	9000	26000	39000	66000	18000
2019	33000	16000	30000	5000	66000	9000	26000	39000	66000	18000
2020	33000	16000	30000	5000	66000	9000	26000	39000	66000	18000
2021	33000	16000	30000	5000	66000	9000	26000	39000	66000	18000
2022	33000	16000	30000	5000	66000	9000	26000	39000	66000	18000
2023	33000	16000	30000	5000	66000	9000	26000	39000	66000	18000
2024	33000	16000	30000	5000	66000	9000	26000	39000	66000	18000
2025	33000	16000	30000	5000	66000	9000	26000	39000	66000	18000
2026	33000	16000	30000	5000	66000	9000	26000	39000	66000	18000
2027	33000	16000	30000	5000	66000	9000	26000	39000	66000	18000

**Table F-29. Industrial Electric: Sales Forecast (MWh)**

<b>Year</b>	<b>Industrial</b>
2007	1,314,446
2008	1,264,681
2009	1,254,988
2010	1,274,408
2011	1,282,529
2012	1,242,275
2013	1,196,442
2014	1,189,451
2015	1,186,576
2016	1,180,342
2017	1,177,324
2018	1,172,608
2019	1,166,488
2020	1,160,423
2021	1,153,479
2022	1,147,354
2023	1,141,885
2024	1,136,499
2025	1,131,324
2026	1,125,671
2027	1,120,690



**Table F-30. Industrial Electric: Building Type Allocation**

Year	Food Mfg	Wood Product Mfg	Paper Mfg	Printing Related Support	Chemical Mfg	Petroleum Coal Products	Plastics Rubber Products	Nonmetallic Mineral Products	Primary Metal Mfg	Fabricated Metal Products	Industrial Machinery	Electrical Equipment Mfg	Transportation Equipment Mfg	Computer Electronic Mfg	Miscellaneous Mfg
2007	6.78%	8.68%	1.31%	7.61%	1.71%	0.78%	2.97%	3.52%	0.95%	5.49%	11.77%	5.47%	7.54%	3.69%	31.74%
2008	6.78%	8.68%	1.31%	7.61%	1.71%	0.78%	2.97%	3.52%	0.95%	5.49%	11.77%	5.47%	7.54%	3.69%	31.74%
2009	6.78%	8.68%	1.31%	7.61%	1.71%	0.78%	2.97%	3.52%	0.95%	5.49%	11.77%	5.47%	7.54%	3.69%	31.74%
2010	6.78%	8.68%	1.31%	7.61%	1.71%	0.78%	2.97%	3.52%	0.95%	5.49%	11.77%	5.47%	7.54%	3.69%	31.74%
2011	6.78%	8.68%	1.31%	7.61%	1.71%	0.78%	2.97%	3.52%	0.95%	5.49%	11.77%	5.47%	7.54%	3.69%	31.74%
2012	6.78%	8.68%	1.31%	7.61%	1.71%	0.78%	2.97%	3.52%	0.95%	5.49%	11.77%	5.47%	7.54%	3.69%	31.74%
2013	6.78%	8.68%	1.31%	7.61%	1.71%	0.78%	2.97%	3.52%	0.95%	5.49%	11.77%	5.47%	7.54%	3.69%	31.74%
2014	6.78%	8.68%	1.31%	7.61%	1.71%	0.78%	2.97%	3.52%	0.95%	5.49%	11.77%	5.47%	7.54%	3.69%	31.74%
2015	6.78%	8.68%	1.31%	7.61%	1.71%	0.78%	2.97%	3.52%	0.95%	5.49%	11.77%	5.47%	7.54%	3.69%	31.74%
2016	6.78%	8.68%	1.31%	7.61%	1.71%	0.78%	2.97%	3.52%	0.95%	5.49%	11.77%	5.47%	7.54%	3.69%	31.74%
2017	6.78%	8.68%	1.31%	7.61%	1.71%	0.78%	2.97%	3.52%	0.95%	5.49%	11.77%	5.47%	7.54%	3.69%	31.74%
2018	6.78%	8.68%	1.31%	7.61%	1.71%	0.78%	2.97%	3.52%	0.95%	5.49%	11.77%	5.47%	7.54%	3.69%	31.74%
2019	6.78%	8.68%	1.31%	7.61%	1.71%	0.78%	2.97%	3.52%	0.95%	5.49%	11.77%	5.47%	7.54%	3.69%	31.74%
2020	6.78%	8.68%	1.31%	7.61%	1.71%	0.78%	2.97%	3.52%	0.95%	5.49%	11.77%	5.47%	7.54%	3.69%	31.74%
2021	6.78%	8.68%	1.31%	7.61%	1.71%	0.78%	2.97%	3.52%	0.95%	5.49%	11.77%	5.47%	7.54%	3.69%	31.74%
2022	6.78%	8.68%	1.31%	7.61%	1.71%	0.78%	2.97%	3.52%	0.95%	5.49%	11.77%	5.47%	7.54%	3.69%	31.74%
2023	6.78%	8.68%	1.31%	7.61%	1.71%	0.78%	2.97%	3.52%	0.95%	5.49%	11.77%	5.47%	7.54%	3.69%	31.74%
2024	6.78%	8.68%	1.31%	7.61%	1.71%	0.78%	2.97%	3.52%	0.95%	5.49%	11.77%	5.47%	7.54%	3.69%	31.74%
2025	6.78%	8.68%	1.31%	7.61%	1.71%	0.78%	2.97%	3.52%	0.95%	5.49%	11.77%	5.47%	7.54%	3.69%	31.74%
2026	6.78%	8.68%	1.31%	7.61%	1.71%	0.78%	2.97%	3.52%	0.95%	5.49%	11.77%	5.47%	7.54%	3.69%	31.74%
2027	6.78%	8.68%	1.31%	7.61%	1.71%	0.78%	2.97%	3.52%	0.95%	5.49%	11.77%	5.47%	7.54%	3.69%	31.74%

**Table F-31. Industrial Electric: Customer Count Forecast**

<b>Year</b>	<b>Industrial</b>
2007	3,802
2008	3,802
2009	3,802
2010	3,802
2011	3,802
2012	3,802
2013	3,802
2014	3,802
2015	3,802
2016	3,802
2017	3,802
2018	3,802
2019	3,802
2020	3,802
2021	3,802
2022	3,802
2023	3,802
2024	3,802
2025	3,802
2026	3,802
2027	3,802

**Table F-32. Industrial Electric: Load Allocation by Building Type**

Year	Food Mfg	Wood Product Mfg	Paper Mfg	Printing Related Support	Chemical Mfg	Petroleum Coal Products	Plastics Rubber Products	Nonmetallic Mineral Products	Primary Metal Mfg	Fabricated Metal Products	Industrial Machinery	Electrical Equipment Mfg	Transportation Equipment Mfg	Computer Electronic Mfg	Miscellaneous Mfg
2007	13.07%	9.04%	3.56%	3.08%	4.83%	0.75%	9.47%	6.07%	0.28%	9.30%	6.66%	5.17%	10.16%	4.50%	14.04%
2008	13.07%	9.04%	3.56%	3.08%	4.83%	0.75%	9.47%	6.07%	0.28%	9.30%	6.66%	5.17%	10.16%	4.50%	14.04%
2009	13.07%	9.04%	3.56%	3.08%	4.83%	0.75%	9.47%	6.07%	0.28%	9.30%	6.66%	5.17%	10.16%	4.50%	14.04%
2010	13.07%	9.04%	3.56%	3.08%	4.83%	0.75%	9.47%	6.07%	0.28%	9.30%	6.66%	5.17%	10.16%	4.50%	14.04%
2011	13.07%	9.04%	3.56%	3.08%	4.83%	0.75%	9.47%	6.07%	0.28%	9.30%	6.66%	5.17%	10.16%	4.50%	14.04%
2012	13.07%	9.04%	3.56%	3.08%	4.83%	0.75%	9.47%	6.07%	0.28%	9.30%	6.66%	5.17%	10.16%	4.50%	14.04%
2013	13.07%	9.04%	3.56%	3.08%	4.83%	0.75%	9.47%	6.07%	0.28%	9.30%	6.66%	5.17%	10.16%	4.50%	14.04%
2014	13.07%	9.04%	3.56%	3.08%	4.83%	0.75%	9.47%	6.07%	0.28%	9.30%	6.66%	5.17%	10.16%	4.50%	14.04%
2015	13.07%	9.04%	3.56%	3.08%	4.83%	0.75%	9.47%	6.07%	0.28%	9.30%	6.66%	5.17%	10.16%	4.50%	14.04%
2016	13.07%	9.04%	3.56%	3.08%	4.83%	0.75%	9.47%	6.07%	0.28%	9.30%	6.66%	5.17%	10.16%	4.50%	14.04%
2017	13.07%	9.04%	3.56%	3.08%	4.83%	0.75%	9.47%	6.07%	0.28%	9.30%	6.66%	5.17%	10.16%	4.50%	14.04%
2018	13.07%	9.04%	3.56%	3.08%	4.83%	0.75%	9.47%	6.07%	0.28%	9.30%	6.66%	5.17%	10.16%	4.50%	14.04%
2019	13.07%	9.04%	3.56%	3.08%	4.83%	0.75%	9.47%	6.07%	0.28%	9.30%	6.66%	5.17%	10.16%	4.50%	14.04%
2020	13.07%	9.04%	3.56%	3.08%	4.83%	0.75%	9.47%	6.07%	0.28%	9.30%	6.66%	5.17%	10.16%	4.50%	14.04%
2021	13.07%	9.04%	3.56%	3.08%	4.83%	0.75%	9.47%	6.07%	0.28%	9.30%	6.66%	5.17%	10.16%	4.50%	14.04%
2022	13.07%	9.04%	3.56%	3.08%	4.83%	0.75%	9.47%	6.07%	0.28%	9.30%	6.66%	5.17%	10.16%	4.50%	14.04%
2023	13.07%	9.04%	3.56%	3.08%	4.83%	0.75%	9.47%	6.07%	0.28%	9.30%	6.66%	5.17%	10.16%	4.50%	14.04%
2024	13.07%	9.04%	3.56%	3.08%	4.83%	0.75%	9.47%	6.07%	0.28%	9.30%	6.66%	5.17%	10.16%	4.50%	14.04%
2025	13.07%	9.04%	3.56%	3.08%	4.83%	0.75%	9.47%	6.07%	0.28%	9.30%	6.66%	5.17%	10.16%	4.50%	14.04%
2026	13.07%	9.04%	3.56%	3.08%	4.83%	0.75%	9.47%	6.07%	0.28%	9.30%	6.66%	5.17%	10.16%	4.50%	14.04%
2027	13.07%	9.04%	3.56%	3.08%	4.83%	0.75%	9.47%	6.07%	0.28%	9.30%	6.66%	5.17%	10.16%	4.50%	14.04%

**Table F-33. Industrial Gas: Sales Forecast (therms)**

<b>Year</b>	<b>Industrial</b>
2007	49,033,697
2008	48,123,643
2009	48,234,060
2010	48,028,038
2011	48,411,544
2012	48,643,427
2013	48,868,308
2014	48,716,974
2015	48,519,827
2016	47,895,274
2017	47,312,668
2018	47,137,658
2019	46,877,308
2020	46,526,645
2021	46,090,061
2022	45,399,275
2023	44,883,716
2024	44,606,476
2025	44,363,677
2026	44,139,225
2027	43,909,362

**Table F-34. Industrial Gas: Building Type Allocation**

Year	Food Mfg	Wood Product Mfg	Paper Mfg	Printing Related Support	Chemical Mfg	Petroleum Coal Products	Plastics Rubber Products	Nonmetallic Mineral Products	Primary Metal Mfg	Fabricated Metal Products	Industrial Machinery	Electrical Equipment Mfg	Transportation Equipment Mfg	Computer Electronic Mfg	Miscellaneous Mfg
2007	8.87%	5.78%	0.79%	6.17%	2.79%	0.26%	1.58%	4.60%	1.28%	10.15%	10.77%	6.01%	7.88%	2.59%	30.48%
2008	8.87%	5.78%	0.79%	6.17%	2.79%	0.26%	1.58%	4.60%	1.28%	10.15%	10.77%	6.01%	7.88%	2.59%	30.48%
2009	8.87%	5.78%	0.79%	6.17%	2.79%	0.26%	1.58%	4.60%	1.28%	10.15%	10.77%	6.01%	7.88%	2.59%	30.48%
2010	8.87%	5.78%	0.79%	6.17%	2.79%	0.26%	1.58%	4.60%	1.28%	10.15%	10.77%	6.01%	7.88%	2.59%	30.48%
2011	8.87%	5.78%	0.79%	6.17%	2.79%	0.26%	1.58%	4.60%	1.28%	10.15%	10.77%	6.01%	7.88%	2.59%	30.48%
2012	8.87%	5.78%	0.79%	6.17%	2.79%	0.26%	1.58%	4.60%	1.28%	10.15%	10.77%	6.01%	7.88%	2.59%	30.48%
2013	8.87%	5.78%	0.79%	6.17%	2.79%	0.26%	1.58%	4.60%	1.28%	10.15%	10.77%	6.01%	7.88%	2.59%	30.48%
2014	8.87%	5.78%	0.79%	6.17%	2.79%	0.26%	1.58%	4.60%	1.28%	10.15%	10.77%	6.01%	7.88%	2.59%	30.48%
2015	8.87%	5.78%	0.79%	6.17%	2.79%	0.26%	1.58%	4.60%	1.28%	10.15%	10.77%	6.01%	7.88%	2.59%	30.48%
2016	8.87%	5.78%	0.79%	6.17%	2.79%	0.26%	1.58%	4.60%	1.28%	10.15%	10.77%	6.01%	7.88%	2.59%	30.48%
2017	8.87%	5.78%	0.79%	6.17%	2.79%	0.26%	1.58%	4.60%	1.28%	10.15%	10.77%	6.01%	7.88%	2.59%	30.48%
2018	8.87%	5.78%	0.79%	6.17%	2.79%	0.26%	1.58%	4.60%	1.28%	10.15%	10.77%	6.01%	7.88%	2.59%	30.48%
2019	8.87%	5.78%	0.79%	6.17%	2.79%	0.26%	1.58%	4.60%	1.28%	10.15%	10.77%	6.01%	7.88%	2.59%	30.48%
2020	8.87%	5.78%	0.79%	6.17%	2.79%	0.26%	1.58%	4.60%	1.28%	10.15%	10.77%	6.01%	7.88%	2.59%	30.48%
2021	8.87%	5.78%	0.79%	6.17%	2.79%	0.26%	1.58%	4.60%	1.28%	10.15%	10.77%	6.01%	7.88%	2.59%	30.48%
2022	8.87%	5.78%	0.79%	6.17%	2.79%	0.26%	1.58%	4.60%	1.28%	10.15%	10.77%	6.01%	7.88%	2.59%	30.48%
2023	8.87%	5.78%	0.79%	6.17%	2.79%	0.26%	1.58%	4.60%	1.28%	10.15%	10.77%	6.01%	7.88%	2.59%	30.48%
2024	8.87%	5.78%	0.79%	6.17%	2.79%	0.26%	1.58%	4.60%	1.28%	10.15%	10.77%	6.01%	7.88%	2.59%	30.48%
2025	8.87%	5.78%	0.79%	6.17%	2.79%	0.26%	1.58%	4.60%	1.28%	10.15%	10.77%	6.01%	7.88%	2.59%	30.48%
2026	8.87%	5.78%	0.79%	6.17%	2.79%	0.26%	1.58%	4.60%	1.28%	10.15%	10.77%	6.01%	7.88%	2.59%	30.48%
2027	8.87%	5.78%	0.79%	6.17%	2.79%	0.26%	1.58%	4.60%	1.28%	10.15%	10.77%	6.01%	7.88%	2.59%	30.48%

**Table F-35. Industrial Gas: Customer Count Forecast**

<b>Year</b>	<b>Industrial</b>
2007	31,917
2008	31,917
2009	31,917
2010	31,917
2011	31,917
2012	31,917
2013	31,917
2014	31,917
2015	31,917
2016	31,917
2017	31,917
2018	31,917
2019	31,917
2020	31,917
2021	31,917
2022	31,917
2023	31,917
2024	31,917
2025	31,917
2026	31,917
2027	31,917

**Table F-36. Industrial Gas: Load Allocation by Building Type**

Year	Food Mfg	Wood Product Mfg	Paper Mfg	Printing Related Support	Chemical Mfg	Petroleum Coal Products	Plastics Rubber Products	Nonmetallic Mineral Products	Primary Metal Mfg	Fabricated Metal Products	Industrial Machinery	Electrical Equipment Mfg	Transportation Equipment Mfg	Computer Electronic Mfg	Miscellaneous Mfg
2007	24.44%	4.95%	2.57%	1.60%	5.55%	0.86%	5.42%	10.10%	2.25%	12.63%	6.66%	1.68%	6.10%	0.96%	14.22%
2008	24.44%	4.95%	2.57%	1.60%	5.55%	0.86%	5.42%	10.10%	2.25%	12.63%	6.66%	1.68%	6.10%	0.96%	14.22%
2009	24.44%	4.95%	2.57%	1.60%	5.55%	0.86%	5.42%	10.10%	2.25%	12.63%	6.66%	1.68%	6.10%	0.96%	14.22%
2010	24.44%	4.95%	2.57%	1.60%	5.55%	0.86%	5.42%	10.10%	2.25%	12.63%	6.66%	1.68%	6.10%	0.96%	14.22%
2011	24.44%	4.95%	2.57%	1.60%	5.55%	0.86%	5.42%	10.10%	2.25%	12.63%	6.66%	1.68%	6.10%	0.96%	14.22%
2012	24.44%	4.95%	2.57%	1.60%	5.55%	0.86%	5.42%	10.10%	2.25%	12.63%	6.66%	1.68%	6.10%	0.96%	14.22%
2013	24.44%	4.95%	2.57%	1.60%	5.55%	0.86%	5.42%	10.10%	2.25%	12.63%	6.66%	1.68%	6.10%	0.96%	14.22%
2014	24.44%	4.95%	2.57%	1.60%	5.55%	0.86%	5.42%	10.10%	2.25%	12.63%	6.66%	1.68%	6.10%	0.96%	14.22%
2015	24.44%	4.95%	2.57%	1.60%	5.55%	0.86%	5.42%	10.10%	2.25%	12.63%	6.66%	1.68%	6.10%	0.96%	14.22%
2016	24.44%	4.95%	2.57%	1.60%	5.55%	0.86%	5.42%	10.10%	2.25%	12.63%	6.66%	1.68%	6.10%	0.96%	14.22%
2017	24.44%	4.95%	2.57%	1.60%	5.55%	0.86%	5.42%	10.10%	2.25%	12.63%	6.66%	1.68%	6.10%	0.96%	14.22%
2018	24.44%	4.95%	2.57%	1.60%	5.55%	0.86%	5.42%	10.10%	2.25%	12.63%	6.66%	1.68%	6.10%	0.96%	14.22%
2019	24.44%	4.95%	2.57%	1.60%	5.55%	0.86%	5.42%	10.10%	2.25%	12.63%	6.66%	1.68%	6.10%	0.96%	14.22%
2020	24.44%	4.95%	2.57%	1.60%	5.55%	0.86%	5.42%	10.10%	2.25%	12.63%	6.66%	1.68%	6.10%	0.96%	14.22%
2021	24.44%	4.95%	2.57%	1.60%	5.55%	0.86%	5.42%	10.10%	2.25%	12.63%	6.66%	1.68%	6.10%	0.96%	14.22%
2022	24.44%	4.95%	2.57%	1.60%	5.55%	0.86%	5.42%	10.10%	2.25%	12.63%	6.66%	1.68%	6.10%	0.96%	14.22%
2023	24.44%	4.95%	2.57%	1.60%	5.55%	0.86%	5.42%	10.10%	2.25%	12.63%	6.66%	1.68%	6.10%	0.96%	14.22%
2024	24.44%	4.95%	2.57%	1.60%	5.55%	0.86%	5.42%	10.10%	2.25%	12.63%	6.66%	1.68%	6.10%	0.96%	14.22%
2025	24.44%	4.95%	2.57%	1.60%	5.55%	0.86%	5.42%	10.10%	2.25%	12.63%	6.66%	1.68%	6.10%	0.96%	14.22%
2026	24.44%	4.95%	2.57%	1.60%	5.55%	0.86%	5.42%	10.10%	2.25%	12.63%	6.66%	1.68%	6.10%	0.96%	14.22%
2027	24.44%	4.95%	2.57%	1.60%	5.55%	0.86%	5.42%	10.10%	2.25%	12.63%	6.66%	1.68%	6.10%	0.96%	14.22%

## Appendix G: Conditional Demand Analysis

---

Conditional demand analysis (CDA) was the methodology used for deriving end-use unit energy consumption (UEC) indices in the residential sector. CDA is a statistical regression technique used for disaggregating total consumption into constituent end uses. The analysis typically relies on periodic (annual, daily or hourly) data, structural characteristic, household demographics, appliance saturations, and weather. The generic specification for a CDA model is as follows:

$$kWh\ Use = f(\text{Structural Characteristics, Demographics, Appliance Saturation, Weather, Vintage})$$

Structural characteristics and household demographics are typically represented as categorical or binary variables; while appliance saturations are often represented as binary variables with a value of 1 indicating the presence of the appliance and 0 indicating otherwise. Information on weather is generally entered in terms of heating and cooling degree days (HDD and CDD).

### Data Development

The Residential Energy Study (RES), conducted on 5,575 residential customers in 2003-2004 was the primary source of data on household demographics and appliance stock. The survey data was collated with daily kWh consumption histories for 2,488 (94%) gas customers and 3,368 (85%) electric customers with complete surveys. Due to data quality problems in the surveys and missing values for some of the critical variables, 5,316 cases were retained in the final analysis, comprised of 2,659 gas and 3,943 electric customers.

As a first step in preparation of the data, the daily consumption histories were merged with the survey data. Next, the daily temperature was compiled into this database by mapping information from 11 weather stations in PSE's service area to the surveys by ZIP Code. The 11 weather stations used were: Bellingham, Everett, Olympia, Port Angeles, Renton, SeaTac, Seattle, Tacoma (McChord AFB), Toledo, Wenatchee, and Yakima. From the average daily temperature data, cooling degree days (CDD) with bases of 65° and 70°F, and heating degree days (HDD) with bases of 60° and 65°F were calculated.

The compiled database was then thoroughly examined using statistical screening procedures to identify any data quality problems such as missing values, outliers and other anomalies such as inconsistent survey responses. The data screening and validation process led to the elimination of 15 % of the electric cases and 29% of the gas cases in the database. The data screening process and the disposition of the final database is summarized below.

#### **Electric Accounts**

- Total number of cases: 3343
- Cases passing quality screens: 2834 (85%)
- Cases with incomplete usage data: 195 (6%)
- Vacancies: 140 (4%)



- Inconsistent survey response: 94 (3%)
- Bad or missing square footage: 79 (2%)

### ***Gas Accounts***

- Total number of cases: 2405
- Cases passing quality screens: 1716 (71%)
- Cases with incomplete usage data: 347 (14%)
- Inconsistent survey response: 222 (9%)
- Bad or missing square footage: 70 (3%)
- Vacancies : 48 (2%)

### **Composition of the Final Database**

Once the survey and consumption data were screened and validated, all relevant variables were compiled into one database and merged with weather data. The final database included the following key variables:

### ***Consumption Data***

- Hourly, daily and monthly kWh and therms usage by year (2003-2005)
- Total number of billing days by year
- Maximum usage by year
- Coefficient of variation of usage by year
- Energy use intensity (kWh/ft<sup>2</sup>, therms/ft<sup>2</sup>)

### ***End Use/Appliance Stock Variables***

- Gas/electric heating
- Gas/electric water heating
- Gas/electrically heated spa
- Gas/electric heated pool
- Electric/gas dryer (only if home did not have gas heating/water heating)
- Electric/gas cooking (only if home did not have gas heating/water heating)
- Gas fireplace (only if home did not have gas heating/water heating)
- Electric AC

### ***Home Characteristics & Occupant Data***

- Square footage of home
- Number of heated rooms
- Number of bathrooms
- Number of occupants

## Data Modeling

Separate conditional demand models were specified and estimated by fuel (electricity and gas) and dwelling type (single-family gas and multi-family) and vintage (new, or post-2000, construction, and existing, or pre-2000, structures). Due to the small sample of manufactured homes in the survey, this segment of the residential market was not analyzed separately. Instead, the single family results for various end-uses were calibrated to manufactured homes, using total consumption and occupancy for the adjustment. The final specification of the regression models by fuel and dwelling type are shown below.

### Electric Conditional Demand Model Specification and Results

#### Single-Family

$$\begin{aligned} DAILYKWH_{it} = & \beta_1 ELECTRICHEAT * HDD65_{it} + \beta_2 ELECTRICHEAT * SQFT_i + \\ & \beta_3 HEATPUMP * (HDD60 + CDD70)_{it} + \beta_4 ELECTRICWATERHEAT * TOTOCC_i + \\ & \beta_5 ELECTRICWATERHEAT * HDD65_{it} + \beta_6 ELECTRICDRYER_i + \\ & \beta_7 CENTRAL\_AC * CDD70_{it} + \beta_8 ELECTRICHEAT * VPRE1980_i + \beta_9 ELECTRICHEAT * \\ & V1980-2000_i + \beta_{10} ELECTRICHEAT * VPOST2000_i + \beta_{11} ELECTRICWATERHEAT_i + \\ & \varepsilon_{it} \end{aligned} \quad (1)$$

where,

$DAILYKWH_{it}$  = Daily kWh for customer  $i$  and day  $t$ ;

$ELECTRICHEAT_i$  = 1 if customer  $i$  has electric space heating, 0 otherwise;

$HEATPUMP_i$  = 1 if customer  $i$  has a heat pump, 0 otherwise;

$ELECTRICWATERHEAT_i$  = 1 if customer  $i$  has electric water heating, 0 otherwise;

$ELECTRICDRYER_i$  = 1 if customer  $i$  has an electric dryer, 0 otherwise;

$CENTRAL\_AC_i$  = 1 if customer  $i$  has a central air conditioner, 0 otherwise;

$SQFT_i$  = Heated square footage of home for customer  $i$ ;

$HDD60_i$  = Heating degree days (base 60°F) for customer  $i$  and day  $t$ ;

$HDD65_i$  = Heating degree days (base 65°F) for customer  $i$  and day  $t$ ;

$CDD70_i$  = Cooling degree days (base 70°F) for customer  $i$  and day  $t$ ;

$TOTOCC_i$  = Number of occupants in home for customer  $i$ ;

$VPRE1980_i$  = 1 if home was built before 1980 for customer  $i$ ;

$V1980\_2000_i$  = 1 if home was built between 1980 and 2000 for customer  $i$ ;

$VPOST2000_i$  = 1 if home was built after 2000 for customer  $i$ ; and

$\varepsilon_{it}$  = Error term for customer  $i$  and day  $t$ ;

The estimated parameters and the associated t-tests of statistical significance are shown in Table G-1. All estimated parameters are statistically significant at a 99% confidence level.

**Table G-1. Electric Single-Family Conditional Demand Model Results**

Variable	Parameter Estimate	T-test
R <sup>2</sup> = 0.40		
Intercept	24.32	410.3
Elecheathdd	1.36	179.3
Elecheatsqft	0.006	63.0
heatpumpdd60_70	1.71	174.4
Elecwhocc	5.00	166.5
Elecwhhdd	0.56	109.6
Electdry	1.76	26.7
Centralcdd	2.58	81.1
elecheat_pre80	-10.92	-59.1
elecheat_80_00	-16.09	-78.1
elecheat_post00	-24.3	-54.4
Elecwh	-10.50	-92.7

### **Multifamily**

$$\begin{aligned}
 DAILYKWH_{it} = & \beta_1 ELECTRICHEAT * HDD65_{it} + \beta_2 ELECTRICHEAT * SQFT_i + \beta_3 HEATPUMP * (HDD60 + CDD70)_{it} + \beta_4 ELECTRICWATERHEAT * TOTOCC_i + \\
 & \beta_5 ELECTRICWATERHEAT * HDD65_{it} + \beta_6 ELECTRICDRYER_i + \beta_7 CENTRAL\_AC * CDD70_{it} + \beta_8 ELECTRICHEAT * VPRE1980_i + \beta_9 ELECTRICHEAT * \\
 & V1980-2000_i + \beta_{10} ELECTRICHEAT * VPOST 2000_i + \beta_{11} ELECTRICWATERHEAT_i + \varepsilon_{it}
 \end{aligned} \tag{2}$$

where,

$DAILYKWH_{it}$  = Daily kWh for customer  $i$  and day  $t$ ;

$ELECTRICHEAT_i$  = 1 if customer  $i$  has electric space heating, 0 otherwise;

$HEATPUMP_i$  = 1 if customer  $i$  has a heat pump, 0 otherwise;

$ELECTRICWATERHEAT_i$  = 1 if customer  $i$  has electric water heating, 0 otherwise;

$ELECTRICDRYER_i$  = 1 if customer  $i$  has an electric dryer, 0 otherwise;

$CENTRAL\_AC_i$  = 1 if customer  $i$  has a central air conditioner, 0 otherwise;

$SQFT_i$  = Heated square footage of home for customer  $i$ ;

$HDD60_i$  = Heating degree days (base 60°F) for customer  $i$  and day  $t$ ;

$HDD65_i$  = Heating degree days (base 65°F) for customer  $i$  and day  $t$ ;

$CDD70_i$  = Cooling degree days (base 70°F) for customer  $i$  and day  $t$ ;

$TOTOCC_i$  = Number of occupants in home for customer  $i$ ;  
 $VPRE1980_i$  = 1 if home was built before 1980 for customer  $i$ ;  
 $V1980\_2000_i$  = 1 if home was built between 1980 and 2000 for customer  $i$ ;  
 $VPOST2000_i$  = 1 if home was built after 2000 for customer  $i$ ; and  
 $\varepsilon_{it}$  = Error term for customer  $i$  and day  $t$ ;

The estimated parameters and the associated t-tests of statistical significance are shown in Table G-2. All estimated parameters are statistically significant at a 99% confidence level.

**Table G-2. Electric Multifamily Conditional Demand Model Results**

Variable	Parameter Estimate	T-test
$R^2 = 0.40$		
Intercept	16.73	133.1
elecheathdd	0.17	16.9
elecheatsqft	0.0018	22.4
heatpumpdd60_70	2.14	60.8
elecwhocc	4.66	92.4
elecwhhdd	0.82	83.9
centralcdd	2.67	15.8
roomcdd	1.34	8.9
elecheat_pre80	3.80	24.6
elecheat_80_00	-0.73	-5.5
elecheat_post00	-1.66	-4.8
elecwh	-12.79	-64.7

Because of high co-linearity between electric water heat and its interactions with HDD and occupants, the sign on the water heat indicator is wrong. However, when the final UECs are obtained the total water heat UEC is still reasonable.

## Gas Model Specification and Results

### Single-Family

$$\begin{aligned}
 DAILYTHERMS_{it} = & \beta_1 GASSPA_i + \beta_2 GASDRYER_i + \beta_3 GASCOOKING_i + \\
 & \beta_4 GASFIREPLACE_i + \beta_5 GASHEAT * SQFT_i + \beta_6 GASHEAT * HDD65_{it} + \\
 & \beta_7 GASWATERHEAT * TOTOCC_i + \beta_8 GASHEAT * VPRE1980_i + \beta_9 GASHEAT * V1980- \\
 & 2000_i + \beta_{10} GASHEAT * VPOST\ 2000_i + \varepsilon_{it}
 \end{aligned} \tag{3}$$

where,

$DAILYTHERMS_{it}$  = Daily therms for customer  $i$  and day  $t$ ;  
 $GASSPA_i$  = 1 if customer  $i$  has a gas heated spa, 0 otherwise;  
 $GASDRYER_i$  = 1 if customer  $i$  has a gas dryer, 0 otherwise;  
 $GASCOOKING_i$  = 1 if customer  $i$  has a gas stove/oven, 0 otherwise;  
 $GASFIREPLACE_i$  = 1 if customer  $i$  has a gas fireplace, 0 otherwise;  
 $GASHEAT_i$  = 1 if customer  $i$  has gas space heating, 0 otherwise;  
 $GASWATERHEAT_i$  = 1 if customer  $i$  has gas water heating, 0 otherwise;  
 $SQFT_i$  = Heated square footage of home for customer  $i$ ;  
 $HDD65_{it}$  = Heating degree days (base 65°F) for customer  $i$  and day  $t$ ;  
 $TOTOCC_i$  = Number of occupants in home for customer  $i$ ;  
 $VPRE1980_i$  = 1 if home was built before 1980 for customer  $i$ , 0 otherwise;  
 $VI980\_2000_i$  = 1 if home was built between 1980 and 2000 for customer  $i$ , 0 otherwise;  
 $VPOST2000_i$  = 1 if home was built after 2000 for customer  $i$ , 0 otherwise; and  
 $\varepsilon_{it}$  = Error term for customer  $i$  and day  $t$ .

The estimated parameters and the associated t-tests of statistical significance are shown in Table G-3. All estimated parameters are statistically significant at a 99% confidence level.

**Table G-3. Estimated Parameters (Single-Family)**

Variable	Parameter Estimate	T-test
$R^2 = .80$		
GASSPA	0.27	21.9
GASDRY	0.14	27.9
GASCOOK	0.20	50.0
GASFP	0.21	48.4
GASHEATSQFT	0.00024	108.5
GASHEATHDD	0.14	746.5
GASWHOCC	0.22	214.3
GASHEAT_pre80	-0.77	-139.0
GASHEAT_80_00	-0.96	-150.3
GASHEAT_post00	-1.22	-117.6

## Multifamily

$$DAILYTHERMS_{it} = \beta_1 GASDRYER_i + \beta_2 GASCOOKING_i + \beta_3 GASFIREPLACE_i + \beta_4 GASHEAT * AVGHDD65_{it} + \beta_5 GASWATERHEAT * TOTOCC_i + \beta_6 GASHEAT * VPRE1980_i + \beta_7 GASHEAT * V1980-2000_i + \beta_8 GASHEAT * VPOST 2000_i + \varepsilon_{it} \quad (4)$$

where,

$DAILYTHERMS_{it}$  = Daily therms for customer  $i$  and day  $t$ ;

$GASDRYER_i$  = 1 if customer  $i$  has a gas dryer, 0 otherwise;

$GASCOOKING_i$  = 1 if customer  $i$  has a gas stove/oven, 0 otherwise;

$GASFIREPLACE_i$  = 1 if customer  $i$  has a gas fireplace, 0 otherwise;

$GASHEAT_i$  = 1 if customer  $i$  has gas space heating, 0 otherwise;

$GASWATERHEAT_i$  = 1 if customer  $i$  has gas water heating, 0 otherwise;

$AVGHDD65_i$  = Heating degree days (base 65°F) for customer  $i$  and day  $t$ ;

$TOTOCC_i$  = Number of occupants in home for customer  $i$ ;

$VPRE1980_i$  = 1 if home was built before 1980 for customer  $i$ , 0 otherwise;

$V1980\_2000_i$  = 1 if home was built between 1980 and 2000 for customer  $i$ , 0 otherwise;

$VPOST2000_i$  = 1 if home was built after 2000 for customer  $i$ , 0 otherwise; and

$\varepsilon_{it}$  = Error term for customer  $i$  and day  $t$ .

The estimated parameters and the associated t-tests of statistical significance are shown in Table G-4. All estimated parameters are statistically significant at a 99% confidence level.

**Table G–4. Estimated Parameters (Multifamily)**

Variable	Parameter Estimate	T-test
R <sup>2</sup> = .70		
GASDRY	0.12	6.4
GASCOOK	0.12	13.4
GASFP	0.30	29.3
GASHEATHDD	0.08	121.9
GASWHOCC	0.40	96.0
GASHEAT_pre80	-0.19	-13.2
GASHEAT_80_00	-0.30	-22.9
GASHEAT_post00	-0.45	-15.9

## Derivation of End-Use Consumption (UEC) Indices

Once the conditional demand models parameters were estimated, the average use per end-use customer was derived by multiplying the estimated coefficients by the average values of the independent variables in the model to obtain UECs. In the case of CDD- and HDD-independent variable interactions, long-run heating and cooling degree days were used instead of the actual values.<sup>4</sup> The procedures for calculation of average use per customer and UECs for each vintage (v) are analytically shown below.

### Electric UECs

$$\begin{aligned} \text{AverageUsePerCustomer\_SPACEHEAT}_v = & \beta_5 * \text{ELECTRICHEAT} * \text{SQFT\_AVG}_v + \beta_6 * \text{ELECTRICHEAT} * \text{LRHDD65\_AVG}_v + \\ & \beta_8 * \text{ELECTRICHEAT\_VPRE1980\_AVG}_v + \beta_9 * \text{ELECTRICHEAT\_V1980-2000\_AVG}_v + \\ & \beta_{10} * \text{ELECTRICHEAT} * \text{VPOST 2000\_AVG}_v \end{aligned} \quad (5)$$

$$\text{AverageUsePerCustomer\_WATERHEAT}_v = \beta_7 * \text{ELECTRICWATERHEAT} * \text{TOTOCC\_AVG}_v \quad (6)$$

$$\text{AverageUsePerCustomer\_DRYER}_v = \beta_2 * \text{ELECTRICDRYER\_AVG}_v \quad (7)$$

$$\text{UEC}_{ve} = \text{AverageUsePerCustomer}_{ve} / \text{Enduse Saturation}_{ve} \quad (8)$$

<sup>4</sup> Normal heating degree days are base 65, from NOAA “normal” from 1970-2000.

## Single-Family Electric

**Table G–5. Single-Family Electric Averages by Vintage**

Variable	Overall	Pre 1980	1980-2000	Post 2000
Elecheathdd	1.94	2.16	1.69	0.97
Elecheatsqft	242.4	260.8	224.4	114.3
heatpumpdd60_70	0.40	0.42	0.38	0.15
Elecwhocc	0.91	1.10	0.73	0.29
Elecwhhdd	4.78	6.06	3.40	1.79
Elecdry	0.84	0.86	0.83	0.83
Centralcdd	0.08	0.07	0.09	0.11
elecheat_pre80	0.09	0.17	0	0
elecheat_80_00	0.05	0	0.13	0
elecheat_post00	0.003	0	0	0.07
<i>Avg Daily Use</i>	<i>32.2</i>	<i>33.2</i>	<i>31.6</i>	<i>25.8</i>
<i>2003 HDD</i>	<i>4746</i>	<i>4721</i>	<i>4782</i>	<i>4844</i>
<i>NORMAL HDD</i>	<i>5042</i>	<i>5053</i>	<i>5025</i>	<i>5034</i>
<i>2003 CDD</i>	<i>234</i>	<i>246</i>	<i>217</i>	<i>220</i>
<i>NORMAL CDD</i>	<i>152</i>	<i>159</i>	<i>141</i>	<i>143</i>
<i>Elecwh</i>	<i>0.37</i>	<i>0.47</i>	<i>0.26</i>	<i>0.13</i>
<i>Elecheat</i>	<i>0.15</i>	<i>0.17</i>	<i>0.13</i>	<i>0.07</i>
<i>Heatpump</i>	<i>0.04</i>	<i>0.05</i>	<i>0.04</i>	<i>0.02</i>
<i>Centac</i>	<i>0.13</i>	<i>0.11</i>	<i>0.16</i>	<i>0.18</i>
<i>Roomac</i>	<i>0.05</i>	<i>0.05</i>	<i>0.04</i>	<i>0.11</i>

**Table G–6. Single-Family Electric UEC and Average Use Per Customer—Contribution of Individual Coefficients**

Variable	AVERAGE USE PER CUSTOMER				UEC			
	Overall	pre80	80-00	post 00	Overall	pre80	80-00	post 00
elecheathdd	1023	1145	878	498	6847	6857	6819	6832
elecheatsqft	512	551	474	242	3428	3302	3681	3317
heatpumpdd60_70	251	264	236	94	5778	5780	5805	5476
Elecwhocc	1658	2007	1327	529	4514	4303	5061	3925
Elecwhhdd	1037	1324	734	380	2824	2839	2800	2815
Elecdry	543	553	532	531	642	642	642	642
Centralcdd	51	45	57	66	384	410	365	370
elecheat_pre80	-345	-665	0	0	-2306	-3987	0	0
elecheat_80_00	-319	0	-757	0	-2136	0	-5874	0
elecheat_post00	-28	0	0	-647	-187	0	0	-8880
Elecwh	-1407	-1786	-1004	-517	-3831	-3831	-3831	-3831



**Table G–7. Single-Family Electric UEC and Average Use Per Customer—End Use Totals**

Enduse	AVERAGE USE PER CUSTOMER				UEC			
	Overall	Pre80	80-2000	Post20 00	Overall	Pre80	80-2000	Post 2000
HEATING	844	1030	596	92	5647	6172	4626	1268
BASE LOAD	8877	8877	8877	8877	8877	8877	8877	8877
WATER HEAT	1288	1544	1056	392	3507	3311	4030	2908
DRYER	543	553	532	531	642	642	642	642
CENTRAL AC	51	45	57	66	384	410	365	370
HEAT PUMP	251	264	236	94	5778	5780	5805	5476
TOTAL	11853	12313	11354	10053				

**Table G–8. Multifamily Electric Averages by Vintage**

Variable	Overall	Pre 1980	1980-2000	Post 2000
Elecheathdd	9.03	9.58	8.61	7.77
Elecheatsqft	791.4	853.7	761.7	1267.5
heatpumpdd60_70	0.11	0.37	0.06	0
Elecwhocc	1.65	1.77	1.55	0.99
Elecwhhdd	10.97	11.44	10.45	7.77
Electdry	0.012	0.015	0.017	0
Centralcdd	0.015	0.041	0.007	0.044
elecheat_pre80	0.180	0.753	0	0
elecheat_80_00	0.336	0	0.676	0
elecheat_post00	0.023	0	0	0.588
<i>Avg Daily Use</i>	<i>26.19</i>	<i>30.74</i>	<i>24.87</i>	<i>21.88</i>
<i>2003 HDD</i>	<i>4656</i>	<i>4641</i>	<i>4652</i>	<i>4828</i>
<i>NORMAL HDD</i>	<i>5006</i>	<i>5008</i>	<i>5004</i>	<i>5015</i>
<i>2003 CDD</i>	<i>216</i>	<i>330</i>	<i>146</i>	<i>358</i>
<i>NORMAL CDD</i>	<i>148</i>	<i>139</i>	<i>149</i>	<i>218</i>
Elecwh	0.86	0.89	0.82	0.59
<i>Elecheat</i>	<i>0.71</i>	<i>0.75</i>	<i>0.68</i>	<i>0.59</i>
<i>Heatpump</i>	<i>0.013</i>	<i>0.044</i>	<i>0.006</i>	<i>0</i>
<i>Centac</i>	<i>0.024</i>	<i>0.018</i>	<i>0.035</i>	<i>0</i>
<i>Roomac</i>	<i>0.023</i>	<i>0.046</i>	<i>0.017</i>	<i>0.044</i>

**Table G–9. Multifamily Electric UEC and Average Use Per Customer—Contribution of Individual Coefficients**

Variable	AVERAGE USE PER CUSTOMER				UEC			
	Overall	pre80	80-00	post 00	Overall	pre80	80-00	post 00
elecheatddd	600	638	572	499	845	847	847	848
elecheatsqft	529	570	509	847	745	757	753	1440
heatpumpdd60_70	92	288	47	0	6825	6543	7816	NA
Elecwhocc	2817	3018	2647	1693	3281	3381	3240	2880
Elecwhhdd	3548	3713	3382	2430	4133	4161	4140	4134
Elecdry	8	6	17	0	341	358	477	NA
Centralcdd	5	9	3	13	226	187	199	292
elecheat_pre80	249	1045	0	0	351	1387	0	0
elecheat_80_00	-90	0	-181	0	-127	0	-268	0
elecheat_post00	-14	0	0	-357	-20	0	0	-608
Elecwh	-4007	-4165	-3812	-2743	-4667	-4667	-4667	-4667

**Table G–10. Multifamily Electric UEC and Average Use Per Customer—End Use Totals**

Enduse	AVERAGE USE PER CUSTOMER				UEC			
	Overall	pre80	80-00	post 00	Overall	pre80	80-00	post 00
HEATING	1273	2253	900	988	1794	2991	1332	1681
BASE LOAD	6107	6107	6107	6107	6107	6107	6107	6107
WATER HEAT	2358	2566	2217	1379	2747	2875	2714	2347
DRYER	8	6	17	0	341	358	477	NA
CENTRAL AC	5	9	3	13	226	187	199	292
HEAT PUMP	92	288	47	0	6825	6543	7816	NA
TOTAL	9843	11228	9290	8487				

## Gas UECs

Once the conditional demand models are run, the average use per customer is derived by multiplying the coefficients by their averages. In the case of the HDD space heat interaction variable, long run heating degree days were used in place of the actual 2003 averages. The detailed average-use-per-customer calculations for each end use and vintage (v) was calculated as follows:

$$\begin{aligned} \text{AverageUsePerCustomer\_SPACEHEAT}_v = & \beta_5 * \text{GASHEAT} * \text{SQFT\_AVG}_v + \\ & \beta_6 * \text{GASHEAT} * \text{LRHDD65\_AVG}_v + \beta_8 * \text{GASHEAT\_VPRE1980\_AVG}_v + \\ & \beta_9 * \text{GASHEAT\_V1980-2000\_AVG}_v + \beta_{10} * \text{GASHEAT} * \text{VPOST 2000\_AVG}_v \end{aligned} \quad (9)$$

$$\begin{aligned} \text{AverageUsePerCustomer\_WATERHEAT}_v = & \beta_7 * \text{GASWATERHEAT} * \\ & \text{TOTOCC\_AVG}_v \end{aligned} \quad (10)$$

$$\text{AverageUsePerCustomer\_COOKING}_v = \beta_3 * \text{GASCOOKING\_AVG}_v \quad (11)$$

$$\text{AverageUsePerCustomer\_FIREPLACE}_v = \beta_4 * \text{GASFIREPLACE\_AVG}_v \quad (12)$$

$$\text{AverageUsePerCustomer\_SPA}_v = \beta_1 * \text{GASSPA\_AVG}_v \quad (13)$$

$$\text{AverageUsePerCustomer\_DRYER}_v = \beta_2 * \text{GASDRYER\_AVG}_v \quad (14)$$

UECs for vintage  $v$  and end use  $e$  are obtained from the average use per customer by dividing by the end-use saturation as follows:

$$\text{UEC}_{ve} = \text{AverageUsePerCustomer}_{ve} / \text{Enduse Saturation}_{ve} \quad (15)$$

## Single-Family Gas

**Table G–11. Single-Family Gas Averages by Vintage**

Variable	Overall	Pre 1980	1980-2000	Post 2000
GASSPA	0.02	0.01	0.03	0.05
GASDRY	0.16	0.14	0.18	0.22
GASCOOK	0.30	0.28	0.34	0.43
GASFP	0.22	0.14	0.29	0.55
GASHEATSQFT	1788	1711	1927	1688
GASHEATHDD	11.6	11.5	11.7	11.0
GASWHOCC	2.4	2.1	2.7	3.1
GASHEAT_pre80	0.48	0.90	0	0
GASHEAT_80_00	0.36	0	0.89	0
GASHEAT_post00	0.04	0	0	0.84
<i>Avg Daily Use</i>	<i>2.1</i>	<i>2.0</i>	<i>2.1</i>	<i>2.1</i>
<i>2003 HDD</i>	<i>4,787</i>	<i>4,722</i>	<i>4,677</i>	<i>4,788</i>
<i>NORMAL HDD</i>	<i>4,991</i>	<i>4,988</i>	<i>4,975</i>	<i>5,005</i>
<i>GasHeat</i>	0.89	0.90	0.89	0.84
<i>GasWH</i>	0.86	0.80	0.95	0.97

**Table G–12. Single-Family Gas UEC and Average Use Per Customer—Contribution of Individual Coefficients**

Variable	AVERAGE USE PER CUSTOMER				UEC			
	Overall	pre80	80-00	post 00	Overall	pre80	80-00	post 00
GASSPA	2	1	3	5	100	100	100	100
GASDRY	8	7	9	11	50	50	50	50
GASCOOK	22	20	24	31	72	72	72	72
GASFP	17	11	22	42	77	77	77	77
GASHEATSQFT	156	149	168	147	175	166	189	176
GASHEATHDD	633	637	633	594	709	707	711	709
GASWHOCC	193	169	222	253	224	212	235	260
GASHEAT_pre80	-136	-254	0	0	-152	-281	0	0
GASHEAT_80_00	-124	0	-311	0	-139	0	-349	0
GASHEAT_post00	-18	0	0	-372	-20	0	0	-444

**Table G–13. Single-Family Gas UEC and Average Use Per Customer—End Use Totals**

Variable	AVERAGE USE PER CUSTOMER				UEC			
	Overall	pre80	80-00	post 00	Overall	pre80	80-00	post 00
SPACE HEAT	511	533	490	369	572	591	551	441
WATER HEAT	193	169	222	253	224	212	235	260
COOKING	22	20	24	31	72	72	72	72
FIREPLACE	17	11	22	42	77	77	77	77
SPA	2	1	3	5	100	100	100	100
DRYER	8	7	9	11	50	50	50	50
TOTAL	752	740	770	711				

**Multifamily Gas**

**Table G–14. Multifamily Gas Averages by Vintage**

Variable	Overall	Pre 1980	1980-2000	Post 2000
GASDRY	0.09	0.02	0.11	0.10
GASCOOK	0.41	0.57	0.25	0.76
GASFP	0.37	0.12	0.47	0.66
GASHEATHDD	7.3	6.9	8.1	3.8
GASWHOCC	1.2	0.5	1.4	1.3
GASHEAT_pre80	0.18	0.56	0	0
GASHEAT_80_00	0.33	0	0.64	0
GASHEAT_post00	0.04	0	0	0.30
<i>Avg Daily Use</i>	<i>1.1</i>	<i>0.9</i>	<i>1.3</i>	<i>1.1</i>
<i>2003 HDD</i>	<i>4,595</i>	<i>4,510</i>	<i>4,643</i>	<i>4,561</i>
<i>NORMAL HDD</i>	<i>4,943</i>	<i>4,878</i>	<i>4,976</i>	<i>4,958</i>
<i>GasHeat</i>	<i>0.58</i>	<i>0.56</i>	<i>0.64</i>	<i>0.30</i>
<i>GasWH</i>	<i>0.66</i>	<i>0.38</i>	<i>0.80</i>	<i>0.72</i>

**Table G–15. Multifamily Gas UEC and Average Use Per Customer—Contribution of Individual Coefficients**

Variable	AVERAGE USE PER CUSTOMER				UEC			
	Overall	Pre80	80-2000	Post 2000	Overall	Pre80	80-2000	Post 2000
GASDRY	4	1	5	4	42	42	42	42
GASCOOK	18	25	11	34	44	44	44	44
GASFP	41	13	52	72	109	109	109	109
GASHEATHDD	228	218	253	119	397	390	398	397
GASWHOCC	170	71	208	193	257	184	261	268
GASHEAT_pre80	-12	-39	0	0	-22	-70	0	0
GASHEAT_80_00	-37	0	-70	0	-64	0	-111	0
GASHEAT_post00	-6	0	0	-50	-10	0	0	-165

**Table G–16. Multifamily Gas UEC and Average Use Per Customer—End Use Totals**

End Use	AVERAGE USE PER CUSTOMER				UEC			
	Overall	Pre80	80-2000	Post 2000	Overall	Pre80	80-2000	Post 2000
SPACE HEAT	173	179	182	70	301	320	287	232
WATER HEAT	170	71	208	193	257	184	261	268
COOKING	18	25	11	34	44	44	44	44
FIREPLACE	41	13	52	72	109	109	109	109
DRYER	4	1	5	4	42	42	42	42
TOTAL	405	288	458	373				

## Calibration and Final UEC Calculations

The final electric and gas UECs by home type and vintage are summarized in Tables G–17 and G–18. The estimated UECs were calibrated to total annual consumption levels to ensure consistency with the PSE load forecast. In the case of major end uses, such as electric space heating, cooling and water heating, the UECs from the conditional demand models were used directly.

For some end uses, such as cooking, PSE facilities rate tariff conditional demand estimates were substituted for the 2006 conditional demand results. Generally, the 2006 conditional demand estimates provided refinements to the existing PSE facilities rate tariff and the 2001 end-use survey conditional demand estimates. The 2001 and 2006 UECs were compared to other utility and national studies to cross-check each conditional demand model estimate.

The gas UECs from the conditional demand models were all used directly for modeling of conservation potentials—except for cooking, which was too high in 2006 compared to 2001 and other studies. Gas conditional demand model average use per customer was compared to the actual average use per customer by home type, which was available from PSE. The model UECs were considerably lower in the model sample compared to the actual averages. In fact, the single family model usage of 751 kWh was compared to the 2003 actual 877 kWh overall number from PSE. The usages for all single-family UECs were scaled up about 17% to account for this difference. A similar approach was followed for manufactured homes and multifamily homes.

Since the single-family (SF) models were the most reliable, and the multifamily sample sizes were small, only the space heat conditional demand UEC was used for multifamily homes. In order to obtain manufactured home and multifamily UECs, the average number of occupants was used to ratio down the SF water heating, cooking, and drying UECs.

**Table G–17. Final Electric UECs**

End Use	Vintage	Single-Family	Manufactured	Multifamily	UEC Source
Central AC	Existing	384	531	212	Conditional Demand 2006
Central AC	New	370	433	205	Conditional Demand 2006
Cooking	Existing	890	747	670	Conditional Demand 2001 (PSE Facilities Extensions Rate Tariff converted to electric )
Cooking	New	761	639	574	Conditional Demand 2001 (PSE Facilities Extensions Rate Tariff converted to electric)
Dryer	Existing	1275	1070	960	Conditional Demand 2001 (PSE Facilities Extensions Rate Tariff converted to electric)
Dryer	New	868	729	654	Conditional Demand 2001 (PSE Facilities Extensions Rate Tariff converted to electric)
Freezer	Existing	823	808	599	Conditional Demand 2001 (2004 UEC - PSE 2001 End-use Survey)
Freezer	New	593	579	431	Conditional Demand 2001 (2004 UEC - PSE 2001 End-use Survey)
Heat Pump	Existing	4990	5320	1985	Conditional Demand 2001 (2004 UEC - PSE 2001 End-use Survey)
Heat Pump	New	3272	3489	1302	Conditional Demand 2001 (2004 UEC - PSE 2001 End-use Survey)
Lighting	Existing	2240	2227	1514	Conditional Demand 2001 (2004 UEC - PSE 2001 End-use Survey)
Lighting	New	2240	2227	1514	Conditional Demand 2001 (2004 UEC - PSE 2001 End-use Survey)
Plug Load	Existing	3389	1266	1534	Conditional Demand 2001 (2004 UEC - PSE 2001 End-use Survey)
Plug Load	New	3389	1266	1534	Conditional Demand 2001 (2004 UEC - PSE 2001 End-use Survey)
Refrigeration	Existing	848	854	654	Conditional Demand 2001 (2004 UEC - PSE 2001 End-use Survey)
Refrigeration	New	676	680	638	Conditional Demand 2001 (2004 UEC - PSE 2001 End-use Survey)
Room AC	Existing	248	208	186	Conditional Demand 2006
Room AC	New	230	208	177	Conditional Demand 2006
Space Heat	Existing	8008	9184	2773	Conditional Demand 2001 (2004 UEC - PSE 2001 End-use Survey)
Space Heat	New	3817	4070	1519	Conditional Demand 2001 (2004 UEC - PSE 2001 End-use Survey)
Water Heat	Existing	3510	2947	2651	Conditional Demand 2006
Water Heat	New	2908	2441	2191	Conditional Demand 2006

**Table G–18. Final Gas Base UECs**

End Use	Vintage	Single-Family	Manufactured	Multifamily	UEC Source
Cooking	Existing	50	41	36	Conditional Demand 2001 (PSE Facilities Extensions Rate Tariff)
Cooking	New	43	35	30	Conditional Demand 2001 (PSE Facilities Extensions Rate Tariff)
Dryer	Existing	49	40	35	Conditional Demand 2006
Dryer	New	33	27	24	Conditional Demand 2006
Space Heat	Existing	670	405	315	Conditional Demand 2006
Space Heat	New	515	311	245	Conditional Demand 2006
Water Heat	Existing	259	211	184	Conditional Demand 2006
Water Heat	New	304	248	216	Conditional Demand 2006