PSE Conservation Resource Potential Assessment:

Consistency with Power Council's Methodology

November 17th, 2009

PUGET SOUND ENERGY
The Energy To Do Great Things

WAC Rule

- **WAC 480-109-010 Conservation resources.**

  (1)(b) This projection must be derived from and reasonably consistent with one of two sources:

  (i) The utility's most recent IRP, including any information learned in its subsequent resource acquisition process, or the utility must document the reasons for any differences. When developing this projection, utilities must use methodologies that are **consistent** with those used by the conservation council in its most recent regional power plan. A utility may, with full documentation on the rationale for any modification, alter the conservation council's methodologies to better fit the attributes and characteristics of its service territory.

Draft 6th Plan: "Council Methodology"

- "The Northwest Power Act establishes three criteria for resources included in the Council's power plans: resources must be 1) ***reliable***, 2) ***available*** within the time they are needed, and 3) available at an estimated incremental system ***cost*** no greater than that of the least-cost similarly reliable and available alternative."

- "Beginning with first Power Plan in 1983, the Council interpreted these requirements to mean that conservation resources included in the plans must be:
  - **Technically feasible (reliable)**
  - **Economically feasible (lower cost)**
  - **Achievable (available)"**

From Chap 4: Conservation Supply Assumptions – page 4-21 "Council Methodology"

Source for Methodology

- Regional Act
  - and Council interpretation of the Act
- Bottom line
  - Develop cost-effective resources first
- Defines cost-effective conservation
  - "…estimated incremental system cost no greater than that of the least-cost similarly reliable and available alternative measure or resource…"

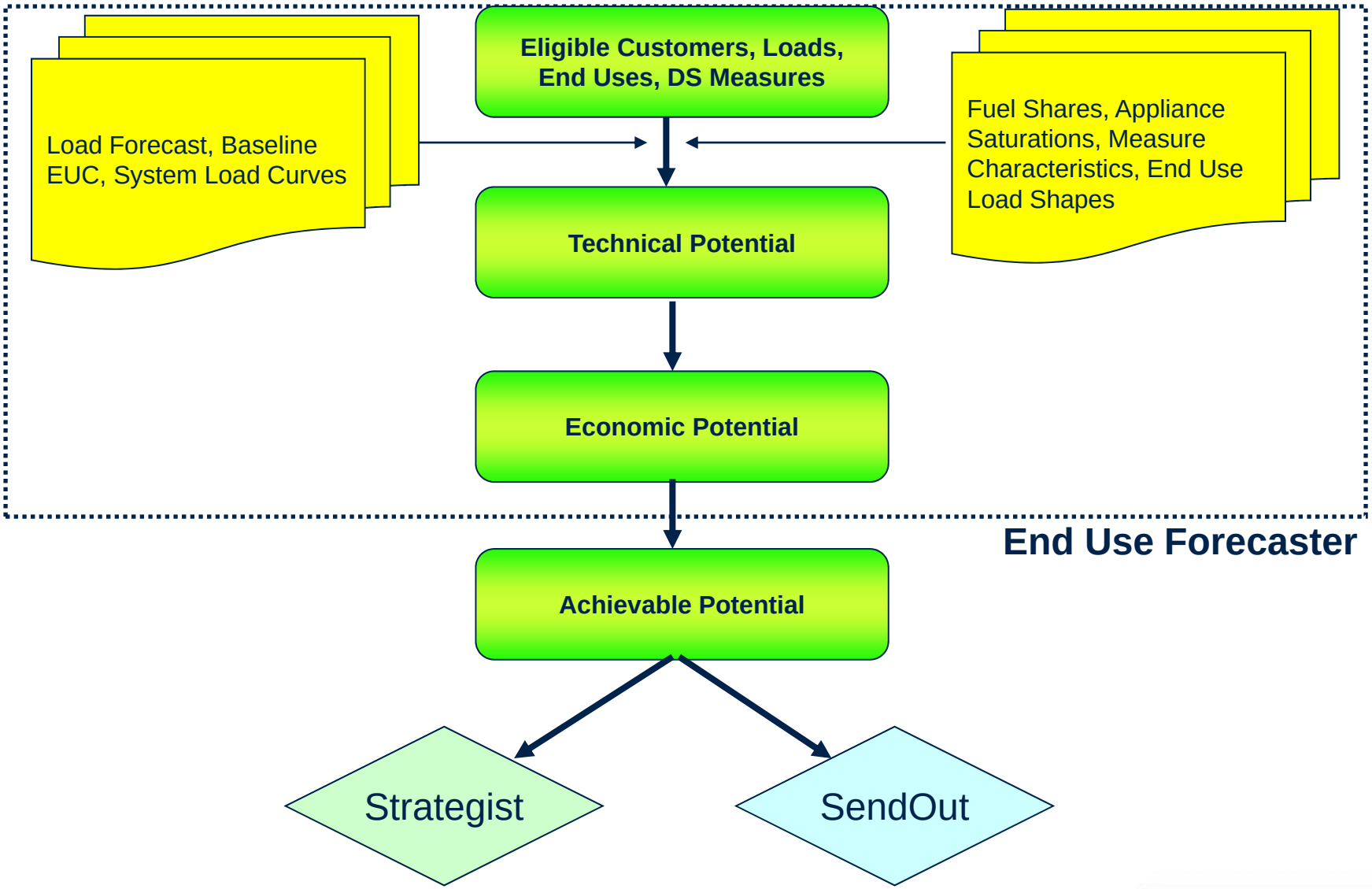
Slide 7 from Tom Eckman's "WA UTC I-937 Workshop" presentation on Sept 3, 2009

Overview of Methodology

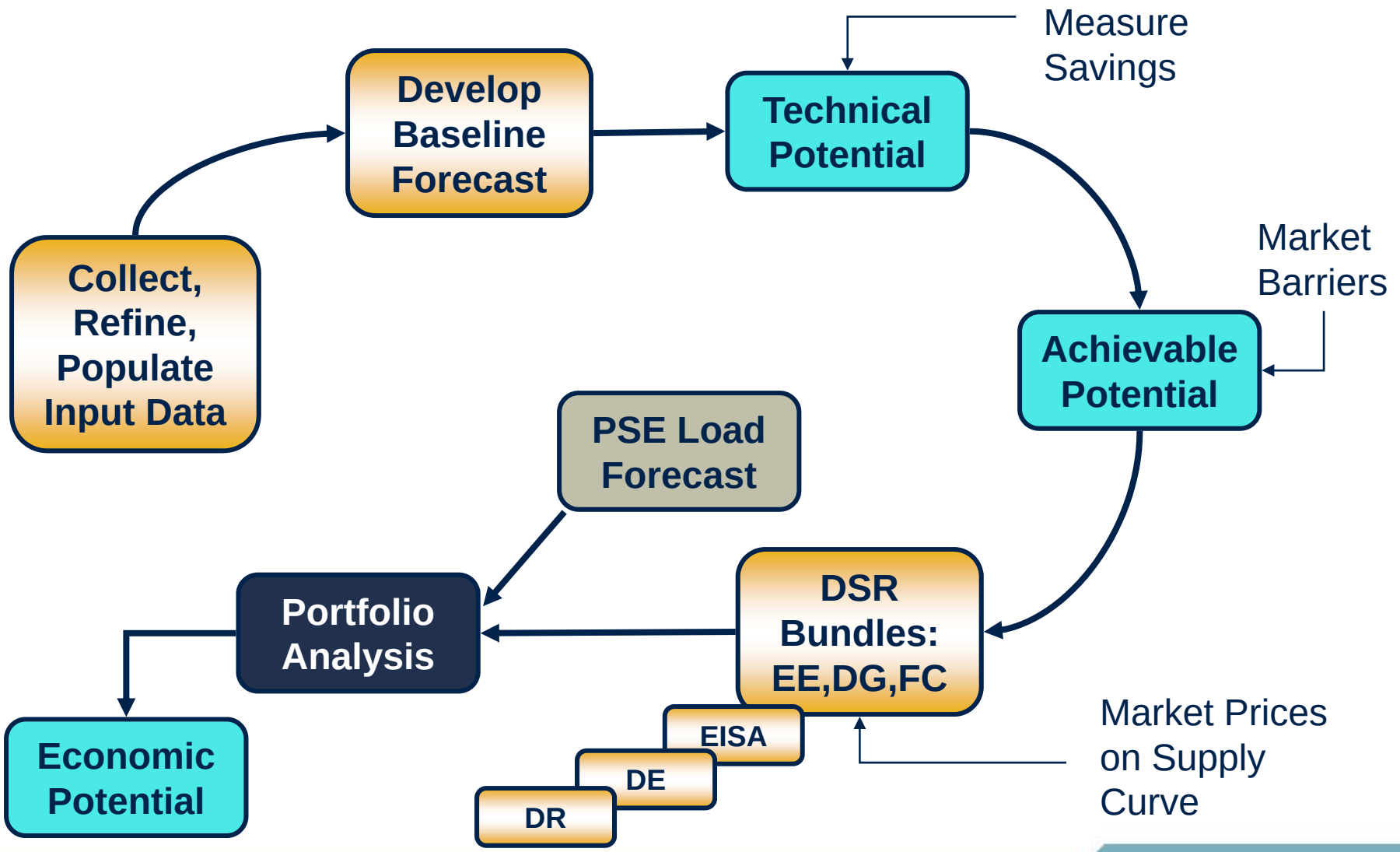
- Resource Potentials Assessment
  - Determines technical availability, achievable potential & cost
- IRP Analysis
  - Determines cost-effectiveness level and “targets”
  - Compares all resources
  - Develops low-cost resources first
  - Results in resource acquisition plans (CRAG process)
    - Targets & budgets & programs for conservation

Slide 6 from Tom Eckman’s “WA UTC I-937 Workshop” presentation on Sept 3, 2009

Demand-Side Resource Screening Tools

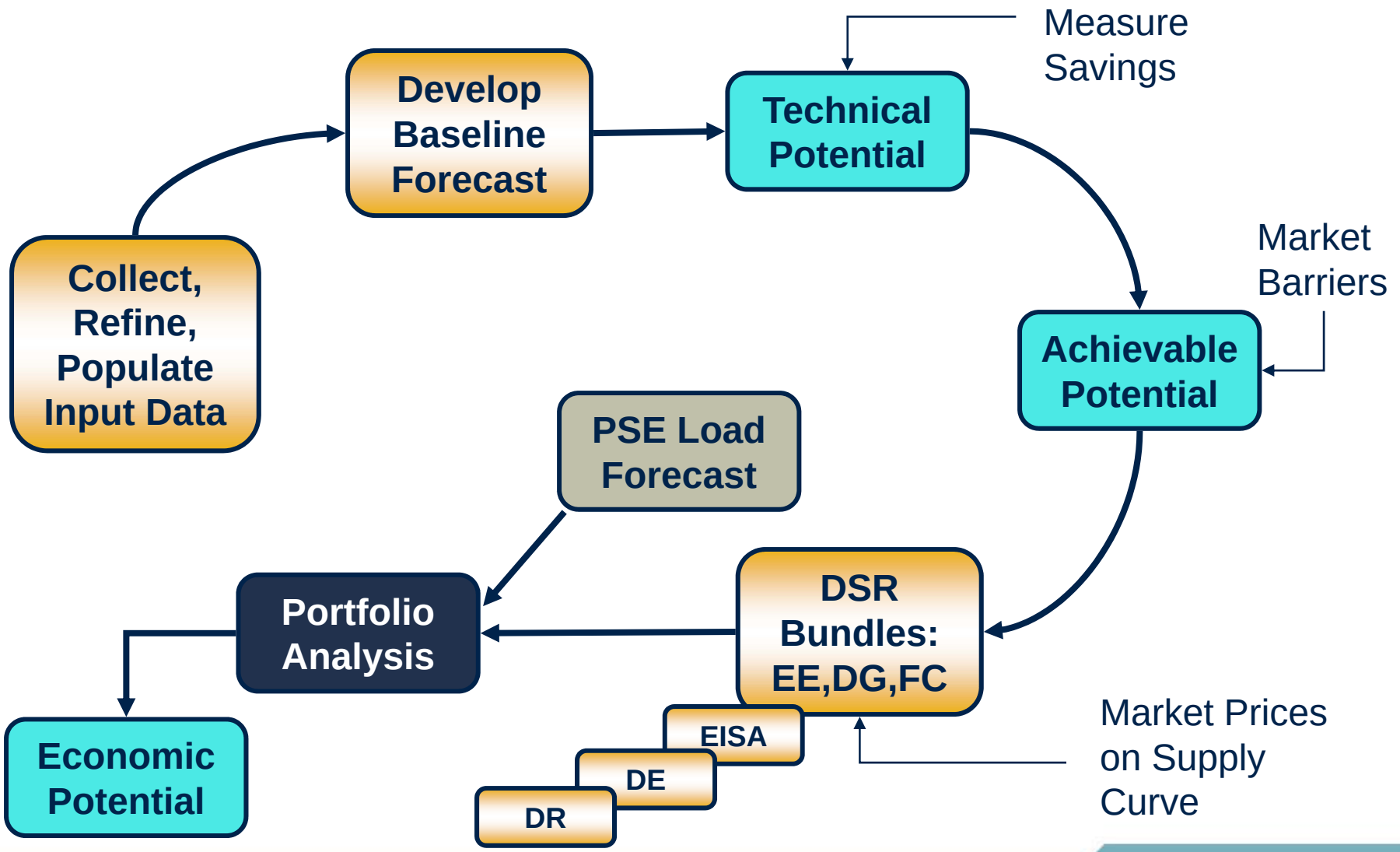


Outline of DS Resources Analysis *2009*



Demand Side Resources Potential Assessment

Outline of DS Resources Analysis *2009*



Technical & Achievable Potential Assessment



Energy Efficiency
Distributed Generation
Fuel Conversion
Demand Response
Distribution Efficiency

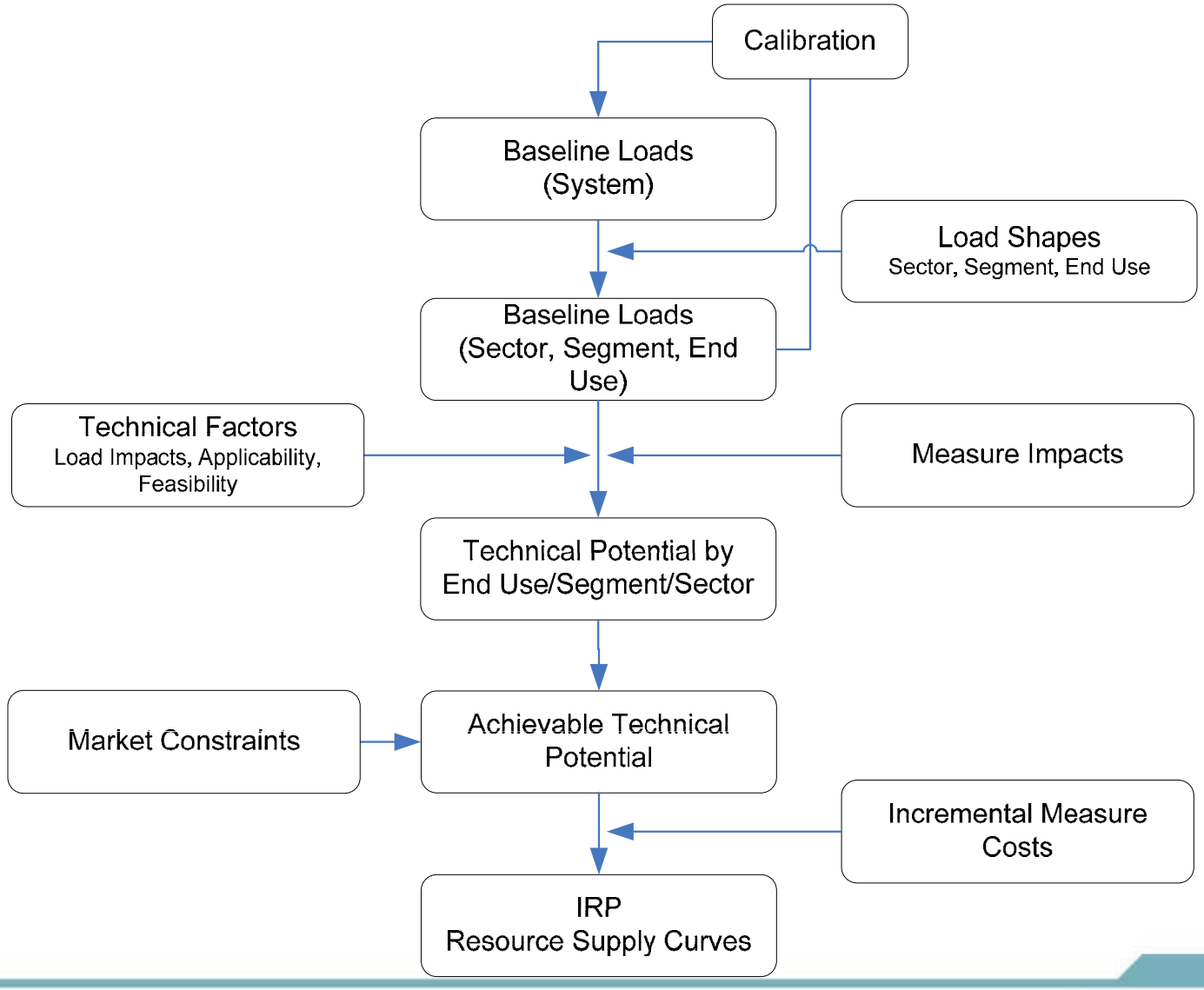
Overview of DSM Analysis

- Data Collection Activities
  - Residential End Use Survey
    - 517 surveys of PSE residential customers to gather information on equipment saturations, fuel shares, and home characteristics
  - Commercial Building Stock Assessment
    - 779 site visits of PSE commercial customers to gather information on equipment saturations, fuel shares, building characteristics, and efficiency measure installations
  - Fuel Conversion Survey
    - 317 surveys of PSE residential electric customers to assess willingness to participate in fuel conversion programs
- DSM Resources Evaluated
  - Energy Efficiency
  - Fuel Conversion
  - Demand Response
  - Distributed Generation/Renewables

Key Differences from 2007 Study

- Energy Efficiency
  - Additional measures considered with updated cost and savings estimates for 2007 measures
  - LED street lighting
  - Updated baseline & measure installation information from data collection efforts
  - Higher administrative and program support costs
- Fuel Conversion
  - Includes customers in Cascade service territory
  - Updated penetration estimates from survey
- Demand Response
  - Residential DLC scenarios
  - Estimates of potential for summer programs
- Distributed Generation
  - Additional technologies included such as gas turbines and small hydro
  - Updated cost and penetration estimates, particularly for PV

Overview of Energy Efficiency Assessment



Overview of Energy Efficiency Assessment

- Electric and Natural Gas potentials estimated for Residential, Commercial, and Industrial Customers
- Customers characterized by market segment within each sector (e.g. Single family, multifamily, and manufactured homes)
- Comprehensive list of energy efficiency measures analyzed

Sector	Electric Measure Counts	Gas Measure Counts
Residential	118 unique, 1,198 permutations across segments	51 unique, 435 permutations across segments
Commercial	105 unique, 2,866 permutations across segments	51 unique, 1,430 permutations across segments
Industrial	16 unique process improvements, 664 permutations across segments	8 unique process improvements, 125 permutations across segments

Energy Efficiency Measure Analysis

- End-use efficiency levels are assumed to be "frozen"
- Measures and are categorized as:
  - "Discretionary" – retrofit of existing structures and equipment
  - "Lost Opportunity" – new construction, replacement upon burnout
- Assumption consistent with the Council

Measure Interaction

- Multiple measure type interactions accounted for:
  - Inter-end use: e.g. lighting measures may affect HVAC consumption
  - Intra-end use: installing measures affects baseline consumption and may affect the savings of other measures. This applies both to:
    - Equipment/retrofit interactions: E.g. upgrading HVAC equipment will reduce the savings of insulation.
    - Retrofit/retrofit interactions: E.g. sealing ducts will reduce the savings from insulation
- Measures screened for IRP based on “stand alone” savings

Energy Efficiency Measure Analysis

- Basic formula:
  - Technical measure potential = No. of *applicable* units **x** incremental savings/unit
- Example Measure:
  - Stand-alone measure analysis: Central AC upgrade – SEER 13 to SEER 14 in existing single family homes:

Model Input	Value	Example of Sources
Baseline consumption (kWh)	864	Building simulation, billing analysis
% Savings	5.7%	RTF, DEER, engineering calculation
Annual savings (kWh)	49	Baseline consumption * % Savings
Total customers	669,577	PSE Single Family Electric Customers
% of Customers with end use	14%	RASS, CBSA, etc.
% of End Users without measure	95%	Market research
Applicable customers	91,496	Product of 3 previous rows
20-Year Technical Potential (kWh)	4,506,010	Applicable customers * kWh savings per unit
Achievable %	85%	Northwest Power & Conservation Council
20-Year Achievable Technical Potential (kWh)	3,830,108	Technical potential * achievable %

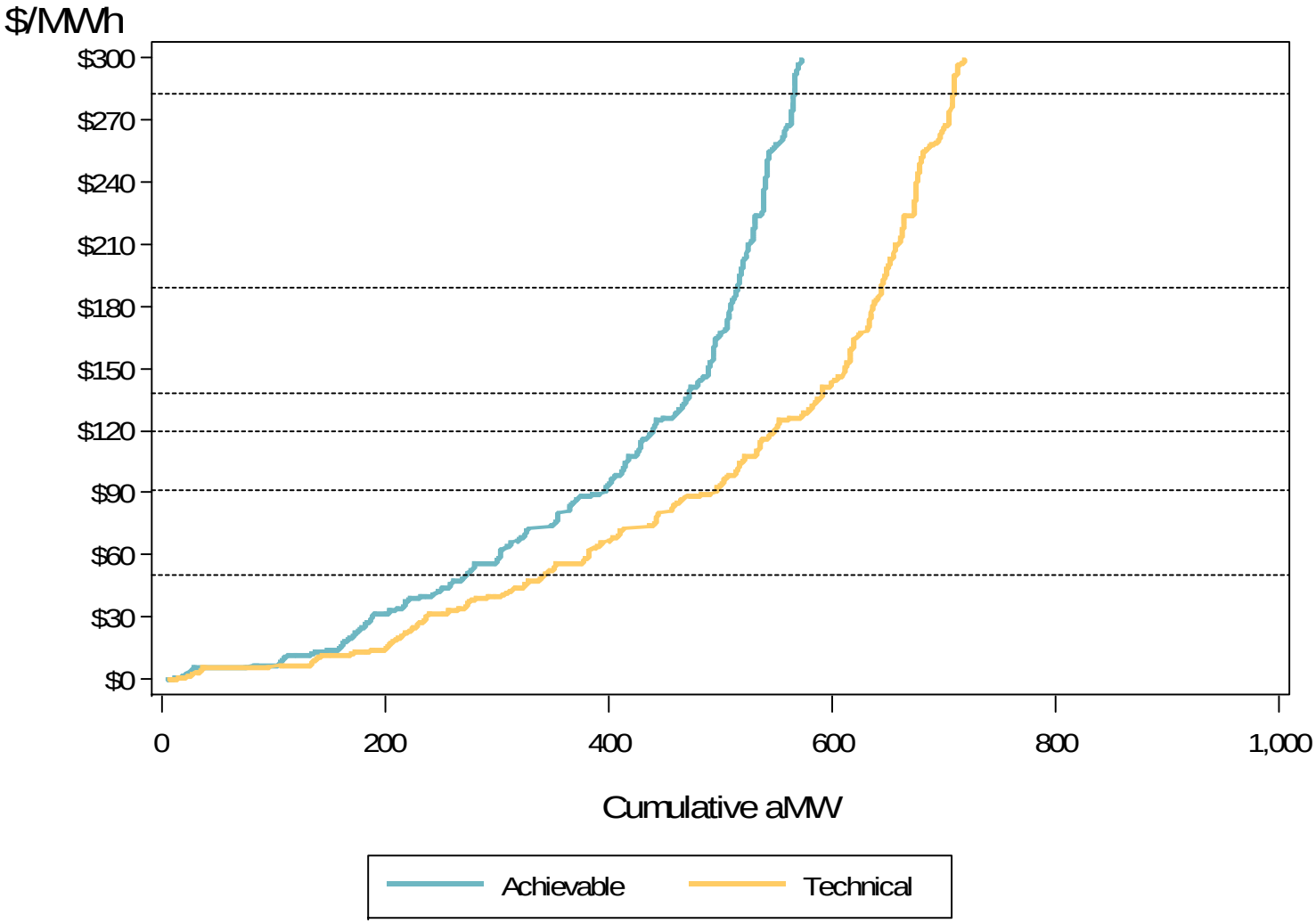
Energy Efficiency Measure Analysis

- Example of interactive savings analysis: Central AC upgrade – SEER 13 to SEER 14 and ENERGY STAR windows

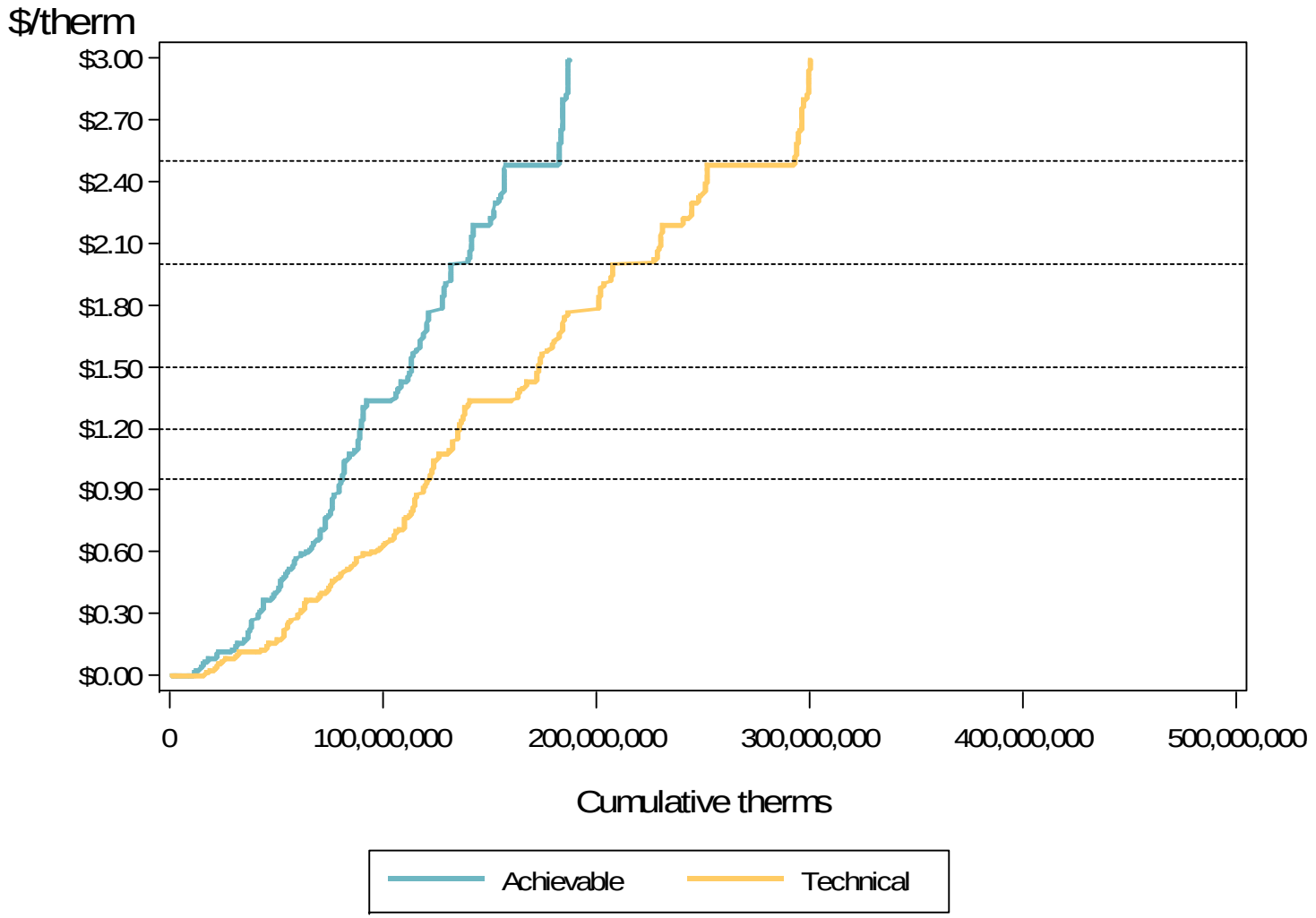
Model Input	SEER 14 Central AC	ENERGY STAR windows	Combined
Baseline Consumption (kWh)	864	864	864
% Savings	5.7%	13%	18.7%
Annual stand alone savings (kWh)	49	112	161
Adjusted baseline (kWh)	864	815	
% Savings	5.7%	13%	17.9%
Annual interactive savings (kWh)	49	106	155

- Savings of a “bundle” of measures is less than the sum of the individual measures’ stand alone savings. Rolling baseline accounts for effects of Interaction

Electric Energy Efficiency Supply Curve

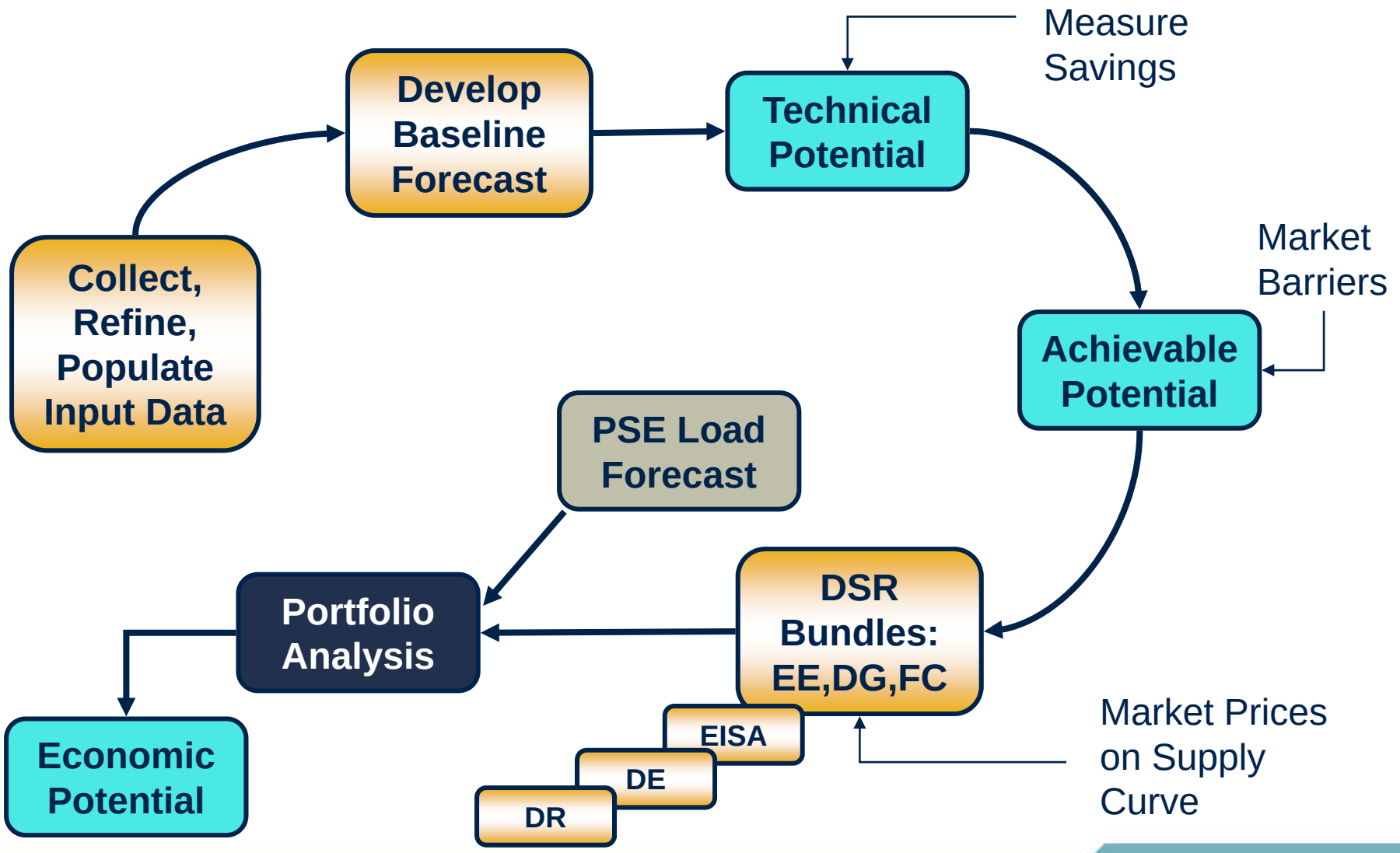


Gas Energy Efficiency Supply Curve

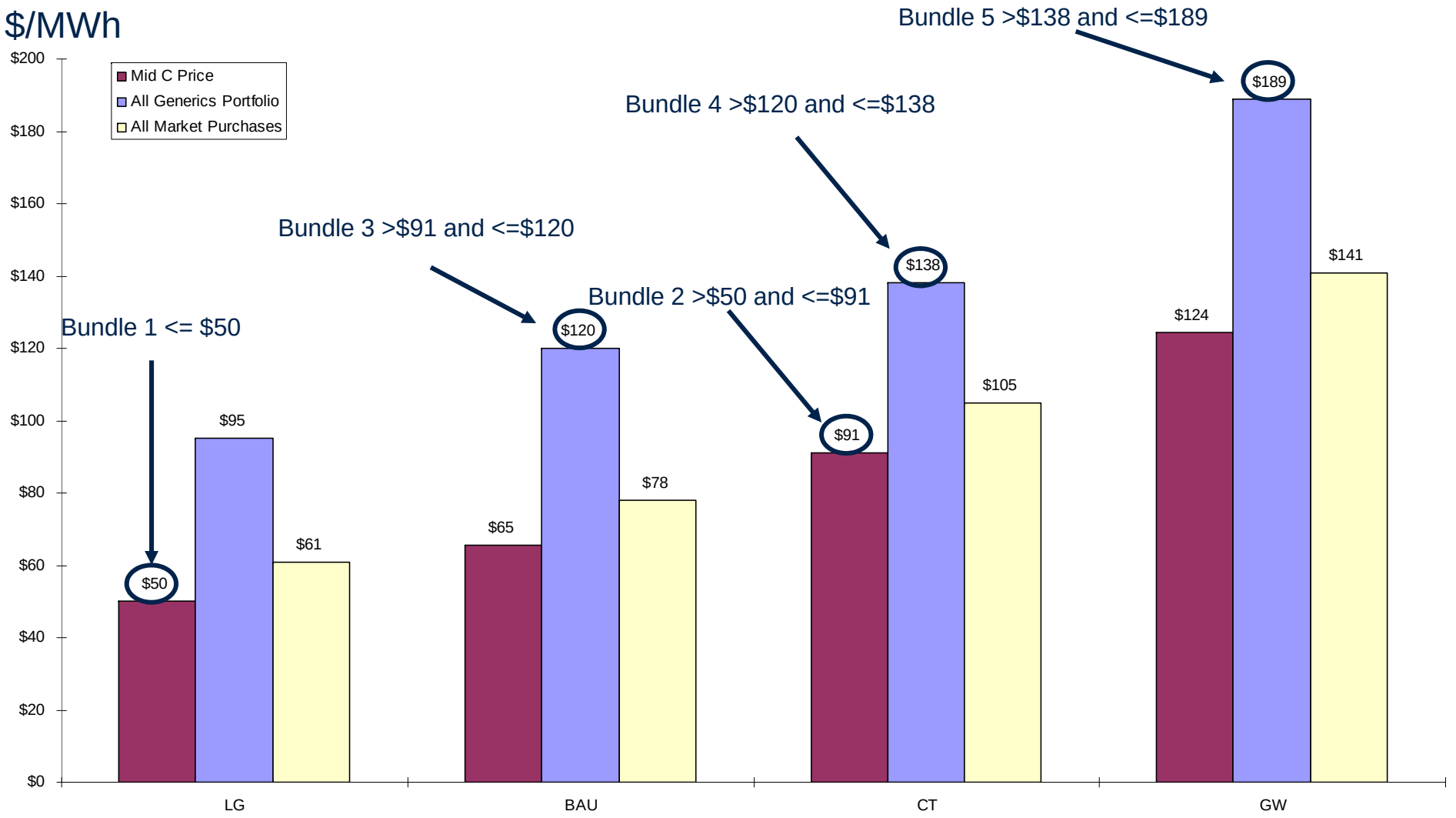


IRP Inputs: Measure Bundles

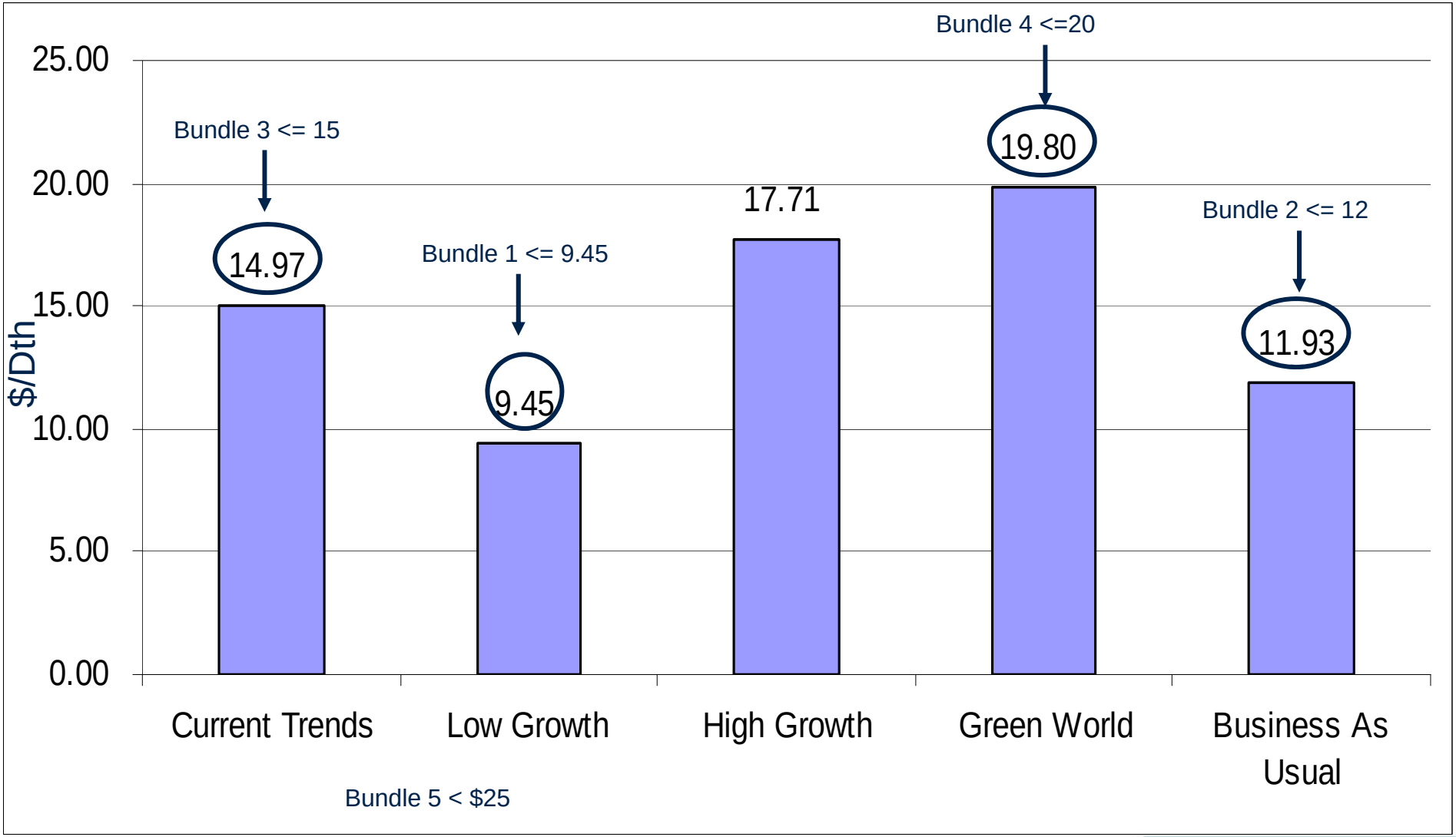
Outline of DS Resources Analysis *2009*



Electric Input Costs by Scenario ($/MWh)



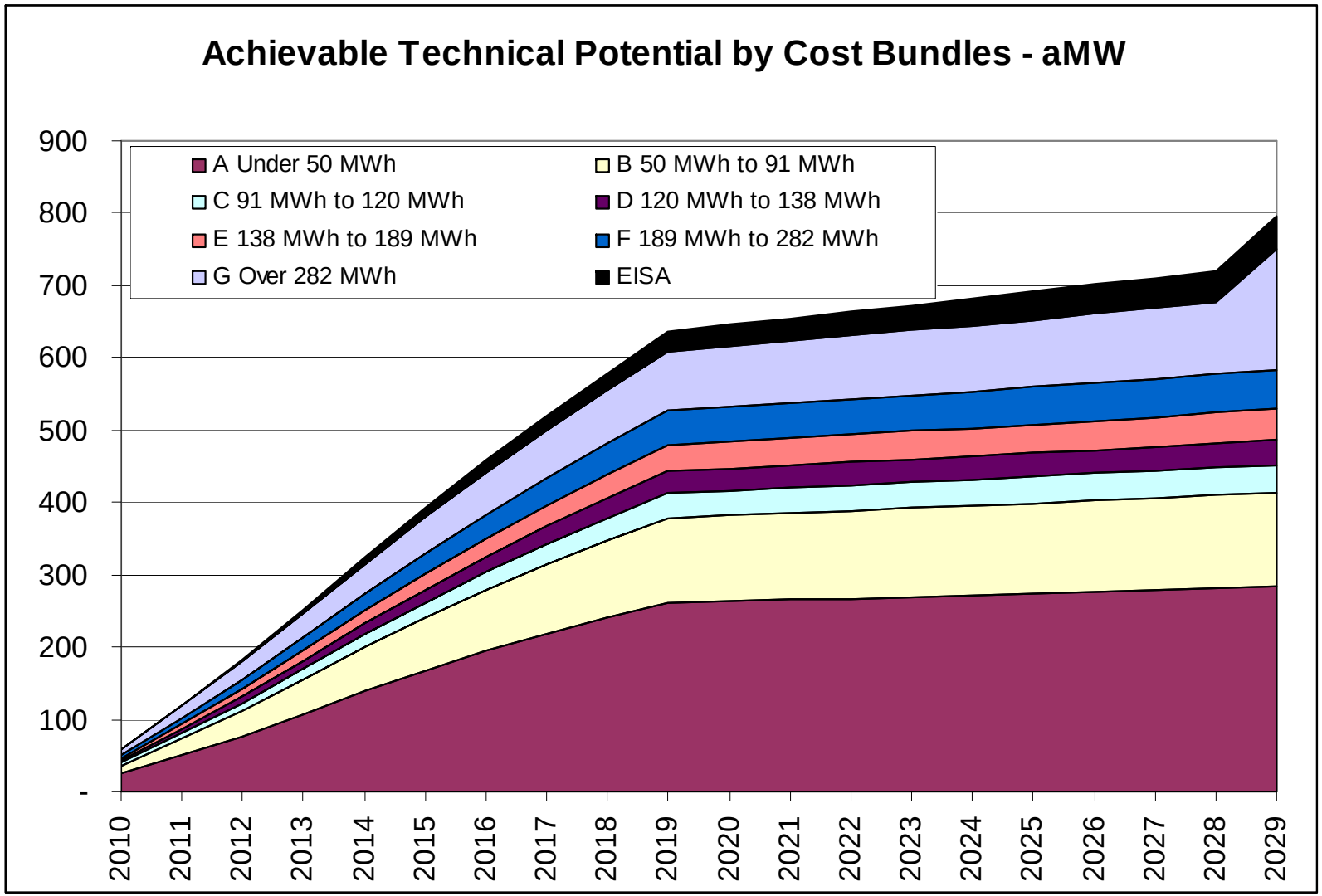
Gas Input Costs by Scenario ($/Dth)



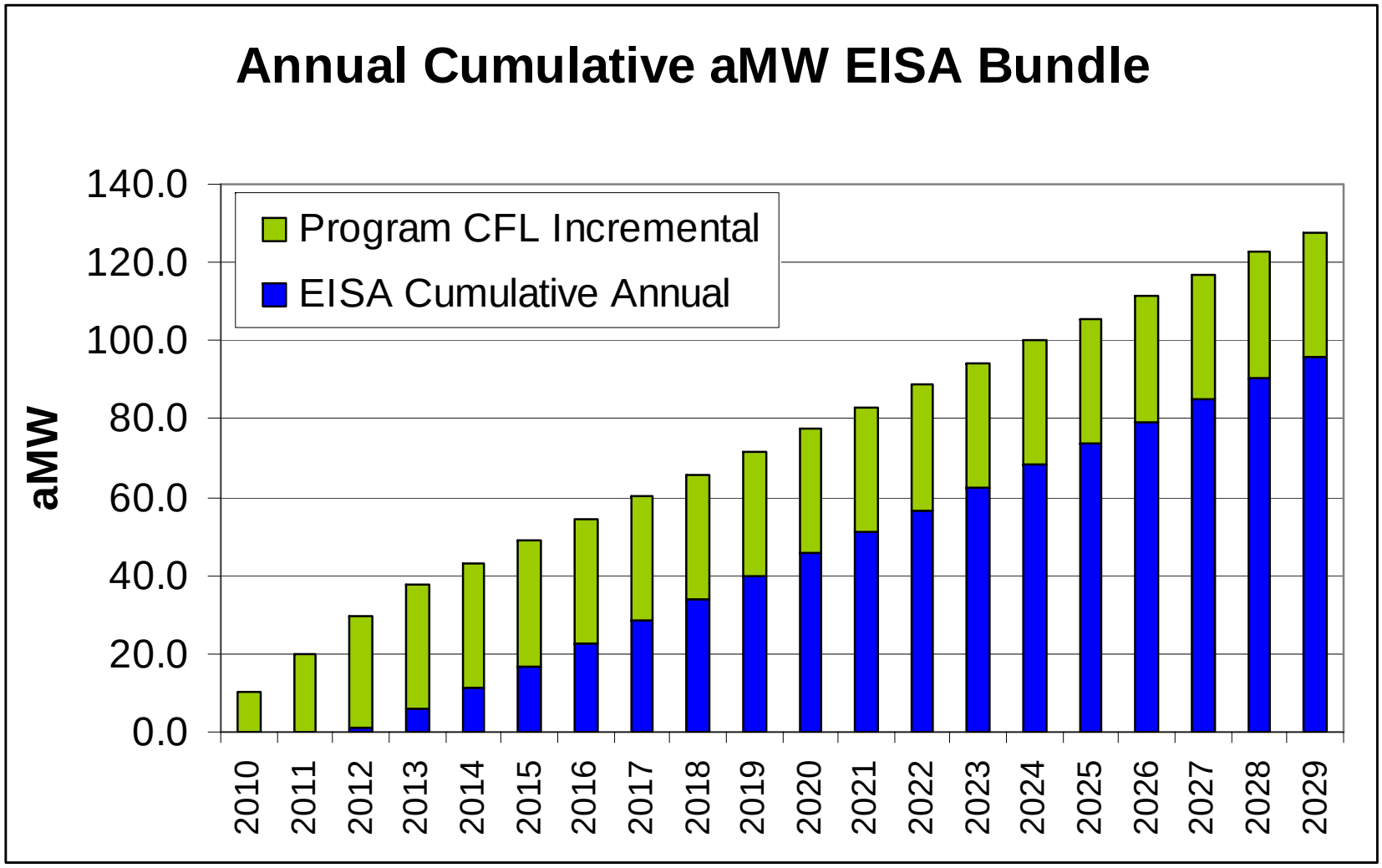
DSR – Measure Bundles

- Main Energy Efficiency Bundle (Bundle “D”)
  - Bundles are Cost Groupings from lowest cost resources (measures) to highest
  - Includes Energy Efficiency Measures, Fuel Conversion, Distributed Generation
- Separate bundles:
  - EISA Bundle – moved to load side
  - Distribution Efficiency - separate bundle
  - Demand Response
- Tested Bundles in Portfolio Model to get the Economic Achievable Potential.

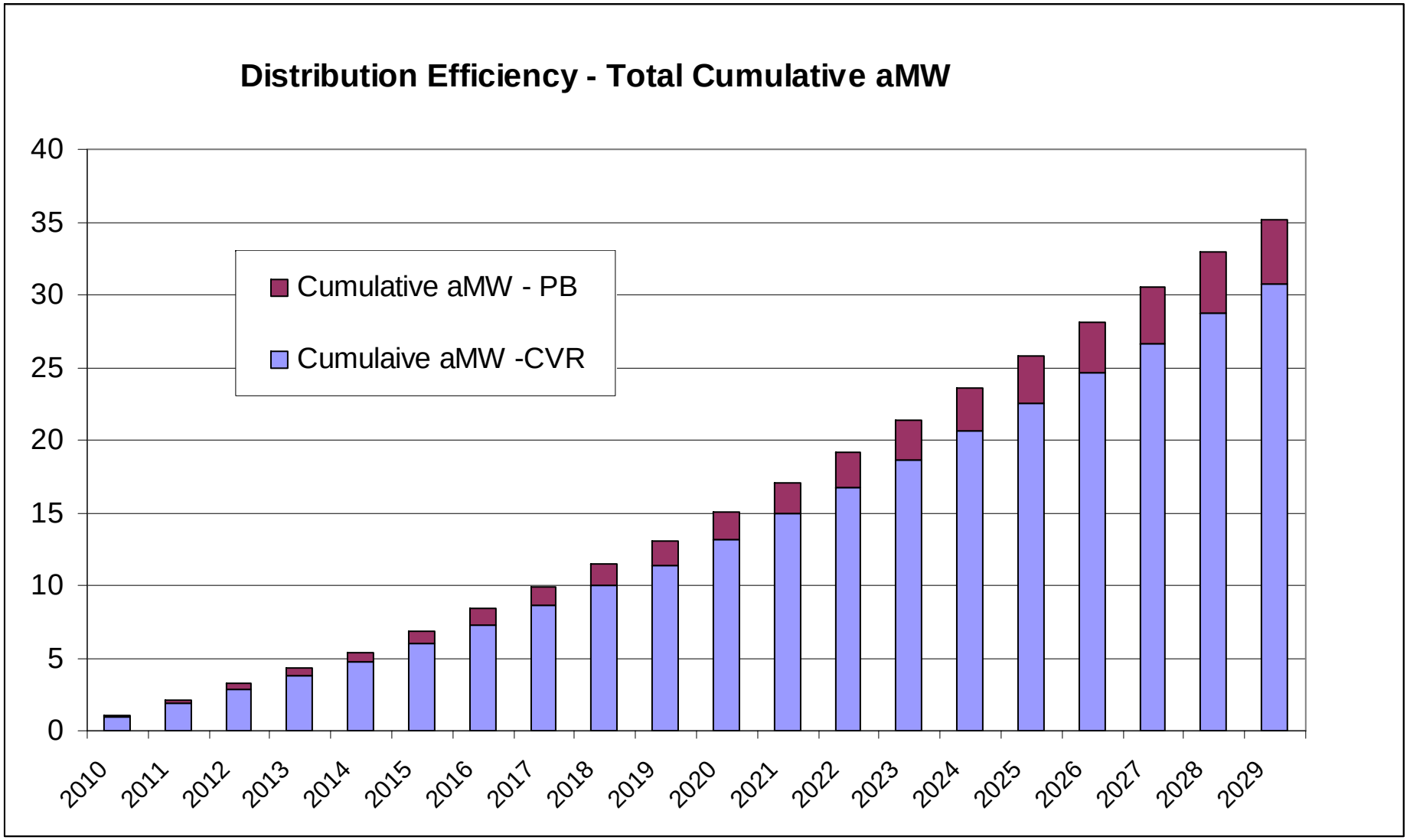
Bundles: Achievable Tech. Potential – Elect.



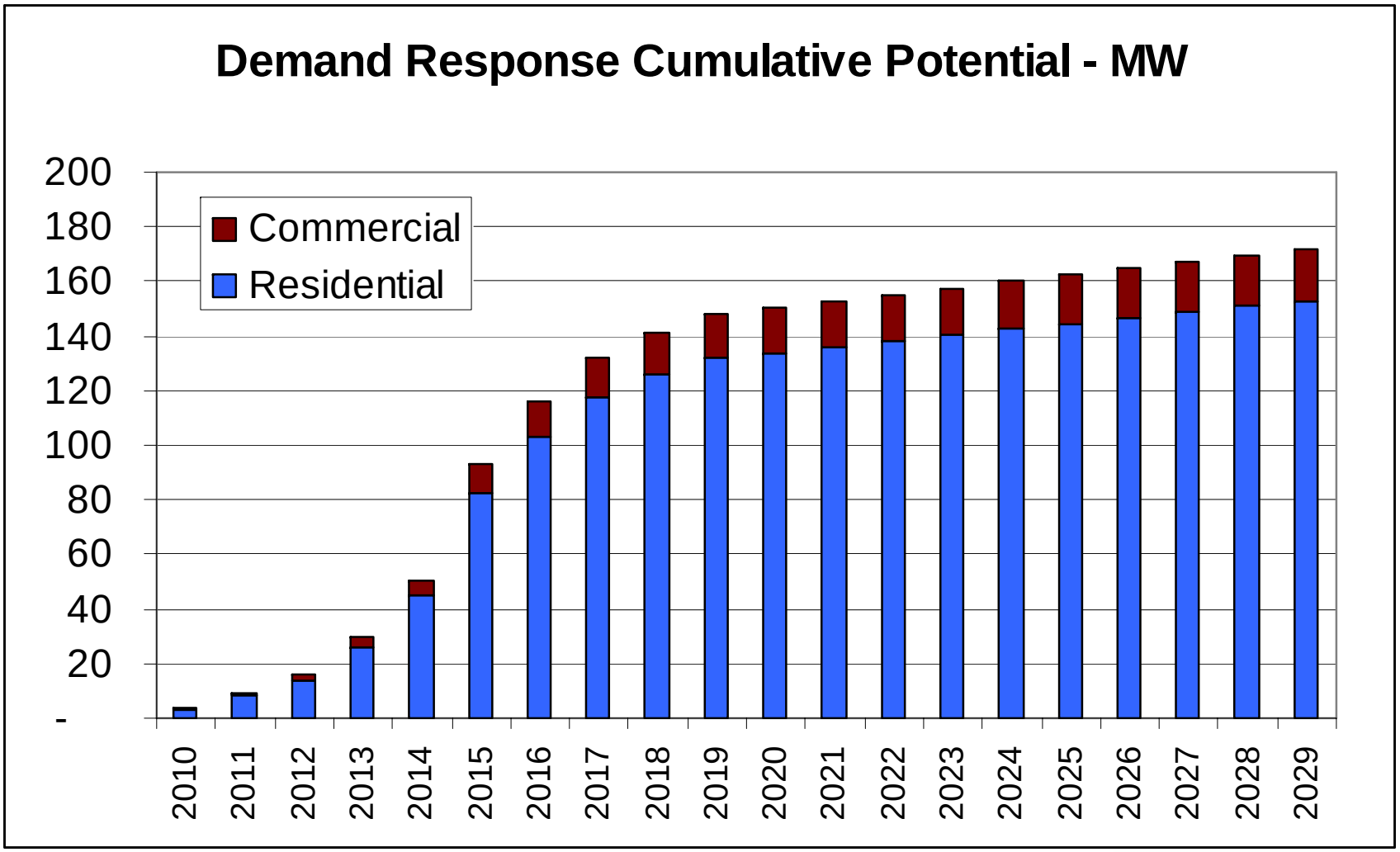
Bundles: Achievable Tech. Potential – EISA



Bundles: Achievable Tech Potentials – DE

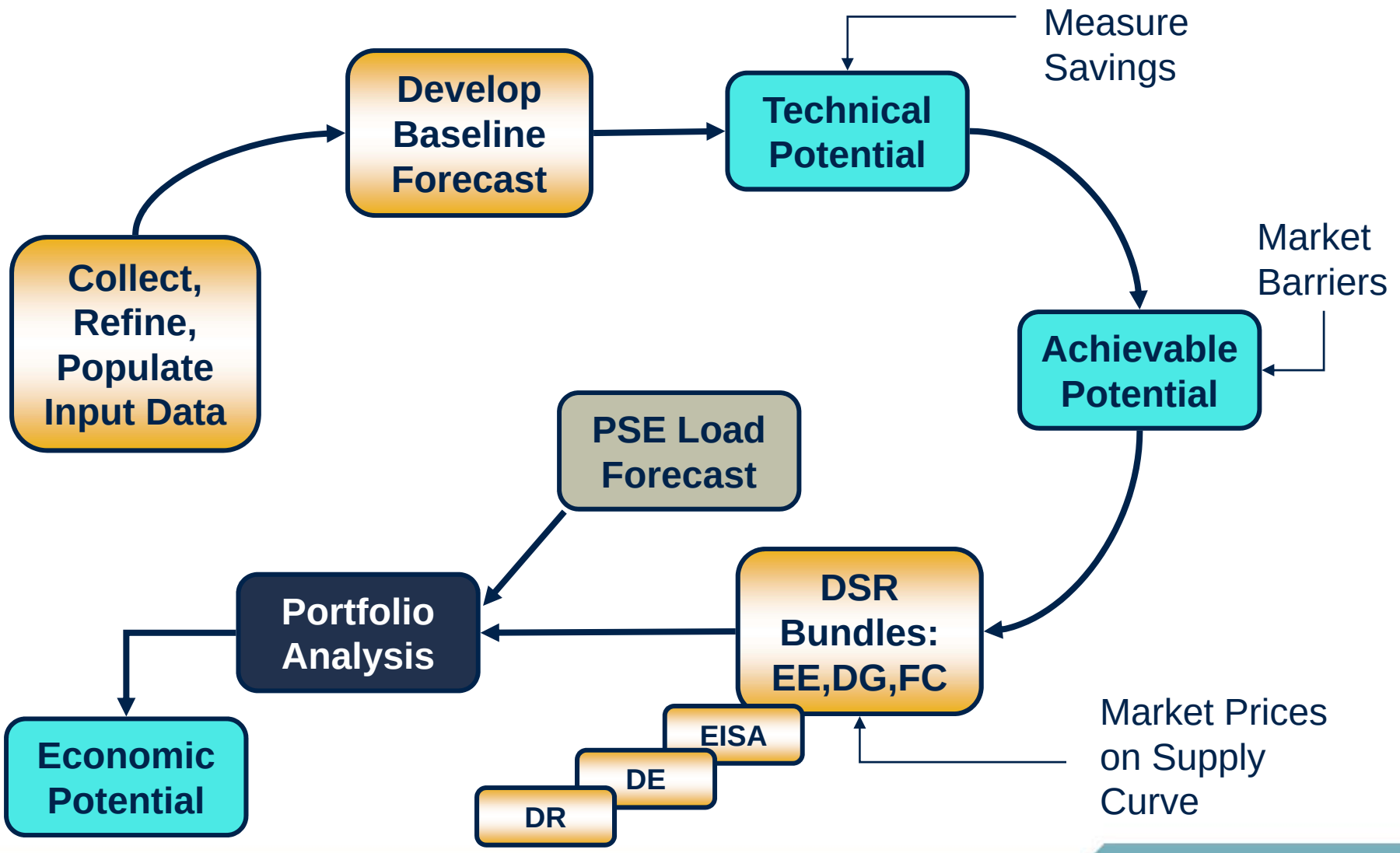


Bundles: Achievable Tech Potentials – DR



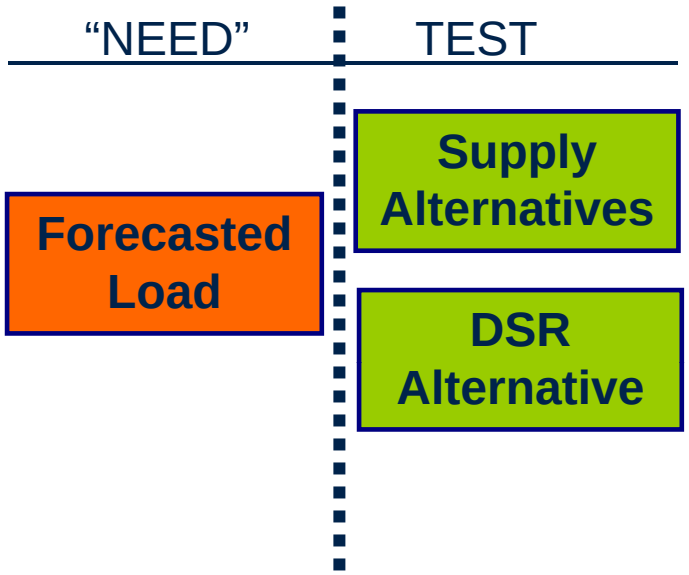
IRP Portfolio Analysis:
Economic Achievable Potential

Outline of DS Resources Analysis *2009*



Economic Achievable Potential

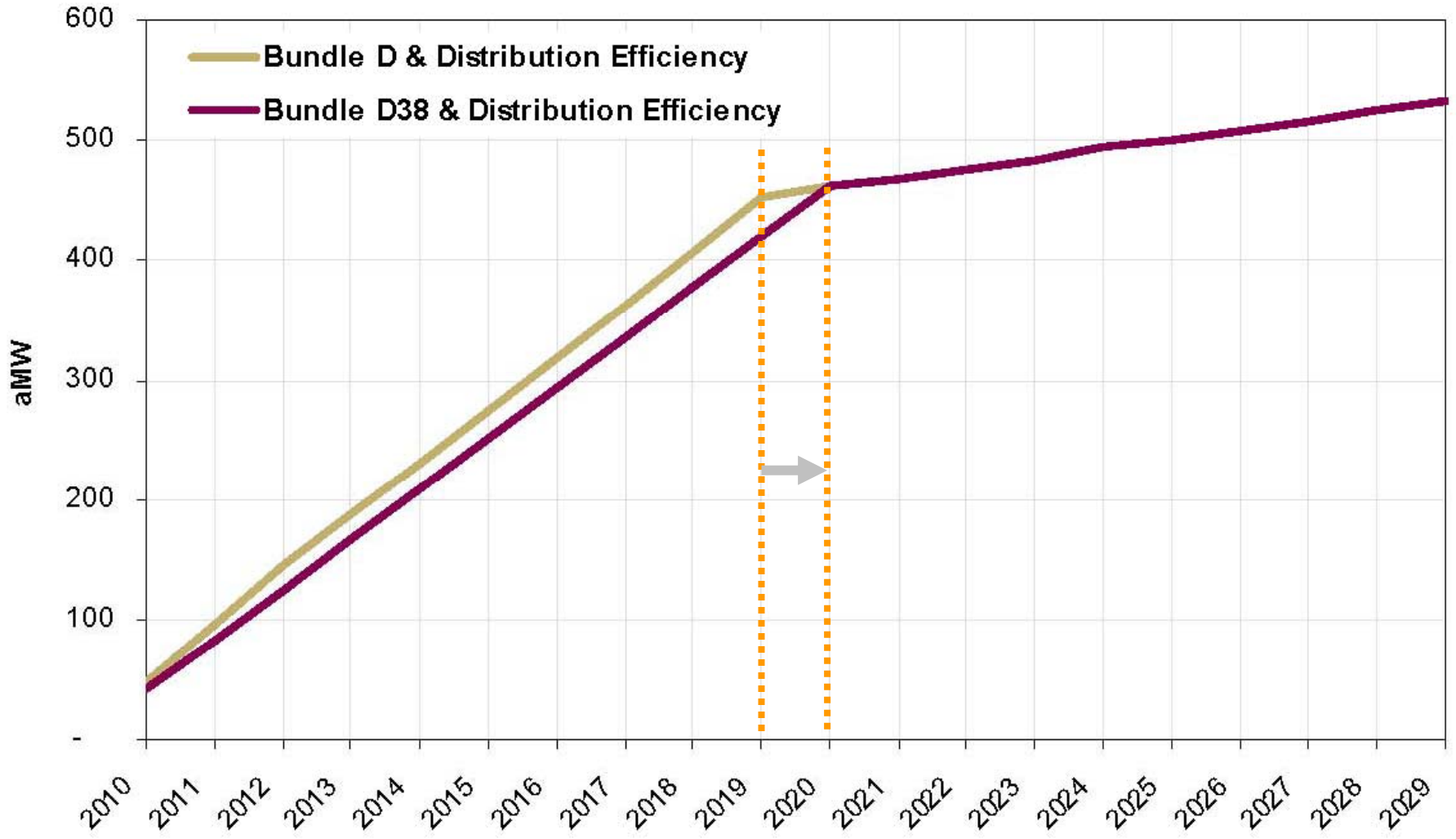
- Portfolio Analysis
  - Identify Available Resources
    - DSR Measure Bundles
  - Create Optimal Integrated Portfolios for each Scenario
    - Add DSR Bundles to Min. NPV
    - Select Lowest Cost Portfolio => **Economic Achievable Potential**
  - Evaluate Costs and Risks
    - Monte Carlo and PSM II
  - Strategist® - Electric
  - SendOut® - Gas



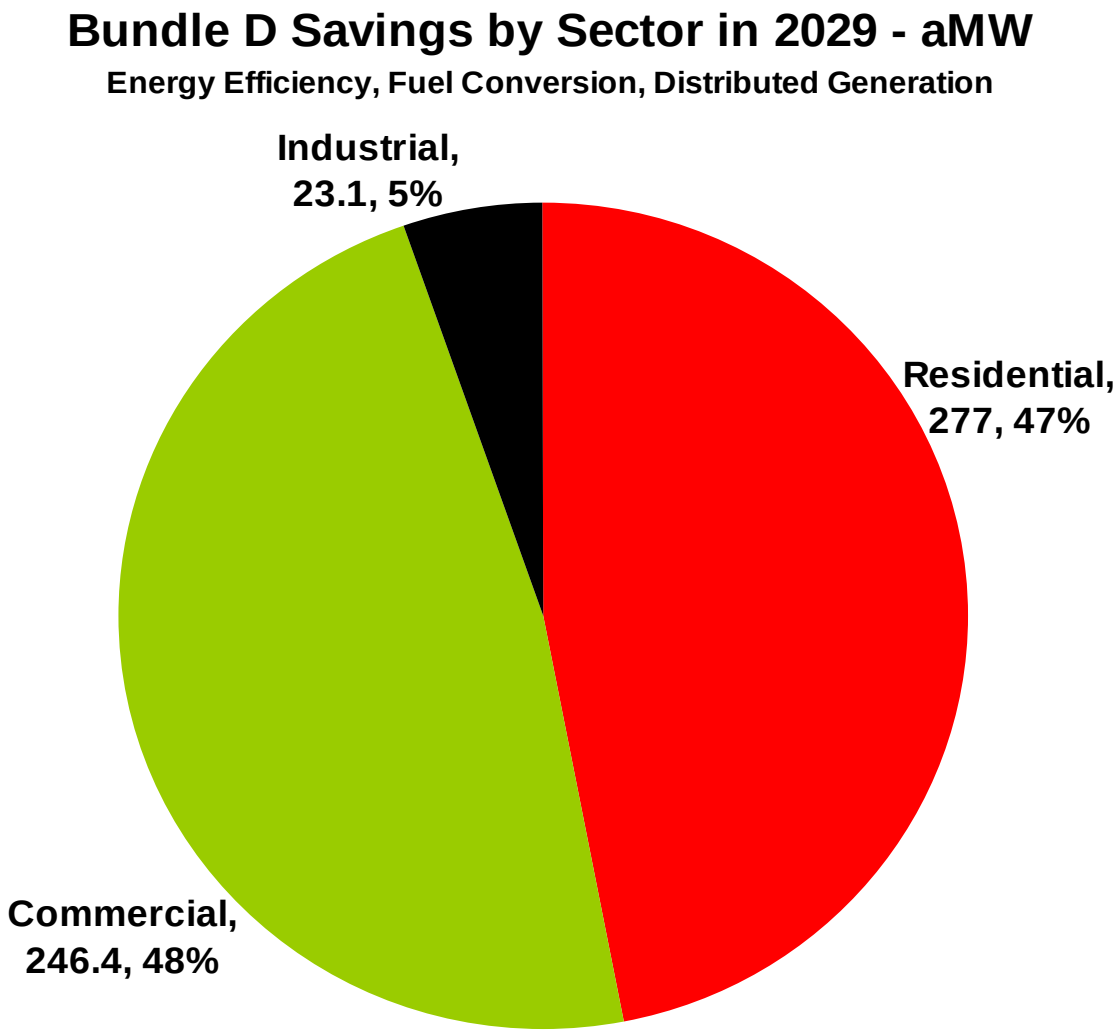
The Plan - Bundle D38

- Real World Acquisition Constraints
  - **"While difficult to quantify, utilities have budget constraints that, given no other consideration, would significantly limit how quickly the region can acquire this conservation."**
    - Council's Draft 6th Plan Chapter 8: Developing a Resource Strategy page 8-22.
- PSE Energy Efficiency Program Experience:
  - Energy efficiency infrastructure constraints (the retailers, auditors, contactors, installers, etc)
  - Adopted a 38 aMW per year of **Electric** DSR Acquisition Rate – very close to historical 10-year ramp used by PSE
  - Adopted a 4.5 million therms per year of **Gas** DSR Acquisition Rate

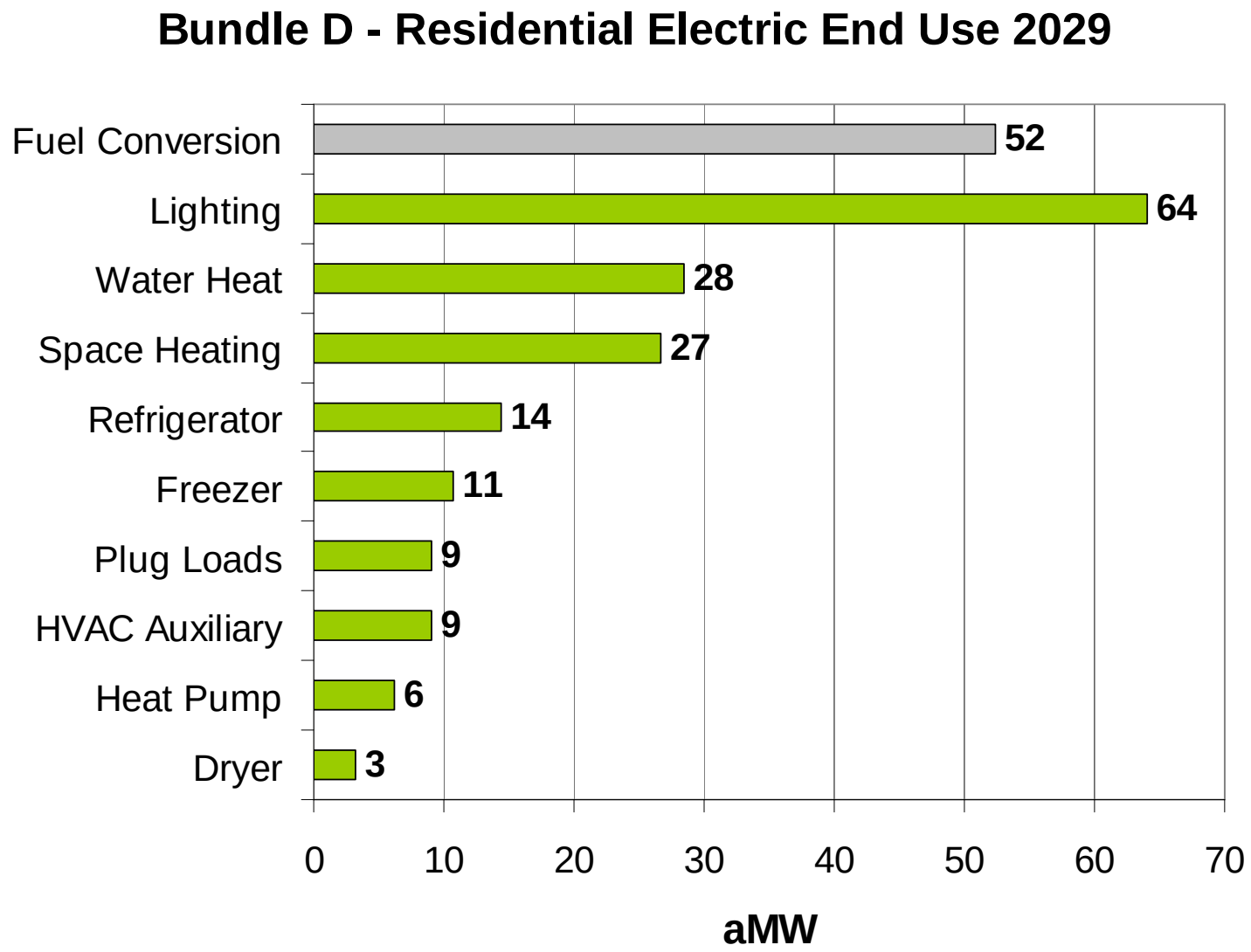
Bundle D38


Bundle D & Distribution Efficiency
Bundle D38 & Distribution Efficiency
aMW
600
500
400
300
200
100
-
2010
2011
2012
2013
2014
2015
2016
2017
2018
2019
2020
2021
2022
2023
2024
2025
2026
2027
2028
2029

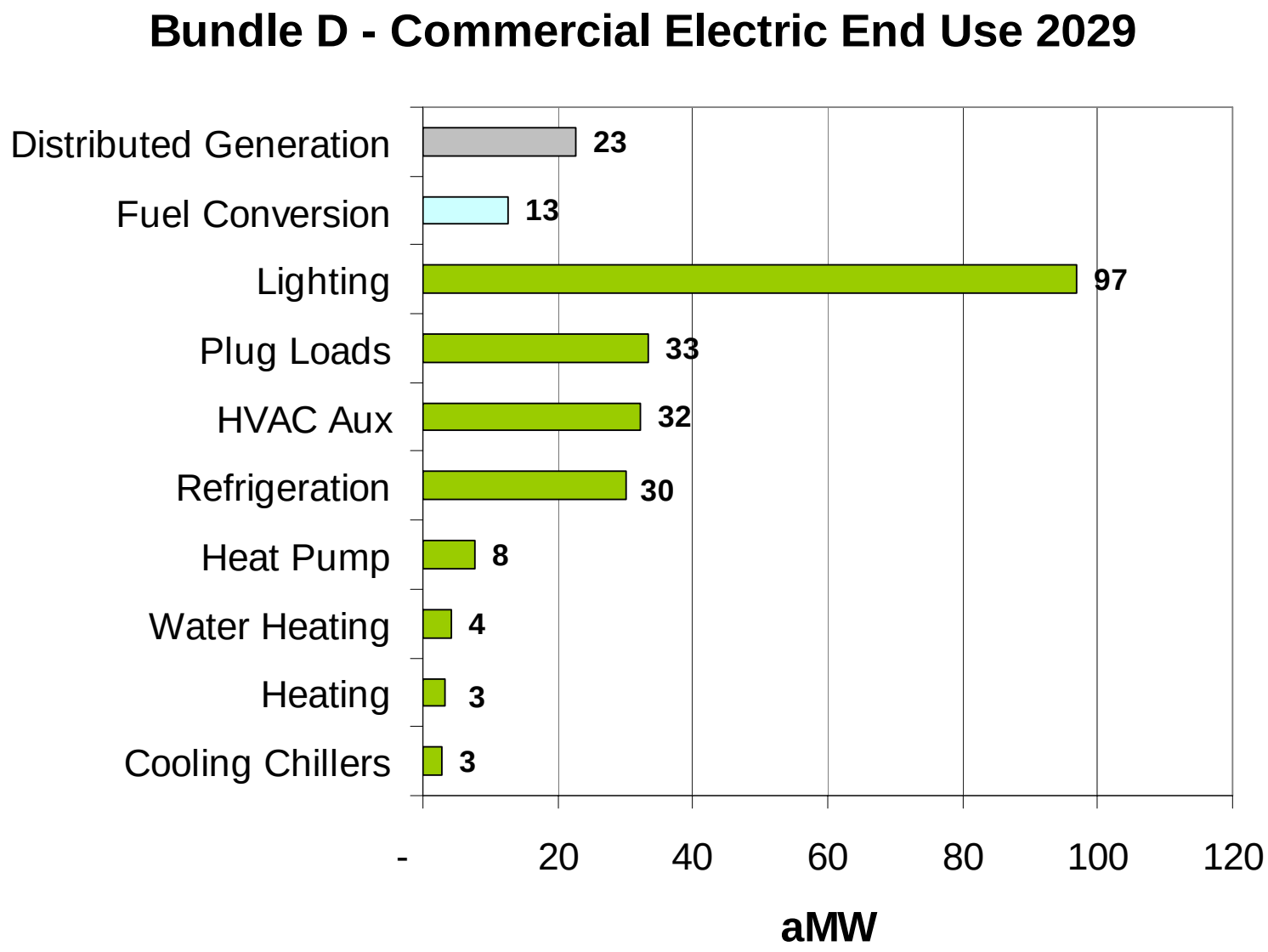
Bundle D38 – Electric by Sector



Bundle D38 – Elect. Residential End Use



Bundle D38 – Elect. Commercial End Use



Bundle D38 – Elect. Industrial End Use