U.S. DEPARTMENT OF ENERGY
Northwest Clean Energy Application Center

Promoting CHP, District Energy, and Waste Heat Recovery

Alaska • Idaho • Montana • Oregon • Washington

Attachment Two: WUTC Docket UE-110667

July, 2011

CHP, DISTRICT ENERGY AND WASTE ENERGY RECOVERY PROJECTS IN WASHINGTON STATE

Includes Projects Being Developed with Stimulus (ARRA) Funds and/or Tax Incentives

Introduction – This report was developed by the Northwest Clean Energy Application Center (NW CEAC). Washington has a wide variety of clean energy projects including combined heat and power (CHP and formerly known as cogeneration), district energy and waste energy recovery. This report shows the status of each project from online to various stages of development. They can be found in industrial facilities, pulp and paper mills, forest products mills, steel mills, refineries, food processing facilities, dairies, university and college campuses, downtown district energy developments, wastewater treatment facilities and other locations. Project funding comes principally from the private sector, but also includes grants, low interest loans and tax incentives.

This report lists clean energy projects (both now online and under development) from 2004 to 2010. The purposes of this report include: 1) Showing the range of clean energy projects in Washington; 2) Tracking progress of individual projects; and 3) Providing a means to determine, if and why, a project stalls or is not brought to completion. This is a valuable feedback loop for clean energy policy improvements. It is structured in three separate main sections:

1) CHP projects including district energy CHP projects;
2) Thermal district energy projects; and
3) Waste energy recovery projects.

CHP systems are highly efficient with significant environmental benefits. For more information, see www1.eere.energy.gov/industry/distributedenergy/. The U.S. Department of Energy Industrial Technologies Program has adopted the goal of increasing CHP capacity from 85 GW in 2006 to 241 GW in 2030. These energy efficiency gains would yield major environmental benefits, including reduction of 600 MMT of greenhouse gases (equal to taking an additional 109 million cars off the road). CHP systems are significantly more efficient than standalone thermally-based power production. CHP systems are baseload not intermittent.

Feedstocks for renewable CHP include wood waste/hog fuel, geothermal heat, and biogas from anaerobic digesters. Natural gas is the typical fossil energy feedstock.

Technologies under development or online in Washington include: combustion turbines, microturbines, reciprocating engines, anaerobic digestion, stirling engines and organic rankine cycle systems. Fuel cells also have CHP application, with some systems fully commercialized while others are still considered emerging technologies.

Incentive Funding – Washington Clean Energy/CHP projects can take advantage of a number of financial incentives. Examples include U.S. Department of Energy Industrial Technologies Program CHP and Energy Efficiency Funding Opportunities, U.S. Forest Service Healthy Forest Wood-to-Energy Projects and Woody Biomass Utilization Grants, State Energy Program (SEP) grants and loans, Energy Efficiency and Conservation Block Grants, USDA Rural Development Rural Energy for America Program (REAP) grants and loans, and state government initiated efforts from the Departments of Commerce, Agriculture and Natural Resources (DNR) demonstration/pilot projects. Some of these funding sources were tied to the American Reinvestment and Recovery Act (ARRA) stimulus funds. Projects that received those funds are now in the construction phase.

The Northwest Clean Energy Application Center had Attorney General Enron natural gas overcharge funds for technical project studies supporting development. Washington state issued awards under two competitive rounds of SEP funding, and reallocated awards which were not accepted. A total of $13.1 million in CHP-related SEP grants and loans are currently under contract.

Wood Waste/Hog Fuel Supply – A number of wood-fueled projects are proposed for the Olympic Peninsula and Puget Sound regions. Concerns have been raised regarding the ability of the "wood shed" to support all the various demands for feedstocks. Forest supply is increased by removing logging slash piles from the woods for use in mills as opposed to open burning on site. Urban wood waste is often recycled but volumes could be increased in lieu of shipments to landfills. This meets a core goal of the Washington Department of Ecology Waste 2 Resources Program's Beyond Waste strategy (www.ecy.wa.gov/beyondwaste/). The Olympic Natural Resource Center has completed an "investment-grade" analysis of Olympic Peninsula wood waste resulting from harvest operations. The U.S. Forest Service lands of the Olympic National Forest are not included. The Northwest Clean Energy Application Center provided $50,000 of Attorney General Enron overcharge funds to broaden the study and guard against overbuilding. The final report is moving toward publication.

Building on this work, a statewide forest biomass study is being conducted by the University of Washington, School of Forest Resources, in cooperation with TSS Consultants. This study is required by the state's Forest Biomass Supply Agreements bill (2SHB 2481), which received almost unanimous support from the 2010 Washington Legislature. The DNR leads this effort with funding from the U.S. Forest Service. The study – the first of its kind in the nation – seeks to obtain data on the economically and ecologically available forest biomass in Washington's working forests. It should reduce investment-grade due diligence costs for biopower CHP projects regarding forest biomass fuel availability. The study is at the half-way point. For more information, see www.dnr.wa.gov/ResearchScience/Topics/OtherConservationInformation/Pages/em_biomass.aspx.

Key concept – Energy data is expressed in MW of electricity (MWe) as opposed to MW of thermal energy (MWth). Washington lacks both a thermal energy database and a related waste energy database. Power production figures are generally shown as maximum "nameplate capacity" (e.g. MWc) as opposed to average power output (e.g. MWa).

Summary – The following table summarizes publicly-announced CHP projects in various stages of development, including initial design, permitting, financing, construction, interconnection and operation (2004 or later). The history of project development is also included.

Status	Number of Projects	MW Increases
CHP		
Projects Completed	14	153.16
Projects Under Development (by feedstock and market sector)		
Natural gas		
Oil refinery	1	738.0
Institutional	1	.06
Wood waste/hog fuel		
Pulp & paper	3	99.22
Forest products	1	3.5
Biorefineries	1	4.7
District energy	4	46.1
Biogas		
Compost facilities	2	4.6
Dairies	4	5.5
Food processors	0	0
Wastewater treatment facilities	3	5.66
CHP Totals	**34**	**1,060.5 MW**
District Energy		
Downtown – On-line	1	
Institutional – On line	1	
Municipal/Neighborhoods – Under Development	10	
Institutional – Under development	3	
Waste Energy Recovery		
Steel – Under development	1	2.8 net
Clean Energy Totals	**50**	**1,063.33 MW**

PROJECTS COMPLETED

CHP

This list traces the history of CHP projects brought online since 2004.

1) Sierra Pacific Industries, Burlington – This is a 28 MWc CHP system at a forest products mill. Excess power is sold to Sacramento Municipal Utility via Seattle City Light. The system came on-line in 2007.

2) Hampton Timber Mill, Darrington – This is a 7.5 MWc (4.5 MWa) wood waste CHP system, downsized from an original 20 MWc proposal. Air quality issues raised by the U.S. Forest Service have been resolved. The Puget Sound Clean Air Agency issued a construction permit in June 2005. This system went online in October 2006. Mill needs are approximately 4.5 MW/hr with additional power sold to Snohomish PUD under a 2007 contract. In addition, 7 MW of green tags are sold to the PUD.
3) Wastewater Treatment Facility, Renton – A 1.5 MWc molten carbonate fuel cell is located at the South Treatment Plant in Renton. It was the original FuelCell Energy commercial scale demonstration project. The system is now mothballed but can be brought back online with new fuel cell stacks (the technology has significantly progressed), a new interconnection agreement with Puget Sound Energy and probably a new revenue stream of hydrogen gas (an add-on system). The demonstration went through a series of lessons learned, upgrades (such as scrubbing the biogas) and adjustments. The demonstration period ended in September 2006. The Center has a case study on this CHP system at www.northwestcleanenergy.org/NwChpDocs/KingCoSouthTreatmentPlantFuelCellCaseStudy.pdf. Molten carbonate fuel cells operate at very high temperatures providing a strong thermal energy capability. In addition, an 8 MWc CHP system has been completed at the same facility bringing total production to 9.5 MWc. The 8 MWc system is composed of three turbines (two 3.5 MW turbines and a 1 MW steam turbine). The entire 9 MW system became operational December 2005, operating at 5 MWa. The facility has biogas fuel cell needs for 3.5 MW of power. Facility operators use supplemental natural gas to avoid electrical ratcheted demand charges.
4) FPE Renewables, Lynden – This dairy digester CHP project at Vander Haak Dairy was the first to be completed in the state. It has recently completed a major set of upgrades. A new 600 kW CHP system (on-line in October 2010, Guascor SFGLD 360 genset) has been added to a 450 kW system. The smaller genset serves as backup. It system was originally sized at 300 kWc and began operation in November 2004. The project was rebuilt and upgraded in 2007 to a 450 kWc system. It has been the site of many presentations and tours, including a visit by the governor. Washington State University (WSU) also is using the dairy as a research site to improve the economics/products for this type of system. This is a cold climate GHD/Andgar digester with a design size for 1,500 cows (less with co-digestion of pre-consumer food processing waste). The larger genset was installed to handle increased biogas resulting from co-digestion. The dairy uses a scrape manure handling system. Puget Sound Energy is the utility. The digester is mesophilic (100 F). A new nitrogen and phosphorous nutrient recovery system is also on-line (first commercial operation of this specific technology). It operates at thermophilic (135 F) temperatures using heat from the digester. Interconnection limited the older system to 350 kW. The interconnection has also now been upgraded. A USDA REAP grant of $200,000, and SEP award of $320,000 ($224,000 loan and $96,000 grant), will support a new co-digestion collection pit and larger CHP genset. The dairy nutrient recovery system using WSU developed technology was funded also co-funded ($500,000;
5) George DeRuyter & Sons Dairy, Outlook – Project start-up was completed in November 2006. This is a two dairy system with a total of 5,300 cows. It was funded in part with a $499,219 Renewable Energy Grant from the U.S. Department of Agriculture. A 1.2 MWc system was installed. This project was awarded a $1,972,715 loan under the Washington Energy Freedom Program. It is a cold climate GHD/Andgar digester. A third gen-set could be added.
6) Grays Harbor Paper, Hoquiam – Grays Harbor Paper has completed two upgrades of its CHP capacity (2006 and December 2007) using hog fuel. Total mill capacity is now 18.5 MWc with a

combined increase of 8.0 MWc. Their original goal was to be self-sufficient in meeting their power needs (11-12 MW). They can now sell excess power and/or green tags to Puget Sound Energy or Grays Harbor PUD. In 2001 the company purchased a turbine but lacked the funding to install it. A complex package – involving the pre-purchase of power, Grays Harbor PUD ownership of the turbine and boiler with a lease back, a $6 million state Energy Freedom Program grant and two loan packages – has enabled this project to move forward. At the time, the pending closure of the nearby Cosmopolis Weyerhaeuser mill spurred this economic development project. Note: Grays Harbor paper shut down in May 2011. However, the system capacity remains

7) Longview Fibre, Longview – This is a 20 MWc biomass CHP repowering project. Two power boilers were rebuilt and brought back online in 2006 and 2007 at a cost of $8.6 million. Additional project improvements are underway (see below).
8) Qualco Energy, Monroe – This is a 450 kWc CHP digester project currently serving one dairy (Werkhoven Dairy). The digester can handle up to 2,200 cows, allowing herd size to grow and/or receipt of pre-consumer food waste. The project is run by the non-profit Qualco Energy Corporation. Construction began in July 2008 with completion in October 2008. Full power generation began in January 2009. A feasibility study by the Tulalip Tribe and local dairy farmers was funded by a 2003 USDOE Tribal Energy Program grant of $256,476. The study was done by the Clark Group and RCM Digesters. It included an inventory assessment of flushed and scraped manure volumes as well as non-dairy waste. Alternative digester technologies were reviewed. The Legislature provided the land for the project as part of the capital budget. USDA provided a $500,000 grant for construction (total cost estimate $2 million). Puget Sound Energy has a five-year power purchase agreement with interconnection and wheeling provided by Snohomish PUD. A composting system was added in 2010 to more completely pasteurize the digestate fiber. They are looking for compost markets. An additional CHP genset and nutrient recovery are now planned (see below). Scrubbed/compressed biogas for transportation is an alternative. No decision has been made as to which technology pathway should be chosen.
9) Cedar Hills Regional Landfill, Maple Valley – This 4.68 MWc facility was brought online in May 2009 by Bio Energy Washington (INGENCO) and King County. This system primarily produces pipeline quality gas (985 Btu minimum per cubic foot). However, it also has 18,260 kW refurbished gensets using the tailgas. The landfill currently produces 10,000 scfm and has an expected life of 15 to 20 years. The power generation system heats the facility. It has additional waste heat available for use.
10) Simpson Tacoma Kraft Mill, Tacoma – This project is a 60 MWc CHP system (55 MWa) that came on-line in August 2009. This system has a power purchase agreement with Iberdrola Renewables with wheeling to Sacramento Municipal Utility District. Construction began in January 2008 with a $90 million investment. It uses both sawmill and paper mill wood waste and black liquor as fuels. Tacoma Power provides transmission services.
11) Farm Power Northwest, Rexville – This is a 750 kWc digester CHP system supporting two dairies. The system uses a Guascor SFGLD 560 engine. The project has a power purchase agreement with Puget Sound Energy. Project financing includes a $500,000 state grant administered by the Energy Freedom Program, a $500,000 grant from USDA Rural Development and a $575,000 USDA loan guarantee. The project came on-line in September 2009. Co-digestion permitting concerns were resolved with passage of SSB 5797 in 2009.
12) Budd Inlet Treatment Plant, Olympia – This is a 330 kWc biogas CHP and district energy project at the LOTT Alliance wastewater treatment facility. It received an energy conservation grant of $1.7 million from Puget Sound Energy. Total project cost was $2.4 million, including a district

heating loop. The biogas powers a GE Jenbacher JMS 208 engine. The project development team included TRANE, Cascade Power and Smith Power Products. The system came online in November 2009.

13) Farm Power Northwest, Lynden – This is a 750 kWc CHP system. It came online in December 2010. This Andgar/GHD system serves a single dairy (2,000 cows) and a four-acre neighboring greenhouse operation (Van Wingerden). Approximately half of the heating needs of the four acres of greenhouses are met by the genset. This is a flush dairy system with a thickening cell before the digester. A Gusacor SFGLD 560 is used for power generation. Supported by Puget Sound Energy, the project received a $500,000 USDA REAP grant, a $2.4 million loan from Shorebank Pacific and a $1,063,724 SEP grant. Carbon credits are sold to the Climate Action Reserve.
14) Van Dyk-S Holsteins, Lynden – This is a 400 kWc CHP system. The system came on-line in June 2011. This is a single farm system. The dairy size is 1,092 Holstein wet cow equivalents. The system is a mesophilic digester system developed by DariTech using UTS Biogas technology. The system uses a 2G-CENERGY agenitor genset and features H2S removal, an insulated above ground slurry store tank and an aerobic composter to kill remaining pathogens and dry fiber. Van Dyke-S Holsteins received $1,044,000 ($731,000 loan and $313,000 grant) in SEP funding.

DISTRICT ENERGY

15) Seattle Steam – This is a conversion from natural gas to wood waste that came online in the fall of 2009.
16) Quillayute Valley School District, Forks – This small wood waste boiler system came online in October 2010 to replace a diesel powered system. It currently heats the middle school, and will eventually heat portions the adjacent high school. A 20 kW organic rankine cycle CHP system was considered and an assessment using a low pressure boiler system was completed. This project received a $1 million grant under the state Energy Freedom Program.

WASTE ENERGY RECOVERY

No waste energy recovery projects that produce power have been brought online since 2004. However, the Washington data base for waste energy projects needs further development.

PROJECTS UNDER DEVELOPMENT

CHP

Washington has a number of CHP projects in various stages of development, permitting, fundraising, engineering/design and construction. Projects are organized by fuel source and market sector. In some cases projects have received public funds:

Natural gas – Oil refineries

17) BP Refinery, Cherry Point – This 738 MWc CHP system will be built in two phases. The first phase of 520 MW has an efficiency of 63% LHV. On October 10, 2006 a revised Site Certificate Agreement was approved by Washington's Energy Facility Site Evaluation Council (EFSEC). The WSU Extension Energy Program recalculated the greenhouse gas emissions for the project. This action revised the Governor's approval given on December 21, 2004. The final site certificate agreement was signed at a ceremony in the Governor's Office. This CHP system was

the first high impact technical assistance system selected by the Northwest CHP Application Center. There was no appeal of the governor's decision. The loss of investment partners and failure to find a buyer for power sales delayed scheduled completion of this $400 million project by about two years, to 2009. BP West Coast Products has decided to develop the project, and it is moving forward with development of a staged implementation. The first phase (approximately 520-570 MWc) will consist of two combustion turbines, two heat recovery steam generators and one steam turbine. Construction is on hold pending a major $400 million refinery upgrade. The ability to wheel power to Alberta will help this project. Transmission issues on the north side of the Canadian border are being resolved.

Natural gas – Governmental/Institutional

18) Juanita High School, Kirkland – This 60 kW Capstone microturbine, the first in Washington, replaces an older swimming pool heating system. It is funded by the Washington Jobs Act for Public K-12 and Higher Education and is in the development phase. Apollo Solutions Group is the ESCO.

Wood waste/hog fuel – Pulp & paper mills

19) Nippon Paper Industries, Port Angeles – This is a 20 MWc biopower CHP system at a thermomechanical paper mill. It is under construction. This is a DNR pilot project – the mill has requested wood supply support to eliminate the use of heavy fuel oil and improve their carbon footprint. It received a $2 million SEP award ($1,400,000 loan and a $600,000 grant). In August 2010, the Nippon Paper Group of Japan announced corporate funding of $71 million in support of the project (costs include a new boiler for about $60 million). In November 2010 a condensing economizer was added to an electrostatic precipitator to further improve both air quality and energy efficiency to over 68% LHV with 50% moisture content. The project received its air permit approval on June 21, 2011 for the Olympic Regional Clean Air Authority.
20) Port Townsend Paper, Port Townsend – This is 25 MWc biopower CHP system. It is under construction. Under the $55 million project, a new turbine will be driven by steam from a power boiler and a recovery furnace. The power will be sold in cooperation with Sterling Energy Assets. Upgrades also are being made to the power boiler, recovery furnace and solid fuel handling system. A new dry electrostatic precipitator and a selective non-catalytic reduction system will be installed to improve air quality. This is a BPA direct service customer. The Notice of Construction has been issued October 10/22/10, The NOC was appealed to the Pollution Control Hearings Board and summary judgment in favor of project was made on May 10, 2011. This project was awarded $2 million in SEP grant funds.
21) Longview Fibre, Longview – This is a 54.22 MWc biomass CHP repowering project. Phase two upgrades focus on rebuilding both a recovery/chemical recycling furnace and a third power boiler. It is under construction. These upgrades completed the permitting stage on June 2, 2011. A BPA interconnection is planned with sale of power to the market (CHP wheeling). RPS issues concerning Renewable Energy Credits for new biomass power have been resolved. 34 MWc qualify as I-937 renewable power (does not include the spent liquor/chemical recycling portion) per a ruling of the I-937 Technical Working Group on May 31, 2011. The local utility is Cowlitz PUD.

Wood waste/hog fuel – Forest products

22) Springdale Lumber, Springdale – This 3.5 MWc CHP system is part of the Borgford Bioenergy system. The system is under construction. Springdale Lumber (a specialty beam mill that

handles larger logs) was closed for five years before being sold to Borgford and brought back into production. It received a $4 million USFS Wood to Energy award coupled with private financing to bring the mill back to life. Mill is fully permitted with upgrades including the octaflame system (a new engineering design) which is a key to power production. Attorney General Enron overcharge funds provided $50,000 to help resolve a series of permitting concerns. The final air quality permit for the entire mill was issued on June 13, 2011.

Wood waste/hog fuel - Biorefineries

23) Borgford Bioenergy, Kulzer – This is a 4.7 MWc biopower CHP system operating in a biorefinery structure that includes: 1) biochar for neighboring farms with carbon depleted soils; 2) biopower; 3) a pellet mill to use sawdust; 4) a 2,000 GPD bio-oil processing facility for liquid off-take from the biochar system; 5) heat for greenhouses; and 6) distilled water. This is a DNR pilot project (includes Springdale Lumber above). It received a $771,406 SEP award ($539,984 loan and $231,422 grant). The project is in the permitting phase. Attorney General Enron overcharge funding was provided to help resolve permitting issues.

Wood waste/hog fuel – District energy

24) Seattle Steam, Seattle – This 37 MWc CHP system using wood waste in downtown Seattle at Post Street is part of Seattle Steam's effort to eliminate all fossil energy in their system. It adds power generation to the district energy system and shifts the system from steam to hot water. This project has an energy efficiency of 90% at full development. The project was awarded a $1.5 million SEP loan to improve efficiency, and an $18,750,000 grant from the USDOE Industrial Technologies Program.
25) Central Washington University, Ellensburg – A feasibility study for campus district heating was completed in June 2010 by Abacas Resource Management for $195,000 ($95,000 from a USDA Rural Business Enterprise grant). Wood supply estimates range up to 70,000 TPY. The project would come through the state's capital budget funding and maturing process. Unfortunately, the study did not definitively size the CHP system. The range is 0 to 8 MWc.
26) Dept of Corrections, Clallam Bay – This is a 200 kW biopower CHP system/boiler replacement. Clallam Bay is a remote location and currently burns diesel to heat the facility. A feasibility study was completed by Richmond Engineering. The study was co-funded by the Northwest Clean Energy Application Center using $50,000 of Attorney General Enron overcharge funds matched with Corrections capital budget funds. The feasibility study analyzed conversion to a wood waste boiler CHP system. The results will be used to prepare a capital budget request.
27) Clark County, Vancouver – This is a 4.9 MW wood waste CHP and district energy project being developed by Clark County. A feasibility study has been completed using $225,000 in county ARRA block grant funds. A level one wood supply study has been completed, and phase II engineering and finance study is complete. A level III investment grade engineering, finance and PPA set of studies are being developed by Schneider Electric. The steam would be used for heating, cooling and water heating in up to five county buildings. The goal is to start construction by the end of 2011.

Anaerobic digestion/biogas – Compost facilities

28) Barr-Tech, Fishtrap, Lincoln County – This 3.1 MWc anaerobic digester CHP system with district heating is part of the Barr Bio-Industrial Park. An Andgar/GHD digester is under construction with an estimated completion date of February 2012. Inland Power & Light has agreed to purchase the power. It also includes a high solids anaerobic digester system and

compost facility using Spokane city and county organic wastes and three other facilities needing the waste heat. The project went on hold pending resolution of green waste supply concerns. Barr-Tech won the re-bid for green waste supply from the City of Spokane in November 2010. Construction has resumed. Interconnection financing efforts for this bioenergy industrial park in cooperation with Inland Power and Light is still problematic. The project has had technical support from the Washington State University Bioprocessing and Bioproducts Engineering Laboratory, and received a $2 million award in SEP funded ($1,210,000 loan and $790,000 grant). Power produced from food waste biogas does not comply with RPS requirements for Renewable Energy Credits.

29) Cedar Grove Composting, Everett – This is a 1.5 MWc, 50,000 ton high solids digester CHP system for post-consumer food waste. It is in the permitting stage for its air quality permit from the Puget Sound Clean Air Authority. Significant feasibility studies and reports have been completed. The heat is used to pasteurize compost. It received a $1 million SEP grant, but does not generate RPS-compliant power. The project received its marine estuary water permit from the Army Corp of Engineers.

Anaerobic digestion/biogas – Dairies

30) Qualco Energy, Monroe – This is a potential 750 kWc upgrade to an existing CHP digester project. This upgrade was enabled by passage of SSB 5797 in 2009 allowing co-digestion of pre-consumer food processing waste. Qualco has a choice between power generation and scrubbed/compressed biogas for transportation uses. No decision as to technology pathway has been made;
31) Rainier Biogas, Enumclaw – This is a 1.0 MWc CHP system for three farms with manure piping. It is supported by King County and Puget Sound Energy. A Guascor SFGLD 360 genset has been selected. The project received $1,392,500 in SEP funds ($974,750 loan and $418,228 grant). Construction is scheduled to begin in August 2011.
32) Farm Power Northwest, Nooksack – This 750 kWc CHP system for two farms is supported by Puget Sound Energy. A Guascor SFGLD 560 has been selected.
33) Farm Power Northwest, Samish Bay Community Digester – This is a 3.0 MW CHP digester system of 3 to 4 dairies in the early stages of development.

Anaerobic digestion/biogas – Food processors

No projects are currently active due to I-937 bioenergy definitions which do not include food waste or yard waste.

Anaerobic digestion/biogas – Wastewater treatment facilities

34) Brightwater Wastewater Treatment Facility, Woodinville – A new wastewater treatment facility is nearing completion of construction with membrane bioreactor filters installed and the solids area digesters with energy building almost complete. This technology produces less biogas than typical wastewater treatment systems. Initial operation is scheduled for 2011 with full completion in 2012. Plant size will be 36 mgd. About 1 MW of gas will be produced. A feasibility study on using Brightwater as a test bed facility for CHP applications was conducted by King County in cooperation with the Northwest Energy Technology Collaborative to use Brightwater as a test bed facility for CHP applications. Snohomish PUD has agreed to fund the test bed.
35) West Point Treatment Plant, King County – This CHP facility has operated since 1985. The project will rebuild and enlarge existing CHP operations (2.4 MWc to 4.6 MWc). The Upgrade is

under construction. Two 2.3 MW Caterpillar 3612 generators have been purchased. The three original .8 MW systems were decommissioned in 2007. In addition, digester gas is used to run influent pumps (1.6 MW). A natural gas line is now being run to the plant. The rebuilt system will have two reciprocating engines of 2.3 MW each, plus the 1.6 MW, for a total system capacity of 6.2 MW. Like the Renton plant above, average operations will be at the 3.9 MWa level with peak operation when necessary. Johnson Controls was selected as the contractor.

36) Redondo Wastewater Treatment Plant, Des Moines – This 60 kWc Stirling engine CHP system is a collaborative project between Lakehaven Utility District and Puget Sound Energy. The project entails two Stirling Flexgen engines utilizing digester gas from the plant's solids handling system (approximately 50,000 cubic feet per day). When complete, it will allow the district to offset approximately 20% of the plant's daily electrical requirement. Thermal energy will be used to reduce natural gas as a heating source for the plant. This project will be the first in Washington to use this state of the art technology.

DISTRICT ENERGY SYSTEMS

37) The Evergreen State College, Olympia – The College is exploring a wood waste gasification system as part of a broad sustainability effort leading to a net zero carbon and waste campus. The project was awarded a $3.7 million state Jobs Act grant to install the system and replace failing steam converters, steam valves and condensate piping. The boilers and switchgear are beyond their life expectancy. On April 1, 2011, the College declined the state Jobs Act funds and withdrew its legislative capital budget request. The Sustainability Council will continue its work on a feasibility study with recommendations. In addition, Thurston County has placed a one year moratorium on biomass projects.

38) City of Seattle – The City of Seattle's Office of Sustainability and Environment has funded a pre-feasibility study of nine neighborhoods to determine their potential for district energy. AEI of Madison, Wis. and Cowi of Denmark are doing the study. Technical expertise is being provided by Compass Resource Management of Vancouver, B.C. A second study, scheduled to start in the summer of 2011, will provide a deeper examination of district energy potential in selected neighborhoods.

39) Western Washington University – This is a biomass gasification district energy system. It is a potential Nexterra/GE Jenbacher district energy/CHP demonstration site. The phase I feasibility study was completed in September 2010. This $50,000 study was funded by the Northwest Clean Energy Application Center using Enron natural gas overcharge funds provided by the Washington Attorney General. A $100,000 phase II feasibility study is the next step. The results of the study will be used to prepare a capital budget request. Use of the intermittent waste heat form the downtown Bellingham ECOGEN system owned by Puget Sound Energy is also being considered. A 1.94 biomass Nexterra/GE Jenbacher district energy/CHP demonstration site was also considered but space considerations would require relocation of the facility;

40) University of Washington, Seattle – The University of Washington has a major infrastructure capital plan under development. A feasibility study is to include expansion of the system and CHP.

41) Quinault Indian Nation, Taholah – A biomass district energy system to heat tribal buildings is in the preliminary engineering and design stage. A $50,000 grant by the U.S. Forest Service Woody Biomass Utilization Grant for 2011 was provided.

WASTE HEAT RECOVERY

42) Nucor Steel, Seattle – This 2.8 MW organic rankine cycle system uses waste heat in a dirty gas environment. The electric arc furnace produces 2.5 MW net and the re-heat furnace (natural gas) .3 MWnet. WorleyParsons has completed a prefeasibility study. This would be the first such system in Washington. Seattle City Light views this as an energy efficiency project and offered $3,930,000 in funding. Nucor Steel applied for and was awarded SEP stimulus funds, but turned down the offer because it was largely loan funds. On March 31, 2011, the NW CEAC completed a technical analysis of whether or not the two projects qualify as high efficiency CHP under Washington law. The conclusion was that both projects qualify as efficiency measures. The study pre-dated the I-937 Technical Working Group process.

PROJECTS IN AN EXPLORATORY PHASE OR DID NOT MOVE FORWARD

43) Yakama Nation, White Swan – The Yakama Nation has been developing their renewable energy plans for some time. Studies have been completed by the University of Washington (business case), Jacobs Engineering, Grant County PUD and TSS (wood supply curves). BPA helped establish the tribal utility – Yakama Power. This 20 MW wood waste CHP project was stopped due to footprint issues at the White Swan location. Wood supply concerns remain. An alternative location with a use for the heat would be Toppenish.
44) Interfor Mill, Forks – This 15 MW CHP system using wood waste was proposed for the Interfor mill outside Forks.
45) Cathcart Landfill, Snohomish – This is a 2 MWc landfill gas CHP system co-located with an oilseed crusher and grain drying facility. The landfill is closed and currently flaring the gas. Heat from the flare is used to dry the meal from the canola crusher, and heat a boiler to de-gum the canola oil. Biogas from a dairy farm may also be added. Project financing is needed.
46) Eka Chemicals, Moses Lake – This is a 4.5 MW project located at a chlor-alkali plant. It would use hydrogen as the feedstock (hydrogen currently is flared). A proposal for funding was submitted to the U.S. Department of Energy Industrial Technologies Program. Hydrogen burns at a hot temperature. This is a technical challenge.
47) Central Treatment Plant, Tacoma – This digester CHP system has two biogas flares but production varies (sometimes too much and sometimes too little for a CHP system). The plant supplements its heat needs with diesel. A study has been completed for co-digestion opportunities to increase biogas production. The plant has two stages of digesters: 1) aerobic with an oxygen plant, and 2) anaerobic. A pressure swing absorption system is used to obtain the oxygen.
48) S'Klallam Tribe, Port Gamble – This project using biomass fuel saw early stage development. A combination of power production and heat for the casino was under consideration.
49) Port of Benton, Benton County – This 1.5 MW gasification CHP project with Evergreen Fuel Technologies involves two gensets (.5 MW and 1.0 MW). It builds on lessons learned from a similar gasifier system at FruitSmart in Whitstran. The project received $1 million in congressionally directed funding, and still requires a utility power purchase agreement and design stages.
50) Ocean Spray, Markham – This year-round cranberry processing facility with drying needs has completed an initial assessment. The plant is currently using diesel fuel. In March 2008, the Center analyzed an initial assessment and encouraged selection of a hog fuel-based CHP option. An anaerobic digestion system was also considered.
51) Puget Sound Energy, Sumas – Puget Sound Energy and Ormat signed a 20-year power purchase agreement in January 2006 to install the first organic rankine cycle system in the Northwest. This

heat recovery project at a natural gas compressor station is sized at 4.95 net MW. Recovered waste heat comes from three existing gas turbines.

52) U.S. Navy, Bremerton – An analysis of steam pressure requirements has shown a major opportunity to drop pressure, increase electricity production, and improve economic payback. The system is now sized at 1,986 kWc instead of 1,371 kWc. This project was submitted for engineering review by the Navy. Two questions were raised: 1) impact of natural gas prices on project economics (a sensitivity analysis is needed); and 2) impact of additional steam condensate returns necessitating a design analysis of the steam trap system. Project was submitted for Navy funding but not selected.
53) Community Digester, Stanwood – A group of 10 dairies and one egg production facility joined together for a digester CHP feasibility study funded with an $85,175 Value-Added Producer Grant from USDA in 2005. The CHP system would be roughly 650 kW to 1 MW in size and handle the equivalent of approximately 5,000 head of dairy cows (200 chickens = 1 cow).
54) Mason Conservation District, Shelton – Hood Canal has low levels of dissolved oxygen. One of the causes is animal waste. The Washington State Legislature appropriated $560,000 to study the problem. A biogas fueled CHP/digester system was considered. A feasibility study was completed and developer selected. The project shifted to biogas for thermal use at a different location;
55) AB BioEnergy, Toppenish – A very integrated system was being developed in phases. Phase I would use tallow and yellow grease as feedstock for biodiesel production. The project received a $2 million SEP award but failed to move forward due to siting problems. Phase II envisions a digester for sludge from wastewater treatment ponds and 65 kW Capstone microturbine.
56) Solomon Renewable Energy, Shelton – This is a 31 MWc CHP system co-located with the Simpson Lumber Company sawmill and Olympic Panel Products plywood mill. It is it is on hold. The project has applied to the Olympic Regional Clean Air Authority for its air permit. The submittal is currently incomplete.
57) Chelatchie Green Energy, Chelatchie – This is a 24 to 27 MW facility in northeastern Clark County at an old International Paper mill site. A partner is needed to use the waste heat. A feasibility study by LD Jellison was completed. Two existing boilers are on-site.
58) Clark County Biomass Initiative, Chelatchie – A level one feasibility study explored: 1) 19.8 MWc CHP system, 2) 7,300 GPY cellulosic ethanol, and 3) 12,000 TPY pellet mill. They are seeking a host user for steam, which will significantly improve the energy efficiency and economics of the system. Enabling legislation was passed by the Washington Legislature HB 5724 in the 2009 session. The county has requested wood supply support from DNR. This project is not moving forward at this time.
59) Rappaport Bioenergy, Longview – This is a 25 MWc biopower CHP system. It is an integrated biorefinery that would produce 30 MGY of biofuel and 25 MW of electricity using 300,000 BDT of wood waste per year. A $1.5 million SEP award was returned due to timing limitations. This project is still looking to proceed, but needs full funding and a power purchase agreement.

Project Summary Totals

Incentive	Number Selected*	MWc*	Funding
State Energy Program	10	92.40	$14,083,906
DOE Industrial Technology Program	1	50.00	18,750,000
NW Clean Energy Application Center	2	.20	200,000
Dept of Natural Resources	2	29.40	0

USDA Rural Development	2	1.35	3,100,000
US Forest Service Wood-to-Energy	1	8.20	4,000,000
US Forest Service Woody Biomass Utilization	1		50,000
Totals*	13	142.60	$40,183.906

* A few projects have been selected and received funding from several sources (for different parts of a larger project). Totals are not double counted.

Publication Number: WSUEEP 10-043

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