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TO: **City of The Dalles Planning Commission**
CC: **Dan Durow, Greg Winterowd**
FROM: **Bob Parker and Ethan Nelson**
SUBJECT: **GOAL 13 ENERGY AND LAND USE ANALYSIS**

BACKGROUND

The City of The Dalles is currently involved in the periodic review process for The Dalles Comprehensive Plan (referred to as "The Plan"). This memorandum addresses the energy analysis item in Task 7 of the Winterbrook/ECONorthwest contract for updating The Plan.

The key issue for The Dalles involves an evaluation of whether the Urban Growth Boundary (UGB) has enough land to accommodate the land development associated with the population growth expected within the next 20 years. The expansion of the UGB requires a review of applicable Oregon Land Use Goals. This memorandum focuses upon Goal 13-Energy Conservation and how it applies to the community of The Dalles.

Oregon Land Use Goal 13 (OAR 660-015-0000(13)) states, "Land and uses developed on the land shall be managed and controlled so as to maximize the conservation of all forms of energy, based upon sound economic principles." This memorandum addresses land use policy and its potential implications for energy conservation, in the context of future economic constraints posed by scarcity of petroleum based energy sources.

The Winterbrook scope of work requires the energy consequences of continued reliance on single-occupancy vehicles and lower-density urban development evaluated in the context of increasing fuel prices. Task 7 in the City's work program asks for an evaluation of forecasted population on the potential for mass transit, and the effects of oil shortages on City form.

This memorandum is the Task 7 product and is organized as follows: an overview of the local energy system, followed by a discussion on the reduction of energy demand involving energy efficiency, distributed generation and renewable energy sources. These sections provide a framework for engaging in a discussion on why local governments should promote energy efficiency and renewable energy (EERE) activities and policies, followed by an overview of successful strategies local governments can employ to enjoy the benefits from increased EERE activities. Appendix A provides additional information on the current state and regional energy context, while Appendix B outlines current energy efficiency program available in The Dalles and those offered through the Oregon Department of Energy.

THE DALLES ENERGY SYSTEM

Northern Wasco County People's Utility District (NWC-PUD) provides power to customers and communities in the Northern part of Wasco County, including the City of The Dalles, Dufur, Rowena, Tygh Valley and Wamic. The service area stretches to Memaloose Park on the West, to the Deschutes River on the East and to the towns of Wamic and Tygh Valley to the south. NWC-PUD purchases the majority of its power from the Bonneville Power Administration. (Wilson, 5/19/05). Northwest Natural Gas (NW Natural) provides The Dalles residential, commercial and industrial customers natural gas.

Northern Wasco County PUD is very reliable system with few outages, and some of the lowest rates in the region. Rates are established by the five-member Board of Directors. As a full requirements customer of the BPA, NWC-PUD receives 100% its power comes from the BPA. The PUD is a winter peaking utility because of the increased electric load for lighting and space and water heating. Appendix A provides additional information concerning the regional power system and Oregon's current energy needs.

The NWC-PUD built two generation projects – a 5 MW generator at The Dalles Dam and a 10 MW unit at McNary Dam in Umatilla. The output from The Dalles project is being sold to Puget City & Light. The PC&L contract expires in 2011, signifying full capital payment (at no cost to NWC-PUD ratepayers). At that time NWC-PUD will decide whether to bring the output into the local system or sell to the BPA depending on which is a greater long-term benefit for ratepayers. The McNary project was built in a 50-50 partnership with Klickitat County PUD in Goldendale. Costs and output is split evenly between the two PUDs.

In 2005, NWC-PUD employed 36 full-time equivalent (FTE) staff and paid $2.275 million in annual wages, $252,253 in local property taxes and $242,275 in franchise fees to the local governments. Electric sales in 2004 were: 280,616 Megawatt hours (mWh), of which 241,968 mWh were retail sales and 38,628 mWh were wholesale sales. NWC-PUD serves 8,943 single phase (residential), 402 commercial, and 142 Industrial customers of which there are 41 three phase customers, 5 primary services, an additional 48 irrigation districts, the Northwest Aluminum Smelter and Google.

REDUCING ENERGY DEMAND

The two primary pathways for reducing energy demand are integrated urban form and energy efficiency. By reducing energy concerns in the development of urban areas, jurisdictions can greatly impact the long-term sustainability of their regions. These reductions occur through use of integrated design of zoning, codes, and standards in addition to increasing the use of energy efficient technology. Additional gains of efficiency and supply security occur through use of renewable resources for distributed power generation. This section identifies trends in the areas of urban form, energy efficiency, distributed generation and renewable resources.

THE EFFECT OF URBAN FORM ON ENERGY USE

American cities and town represent over 80% of energy usage in the country. Of this amount, land-use and urban form affect approximately 70%, or 56% of national energy use. Because land-use and urban form represent such a large portion of the energy consumption in the US, even small changes in these areas will result in large energy savings. (Anderson, 1993).

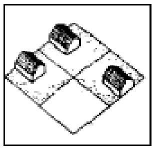
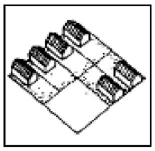
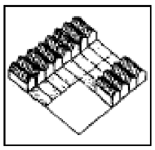
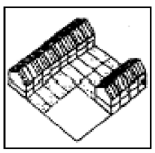
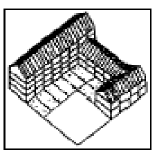
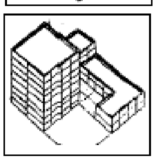
Increased suburbanization of the American city created an urban form dependent upon the automobile and petroleum as a fuel. While there are a number of suitable alternative fuels for transportation (biodiesel, ethanol, hybrid-electrical, and fuel cells), the majority of the US transportation fleet relies upon petroleum fuels. The heavy reliance upon petroleum based fuels present future energy, economic and environmental challenges to local communities.

The suburban form greatly influences the energy use for transportation and residential uses. A low-density community that separates work, commerce, community, residence and entertainment greatly increases the reliance for transportation on automobiles. Additionally, the presence of dispersed infrastructure greatly increases the requisite energy needs. Increasing density and providing for mixed uses increases the energy efficiency of a community.

Figure 1 shows that increased residential density allows for increased use of mass transit options, energy efficiency, and pollution reduction for residential uses. The increase in energy efficient strategies and urban form provides additional social welfare benefits including (PLACE^{3}S, 1996):

- Affordable Housing: Reduced costs for energy and increased mass transit and pedestrian access to work, shopping, etc.
- Reduction in auto dependence helps to alleviate congestion and increase alternative methods of transportation.
- Reduction in pollution and greenhouse gas emissions. Increased environmental benefits by a reduction in greenhouse gas emissions and human health by a reduction in pollution increase in regular exercise (walking/riding bicycle).
- Higher density reduces the overall system costs for public services such as parks, infrastructure, and human services.
- Preservation of natural resource lands.
- Reduction in flight of capital from local areas. Local dollars spent on petroleum leave the community. Increased local capital results in increase in local investment creating stable employment.

Figure 1: Energy Effects on Residential Density

		Total Operating Energy Use Per Household		
		Energy (MMBtu/yr)	Cost ($/yr)	CO_2 (tons/yr)
	3 Units/Acre Single-family subdivision on 10,000 sq. ft. lot, auto dependent.	440	4,800	50
	6 Units/Acre Detached housing on 5,000 sq. ft. lot, commuter oriented transit service.	410	4,600	49
	12 Units/Acre Townhouse on 2,500 sq. ft. lot, high level of transit service to employment centers; attached walls reduce building energy use.	380	4,300	47
	24 Units/Acre Low rise apartments, walking and transit trips equal to auto use; bldg. energy use lower per apt.	360	4,100	47
	48 Units/Acre Mid rise apartments, transit and pedestrian trips exceed auto use; per apartment energy reduced further.	340	3,900	45
	96 Units/Acre High rise, very high transit and pedestrian activity; very low building energy use per apartment	310	3,700	42

Source: PLACE3S, 1996

The Oregon Land Use system works to integrate these social welfare benefits into land-use and planning through Goal 13. Oregon Land Use Goal 13 provides broad guidelines for planning and implementation for energy utilizations. Below is a list of Goal 13 Planning Guidelines:

1. Priority consideration in land use planning should be given to methods of analysis and implementation measures that will assure achievement of maximum efficiency in energy utilization.

2. The allocation of land and uses permitted on the land should seek to minimize the depletion of non-renewable sources of energy.

3. Land use planning should, to the maximum extent possible, seek to recycle and re-use vacant land and those uses which are not energy efficient.

4. Land use planning should, to the maximum extent possible, combine increasing density gradients along high capacity transportation corridors to achieve greater energy efficiency.

5. Plans directed toward energy conservation within the planning area should consider as a major determinant the existing and potential capacity of the renewable energy sources to yield useful energy output. Renewable energy sources include water, sunshine, wind, geothermal heat and municipal, forest and farm waste. Whenever possible, land conservation and development actions provided for under such plans should utilize renewable energy sources.

These planning guidelines are meant to guide community development of elements within a comprehensive plan to address energy utilization. Despite the strong evidence for incorporating energy efficiency into a community comprehensive plan, very few communities have done so with meaningful results. The Local Strategies section of this memorandum presents a number of implementation strategies and recommendations that The Dalles could consider for inclusion into its comprehensive plan, functional plans, or implementing ordinances.

WHY SHOULD LOCAL GOVERNMENTS GET INVOLVED?

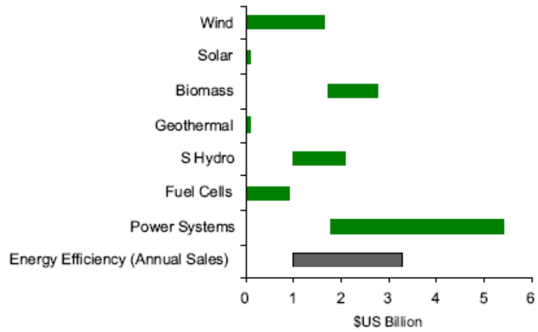
The Oregon Renewable Energy Action Plan (OREAP) outlines three main benefits for use of renewable energy resources and increased energy efficiency, these are environmental benefits, economic development, and risk mitigation. (OREAP, 2005) These three areas of concern and opportunity provide the basis for this section.

The risks associated with continuing on our current energy use pathway are higher electricity and fuel prices, the destabilization of local economies through inflation and material shortages, the increase of household income dedicated to energy, and turning local energy delivery systems obsolete. The potential benefits of increasing energy efficiency and renewable energy transportation fuels and electrical generation include increased energy independence, increased local and regional economic activity, and potentially a more human oriented urban form. Renewable energy and increased efficiency affects all sectors of the economy and is not solely a Smart Growth discussion, but provides multi-objective benefits to a community through the holistic use of resources.

Supporting the use of renewable energy sources for power generation and increasing energy efficiency reduces the level of pollution emitted into local ecosystems. This pollution affects water and air quality and ultimately human health. Global climate change is no longer a myth, but a reality that Oregonians will need to prepare for and address over the next 50 years. Citizens want a clean environment; between 1973 and 1996 the Renewable Energy Policy Project conducted 700 polls, finding Americans have become more concerned about environmental issues. A Mellan Group poll conducted for the World Wildlife Fund found 82 percent of respondents favored clean energy sources such as wind and solar. (Warner and Schoenrich, 1999) Oregonians economic and cultural livelihood requires a clean environment.

Clean energy generated through the use of renewable resources and energy efficiency technologies presents a large economic development opportunity for Oregon and the Pacific Northwest. Figure 5 illustrates the economic value of future clean energy developments in the Pacific Northwest. The Oregon Department of Energy reports that for every $100 million invested in the clean energy sector, 1,250 full time jobs are created, net increase in economic output is $200 million, and state/local taxes of $1 million are generated (OREAP, 2005). These increases are fueled by a global market that is forecasted to increase from a $40 billion industry in 2005 to $167 billion by 2015. (Makower, et.al, 2006) Oregon communities that proactively address energy efficiency and renewable energy technologies and policies gain a competitive economic advantage in the years to come.

Figure 2: Estimated Value of Installed Clean Energy Capacity in the Pacific Northwest, 2000-2020



Source: Poised For Profit, 2003

Energy security and risk mitigation are exacerbated by climate change, fuel price volatility and peak oil production. Climate change presents a level of uncertainty that is impossible to simulate through available analysis methods. Global warming simulation models predictions for the rise in sea level range from 8 inches to 35 inches in the next century, affecting Oregon through a possible reduced snow pack. (Resource Innovations, 2005) Reduction in fresh water and a rise in sea level will devastate Oregon's economy.

The possible effects of climate change are compounded by increasing price volatility for petroleum fuels. Increased modernization and development in China and India have spurred global petroleum prices to rise steadily. Additional pressure will come from the peaking of the world petroleum reserves within the next 50 years. Projections from petroleum industry researchers estimate peak oil production will occur between 2006 and 2025, decreasing steadily from that point on. (Hirsch, 2005).

To manage the risks associated with climate change, price volatility, and peak production, communities must take aggressive steps immediately. Given an accelerated approach to mitigating the decline of available petroleum, the US Department of Energy calculated a 20 year lag period between the start of a program and when a liquid fuel deficit would end. (Hirsch, 2005) The longer a community waits to implement energy efficiency and conservation measures, the greater the obstacles will be towards a stable economic and social future.

HOW CAN LOCAL GOVERNMENTS GET INVOLVED?

The following section provides an outline on how a community can approach energy planning at a regional level. The PLAnning for Community Energy, Economic and Environmental Sustainability (PLACE³S) Program provides the opportunity for a community to engage in an in-depth visioning and identification practice. Once the community vision and strategy are identified through PLACE³S, they must define the action steps of an implementation plan. Example implementation steps are provided in the Energy Aware Program and Oregon Department of Energy's Model Ordinance for Energy Projects.

PLACE^{3}S

PLACE^{3}S is a planning method created in cooperation by the state energy offices of Oregon, Washington and California with planning consultants Criterion Inc. and Mckeever/Morris, Inc. It is an in-depth planning program involving a large commitment of financial, staff and community resources. This model focuses on integrating regional resources and is designed for metropolitan areas. Despite the scale issue, the majority of planning tools, strategies and activities are applicable to a community of any size. The benefit of utilizing a comprehensive model such as PLACE^{3}S is the creation of an integrated community vision and action plan that is developed and ready for adoption.

Step 1: Start Up. Establish relationship of PLACE3S to regional planning processes. Initiate public involvement. Assemble regional and sub-area data on existing conditions. Estimate existing energy use, costs, and air pollutant and CO2 emissions. Establish and apply sub-area rating criteria. Formulate regional plan evaluation criteria.

Step 2: Create a business-as-usual alternative. Project land-use and travel conditions. Estimate energy use, costs, and air pollutant and CO2 emissions. Establish and apply efficiency rating criteria. Conduct public review of Business-as-Usual Alternative.

Step 3: Create and analyze planning alternatives. Create alternative plans. Adjust database to simulate alternatives. Estimate energy use, costs, and air pollutant and CO2 emissions of each Planning Alternative. Apply efficiency rating criteria and compare alternatives. Conduct public review of Planning Alternatives.

Step 4: Create a preferred alternative. Conduct stakeholder selection of Preferred Alternative. Adjust database to simulate Preferred Alternative. Prepare energy use estimate and efficiency ratings. Conduct public review of Preferred Alternative.

Step 5: Adopt, Implement and Monitor. Adopt the Preferred Alternative. Select monitoring benchmarks. Periodically collect and report performance data.

Energy Aware

The Energy Aware Planning Guide was created by the California Energy Commission to provide energy conservation strategies and ideas for integration into land-use planning. In addition to providing a more rudimentary version of the PLACE^{3}S planning process, Energy Aware offers numerous urban design, comprehensive plan, and ordinance action items for implementation. The following sections integrate Energy Aware recommendations with pertinent State of Oregon policies.

Urban Form

As described earlier in this document, the form of urban development greatly affects the intensity of energy use. To address energy conservation in urban form, applicable Energy Aware Planning Guide implementation strategies are provided below.

- **Mixing Residences and Worksites**: Revise zoning code to permit land use mixing. Offer incentives such as density bonuses for commercial projects that include housing. Require a certain amount of housing in and adjacent to large scale commercial developments. Use redevelopment authorities to require housing and commercial uses in redevelopment areas. Coordinate mixed-use development and transit.

- **Shops and Services within Walking Distance of Homes**: Adopt specific plans for new and existing neighborhoods that include zoning for shops and services within a ½ mile radius of homes. Adopt design guidelines and standards which encourage walking. Revise the community subdivision ordinance to include a mix of services within ½ mile of homes. Provide incentives for mixed-use developments including expedited processing, reduced fees or reduced parking requirements. Link requirements to economic demand, conduct a market study to assure the viability of implementing new requirements.

- **Shops and Services at worksites, transit, and park and ride lots**: Prepare specific plans for areas with high employment concentrations. Provide incentives for mixed-use projects.

- **Density near transit for Housing and Jobs:** Provide increased pedestrian, bicycle and transit access.

- **Diverse and Compact Housing:** Develop zoning codes, subdivision ordinances and development plans that allow for a mixture of housing types within an area. Reduce lot size, setback, frontage and/or yard requirements. Allow zero-lot-line (ZLL) zoning to increase dwelling unit density. Adopt an Accessory Unit Dwelling ordinance. Allow attached housing units and multi-family units.

Transportation

Motor vehicle transportation accounts for 38% of Oregonian's energy use (Figure A.1) and presents the largest signal source of air pollution to urban areas (DEQ, 2006). The ubiquitous use of motor vehicles combined with the negative environmental impacts allows for a large number of options that can each provide one integral piece to a larger conservation strategy.

- **Create a City/Regional Transit Agency/System:** A local/regional public transit system is the critical element in all successful transportation and energy conservation programs.

- **Increase opportunities for walking and bicycling:** Review and revise street design standards to accommodate increased walking. Amend the subdivision ordinance to incorporate alternative transportation modes into design, including bike paths and sidewalks. Establish a bicycling education program. Provide incentives to new commercial developments to incorporate bike supportive facilities such as secure parking, showers and lockers, and/or bicycling gear.

- **Create an Integrated Circulation System**: Develop guidelines for streets, paths and sidewalks to include bike and pedestrian friendly design standards for sidewalks and bike lanes throughout system. Incorporate new plans with the Transportation System Plan and Parks Plan to encourage greater connectivity. Provide new connections in critical areas.

- **Design for Transit Access:** Improve existing standards to make transit more convenient, safe and enjoyable. Require developers to build transit stops identified by the transit agency. Integrate transit access, pedestrian and bicycle concerns into the master planning process as a goal and/or objective.

- **Private Employer Programs:** such as the Oregon Department of Environmental Quality's (DEQ) Employee Commute Options program (ECO). This program provides strategies to support alternative employee commuting as required under the US EPA guidelines for air quality non-attainment in the Portland Metro area. Although many of the strategies are designed for major metropolitan areas, they are adaptable to different community sizes. The ECO website provides additional options for commuting. (http://www.deq.state.or.us/nwr/ECO/eco.htm)

- **Public agencies and there employees can create the example for forward thinking conservation policies:** These include reducing employee commute trips by offering to subsidize bicycling and walking, creating a vanpool or carshare program, offer alternative work schedules and/or establish a electronic commuting (telecommuting) program.

- **Vehicle Fleets:** Private companies and public agencies can support energy conservation through purchasing fuel efficient cars including hybrids, purchasing domestically produced biodiesel and ethanol fuel blends, running liquid natural gas (LNG) or the renewable compressed biomethane (CBM) as fuels.

Building Codes

The State of Oregon Building Code mandates a variety of energy efficiency requirements that new construction must meet. This existing code can be strengthened through the local adoptions of retrofit ordinance for residences and commercial buildings. Additionally, adequately enforcing all construction to meet code will provide increased efficiencies. By providing financial incentives for developers to exceed the state building codes, The Dalles can further increase overall stability and decrease the cumulative environmental impact of development. The first step is for the City of The Dalles to create and implement an efficiency standard for city facilities and services, such as the LEED standards which the City of Portland adopted for all new buildings.

A Model Ordinance for Energy Projects

In July of 2005, ODOE developed a model ordinance for siting energy projects in Oregon. This document provides planning support for communities that intend to site a small energy generation facility. The Oregon Energy Facility Siting Council provides oversite for large-scale projects determined in ORS 469.300. The model ordinance provides specific language which a community can adopt for improved integration of local and state policies into the conditional use or special use provisions of the local code. With each model code is commentary provided by ODOE to help with the linkage between the statewide land-use planning goals, applicable rules and statutes, and the local jurisdiction's adopted comprehensive plan. (ODOE, 2005) This document can be accessed through the Energy Facility Siting Council's section of ODOE's website (http://egov.oregon.gov/ENERGY/SITING/local.shtml).

ENERGY EFFICIENCY STRATEGIES

By promoting energy efficiency in land use planning and urban design, Oregonians help to reduce energy costs and support the regional economy. Between 1990 and 2002, Northwest utilities invested $2.4 billion in energy conservation, resulting in a savings of 2,600 average MW annually. The reduction in demand impacts Oregonians through increased cost savings and reducing the likelihood of supply shortages which cause price spikes and negatively affect reliability. (ODOE, 2004)

The focus of most energy efficiency programs is for consumers to replace their current energy intensive products with energy saving models. The largest category of these products are electrical appliances, but larger rates of efficiency occur through the installation of heating, cooling or lighting products which directly reduce the energy need for buildings.

Appendix B summarizes the current energy efficiency programs offered by the North Wasco County PUD and descriptions of Oregon Department of Energy sponsored programs for energy efficiency and renewable energy (EERE). There are a number of approaches to support EERE including tax incentives, financial assistance and zero interest loan programs. A comprehensive community energy plan will incorporate substantial financial incentive programs with regulatory approaches that penalize or create disincentives for developers and consumers to utilize energy intensive appliances and building materials.

DISTRIBUTED GENERATION AND COGENERATION

Cogeneration and distributed generation (DG) offer opportunities for improving energy efficiency in local communities. Location, design, size and fuel source differentiate cogeneration and DG facilities from central power plants. The two approaches are sometimes used interchangeably, but they are distinguished from one another through the use or non-use of excess heat. This section outlines the types, benefits and challenges of the cogeneration and distributed generation technologies currently available.

Distributed generation is the ability to produce power close to the load end use. The benefits of DG include load security, grid backup, and energy source options. Additionally, use of DG can reduce transmission loss, emissions and rate-payer expenses.

Cogeneration is the ability to produce power close to the load end use and utilize the excess heat energy produced from the power generation towards facility needs. Benefits are similar to DG with the addition of providing inexpensive space or process heating to co-located facilities. The US Energy Information Administration forecasts the addition of 19.1 gigawatts (GW) of power added by distributed generation sources nationwide by the year 2020 (Enyon, 2005)

There are numerous examples of cogeneration in Oregon including the Amalgamated Sugar Company Plant in Nyssa (Coal-14,000 KW), Crown Pacific L.P. in Gilchrist (Wood Residue-1,500 KW), City of Salem Willowlake Wastewater Treatment Plant (Wastewater gas-800 KW) and Clatskanie County PUD/Eugene Water and Electric Board Plant on Georgia Pacific Plant in Wauna (spent pulping liquer-36,000 KW). (Shwartz, 2005)

Technologies for Cogeneration and Distributed Generation

There are a number of viable options currently available for the small scale generation of energy. Coupled with the electrical generation capacity of many of these technologies is the cogeneration of usable heat energy. Even though The Dalles enjoys a stable renewable energy source locally provided by hydo-power, it is important to recognize the benefits of distributed generation and the increased efficiency of cogeneration units. This section provides a brief discussion of applicable technologies.

Small Steam-Electric Plants

These plants have historically provided reliable and long lived generating capacity for industrial applications. The efficiency rate of the steam cycle can reach 80% when utilizing the heat products. These plants are best for baseload applications due to the typically high capital and low fuel costs. Per unit capital costs for a steam electric plant can be higher than other types of technologies because of the complexity, fuel handling, emissions controls, and heat rejections systems. In the Northwest, these plants are fueled with wood-residues, coal, or natural gas. Typical cogeneration units range in capacity from 1 to 100MW. Historically in Oregon, these plants were associated with timber mills due to the large quantity of post production wood residue. (NPCC, J-4)

Gas Turbine Generators

Gas turbine generators are capable for 500 kW to 50 MW of electrical generation capacity. The smaller units are generally mobile units which supply the primary electricity to remote activities. They are highly reliable reaching levels between 90 and 98 percent, but must maintain above 70 to 80 percent of the full load. When utilized solely for power generation the efficiency rate ranges from 22 to 37 percent depending upon operating conditions. Additional efficiency is gained through the use of the large amounts of quality thermal exhaust. When utilizing both heat and power, gas turbines reach operating efficiencies up to 70 percent. These engines are best utilized for quick start low load applications such as peak generation, grid support and standby service. (NPCC, J-8/9)

Reciprocating Engines

Reciprocating engine generators utilize either a spark-plug (SI) or compression ignition (CI) for internal combustion engine that drives an electrical generator. These engines can utilize a variety of fuels such as gasoline, diesel oil, propane, natural gas and biogases. They are characterized by high reliability, low initial costs, easy maintenance, and low water consumption. They are generally utilized for emergency back-up systems due to the quick “black start” capability. Load capacity range between 25 and 41 percent for power generation. Because reciprocating engines can work on low fuel pressure, they are ideally suited for low cost power generation from landfill and wastewater gas. The challenge for reciprocating engines is the high level of greenhouse gas emissions generated compared to the other technologies mentioned here. (NPCC, J-12)

Fuel Cells

Currently, there are four types of fuel cell technology suitable for distributed generation; these are phosphoric acid, proton exchange membrane, molten carbonate, and solid oxide fuel cells. The fuel source for these technologies is either hydrogen or carbon dioxide depending on the type of cell. They operate similar to a battery, but utilize a continuous stream of fuel to the anode from an external supply. The chemical energy is converted through an electrochemical process into usable electrical energy. Although basic fuel cell design has been around for over 170 years, the high cost for fabrication and a limited stack life has precluded expansion of the technologies. The benefits of fuel cells are low operating costs and low green house gas emissions. The electrical energy generation efficiencies range between 25 and 46 percent, rising to 80 percent when utilization of exhaust heat is combined in some of the applications. Generation capacity ranges from 5kW to 2 MW in conventional applications. (NPCC, J-16/17)

Microturbines

Microturbines operate in much the same manner as large scale gas turbines, but with the advantage of smaller load delivery, compact size, quietness, and lower uncontrolled air emissions. The technology is derived from automotive turbocharger and aircraft auxiliary power units. They can run on natural gas, biogas, propane, butane, diesel, and kerosene. Operating efficiencies range from 23 to 26 percent for power generation, rising to 70 percent when utilizing the exhaust heat. Individual units range from 30 to 250 kW and can be developed in an array to provide continuous power with back-up potential during routine maintenance. They are more capital cost intensive than other technologies but have long life spans with reduced operation and maintenance costs. They are commonly utilized with anaerobic digestion, wastewater plants and landfill gas operations. (NPCC, J-21/23)

Other Renewable Generation Technologies

This category includes solar photovoltaic systems and small wind turbine generators. Solar photovoltaic utilizes solar radiation run through a semiconductor tube to produce direct current (DC) electricity. The DC energy must then be run through an inverter to produce usable power. These systems are currently very capital intensive with a limited life span of 20 to 30 years. The operation and maintenance costs are low based mainly on the upkeep of the inverter and replacement of batteries (if part of the system). Operating efficiencies range from 4 to 13 percent depending on the type of cell technology utilized. Although the efficiency range is low, the fuel source is free, generates no emissions, and can be integrated into the design of a building. Electrical generation capacity is correlated to the size of the installation, with most residential applications ranging from 2 to 8 kW. (NPCC, J-34/36)

Small wind generators are 100 kW or smaller systems that are commercially tested and available for installation. They are clean, quiet and require no fuel other than wind for operation. Capital costs have reduced dramatically over the past ten years as the industry has developed and more jurisdictions provide substantial financial incentives for installation. Additionally, the operation and maintenance costs over the 20-30 life span of a turbine is generally 2 to 4 percent of the capital cost annually.

LOCAL STRATEGIES

The global energy infrastructure presents the greatest challenge for change. Due to entrenched interests with multiple viewpoints and a lack of governing structure, comprehensive policy changes are near to impossible to implement. Even at the federal and state level, energy efficiency strategies and policies face difficult challenges. Despite these challenges, the local level provides the greatest opportunity for change. Local jurisdictions enact a large amount of control over the manner in which development occurs. Comprehensive land-use planning and design could provide efficiencies unmatched by most federal or state led initiatives. This section outlines motivations for governmental involvement and strategies for success.

SUMMARY

The Dalles enjoys a relatively strong energy position due to the size of community, projected future demographic changes, and located in close proximity to their main power provider's generation facilities. Additionally, as a full requirements customer, 100% of the power comes from the BPA's hydro generation dams. In the case of future disruptions in the BPA distribution of energy, The Dalles can further stabilize the energy supply by evaluating appropriate renewable and distributed generation opportunities. Future disruptions may include increased costs due to salmon recovery efforts, pressure from the federal government for full cost delivery to current shielded customers, and increased competition for clean power sources.

Action strategies should prioritize improving efficiencies in the energy efficiency of the built environment, improvements in urban form, and the transportation sector, respectively. By increasing efficiencies for residents, The Dalles municipal government will proactively secure the economic stability of the city and region for the near and long term. In as much as improvements in the transportation sector are largely outside of the influence of the local jurisdiction, it is recommended that The Dalles invest in energy efficiency programs by either enhancing the existing programs that the North Wasco County PUD offers or expanding programs to include increased efficiency in building standards, denser urban growth patterns, and long-term strategies for a public transportation system.

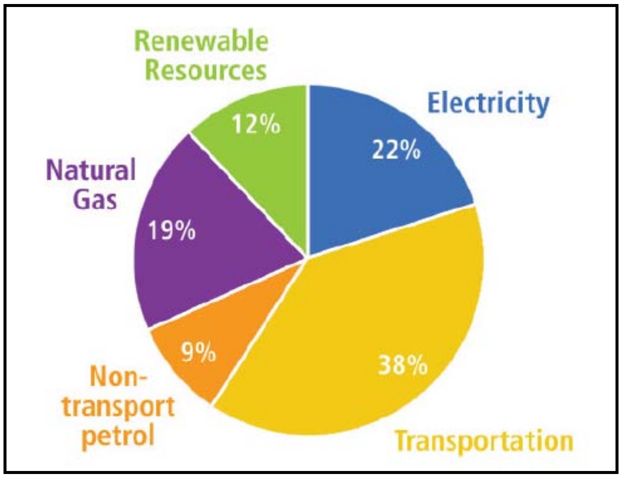
APPENDIX A: OVERVIEW OF STATE AND REGIONAL ENERGY SYSTEMS

OREGON'S ENERGY DEMAND AND SUPPLY

Each biennium the Oregon Department of Energy produces the State of Oregon Energy Plan, the majority of the following data is from the 2005-2007 report.

Oregonians spent over $7.6 billion on energy in 2000, using over 773 trillion British Thermal Units (BTU), which is a 15% increase from 1990. Figure 1 shows the end use of energy in for Oregon in 2000. Transportation fuels represent the largest sector, with renewable energy (including hydro-electric) constituting only 12% of total energy usage. Outside of renewable energy sources (hydro, wind, and biomass) all natural gas and oil is imported from outside of the state. In 2000, Oregon businesses, governments and households expended 1.2% and 3.8% of total income on natural gas and oil respectively.

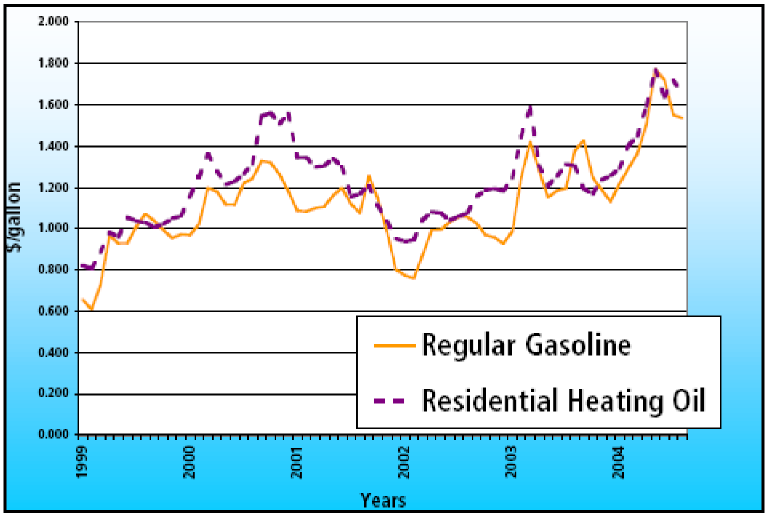
Figure A.1: 2000 Oregon Energy End Uses



Source: State of Oregon Energy Plan: 2005-2007, ODOE, 2005.

The majority of Oregon's energy comes from petroleum-based sources (87%) including energy sources for electricity generation. This reliance upon petroleum energy sources decreases the stability of the Oregon economy and household wealth due to the increasingly volatile prices for petroleum fuel sources. Oregon's high gasoline prices are taking a toll on the state's economy. Oregon consumers are spending more of their household income on gasoline than ever before. High fuel prices also reduce profit margins for manufacturing and transportation sectors, which then pass along the higher cost of their goods and services. Oregonians are therefore not only paying higher prices for the gasoline they need, they are using what's left of their disposable incomes to pay higher prices for other products. Figure A.2 shows the rise in cost of retail petroleum.

Figure A.2: Oregon Retail Petroleum Prices (w/out Tax), 1999-2004



Source: State of Oregon Energy Plan: 2005-2007, ODOE, 2005.

Oregon's electricity supply includes a variety of sources, as is shown in Table A.1. Because hydro-electricity generation is based heavily on water and snow conditions, these percentages change each year. During drought years, natural gas generation fills the gap left. Some climate change models forecast a decrease in the Pacific Northwest snow pack, thereby increasing the reliance upon petroleum sourced generation (Resource Innovations, 2005).

Table A.1: 2003 Oregon Electricity Fuel Mix

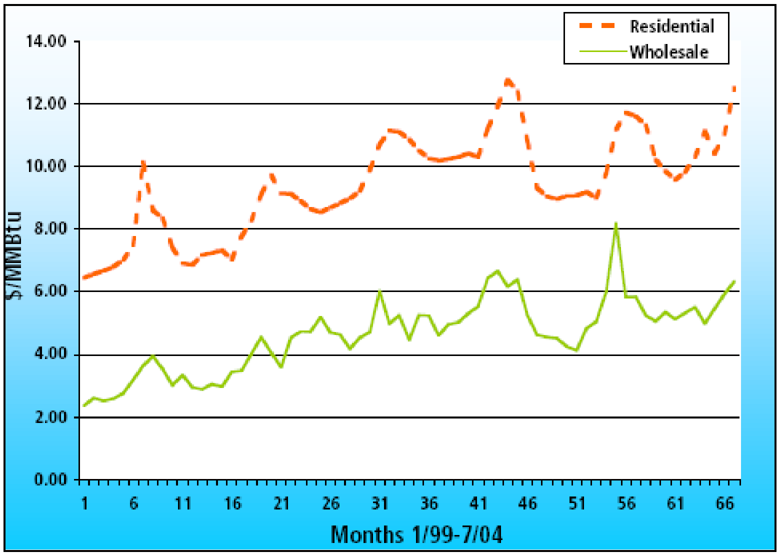
Source	Percent
Wind and Geothermal	1%
Nuclear	3%
Biomass and Solid Municipal Waste	3%
Natural Gas	7%
Coal	42%
Hydro	44%

Source: State of Oregon Energy Plan: 2005-2007, ODOE, 2005.

Coal power is generated from the plant in Boardman and purchased from plants in Utah, Wyoming and Montana. The Columbia Generating Station at Hanford, WA produces the nuclear mix. Biomass and Municipal Solid Waste are generated at industrial sites, garbage incinerators and with gas from landfills. Although wind generation increased in the past few years, it represents only 1% of total generation.

From 2001 to 2003, Oregon added 1,675 MW of new natural gas fired generation. Because natural gas represents 7% of all electricity generation, retail electricity prices continue to rise as natural gas rates increase (Figure A.3).

Figure A.3: Oregon Natural Gas Prices, 1999-2004



Source: State of Oregon Energy Plan: 2005-2007, ODOE, 2005.

Historical Perspective

NWC-PUD is one of a six-member Oregon People's Utility District Association. Public ownership of electric utilities is a service, and the purpose of that service is to provide electricity, at the least cost, for the customers of that utility. Public utilities are non-profit organizations whose facilities are owned by, and operated for, their customers. The public ownership of utilities benefits ratepayers by offering lower than market electricity rates and possessing a responsive locally-elected Board of Directors.

The citizens of Wasco County voted in a PUD in 1939, but faced court opposition from the major power supplier at the time, Pacific Power and Light Company (PP&L, now PacifiCorp). After exhausting all legal recourses, the PUD began serving customers in April 1949. From 1949 until June 30, 1976, both the NWC-PUD and PP&L operated competing systems. PP&L kept their prices artificially lower than the rest of their service customers. This kept energy prices low, but it also served as an obstacle to generate adequate revenue for system improvements.

In 1976, the Oregon Public Utility Commission intervened and required PP&L to charge the same rates as other PP&L service areas in Oregon. This resulted in a large rate increase to the citizens of The Dalles, providing the opportunity for the NWC-PUD to push for reform. In 1976, citizens passed a bond issue for NWC-PUD to buy out all PP&L electric facilities in Wasco County with the exception of the City of Mosier. Northern Wasco County PUD spent the next ten years upgrading and improving system reliability and removing duplicate facilities. (Wilson, 5/19/05)

The Bonneville Power Administration

The Bonneville Power Administration (BPA) provides wholesale power to NWC-PUD as a preference customer. The BPA supplies electrical power to preference citizens (municipal utilities, rural electric co-ops and public utility districts), direct service industries (DSIs) which are mostly aluminum smelters, and investor owned utilities. Surplus or non-firm energy and capacity are also sold both outside (mainly California) and inside the region. BPA's firm utility customers are located in Washington, Oregon, Idaho and Western Montana. (Ashland Comp Plan)

The BPA was created by the US Congress in 1937 to act as the federal marketing agent for power produced by dams on the Columbia River. Under the U.S. Department of Energy, the BPA markets energy from 28 Federal dams in the Northwest. To accomplish its mission, BPA has designed and built the nation's largest network of long-distance, high-voltage transmission lines which serves as the main grid for the Northwest. BPA's transmission system covers about 300,000 square miles and is connected with other regional, US and Canadian transmission systems.

The BPA does not build dams or power plants, these are built and operated in conjunction by the U.S. Army Corps of Engineers and the Bureau of Reclamation. Most Corps and Bureau projects are designed to provide flood control, navigation, recreation, and generate electricity. These dams and the transmission system are operated as the Federal Columbia River Power System. (Ashland Comp Plan)

Condition of the BPA Transmission Network

Federal regulatory activities of the past 30 years provided expanded access for non-BPA power plants to the BPA transmission network. Although the BPA invested over $1 billion in the network, including 150 miles of new 500-kilovolt transmission line, it is being outpaced by the growth in energy use. For example, energy growth is forecast at 12%, while transmission development is at 3% including all projected investments. The electricity grid in the Northwest faces challenges of reliability and access for the near term. The BPA is currently advocating for a “one-utility” approach for transmission operation and planning. By centralizing these responsibilities under one agency, the BPA contends that it manage the region’s power supply system more efficiently and stably than multiple operators. (BPA, 2005)

The issue of transmission is extremely important to the discussion of distributed energy and conservation. As the Northwest continues to increase power generation on an increasingly older network, the grid experiences tremendous loads, even as per-capita use decreases. Greater efficiencies arise through the conservation of available energy resources to minimize the capital necessary to build new generation and transmission networks. Renewable energy sources utilized in distributed generation provides exceptional opportunity for co-located and local facilities. Although distributed generation technologies are not as economically efficient in terms of upfront capital and generation abilities, they provide the opportunity for local communities to stabilize the local power supply and reduce the need for additional transmission networks.

Public Utility Regulation Policies Act

The Public Utility Regulation Policies Act (PURPA) of 1978 provided expanded opportunities for more energy-efficient and environmentally friendly commercial energy production. PURPA defined a new class of energy producer called a qualifying facility. Qualifying facilities are either small-scale producers of commercial energy who normally self-generate energy for their own needs but may have occasional or frequent surplus energy, or incidental producers who happen to generate usable electric energy as a byproduct of other activities. When a facility of this type meets the Federal Energy Regulatory Commission's (FERC) requirements for ownership, size and efficiency, utility companies are obliged to purchase energy from these facilities based on a pricing structure referred to as avoided cost rates. These rates tend to be highly favorable to the producer, and are intended to encourage more production of this type of energy as a means of reducing emissions and dependence on other sources of energy. (Energy Vortex, 5/28/06)

Northwest Power and Conservation Council

In December 1980 the Pacific Northwest Electric Power Planning and Conservation Act (NW Power Act) created the Northwest Power Planning Council (Council), now known as the Northwest Power and Conservation Council. The Council is mandated to determine the northwest's electric needs and to develop a plan for the most cost effective resources to meet these needs.

Additionally, the Act gave the BPA a more active role in acquiring new resources to meet the future needs of the Pacific Northwest. Rather than simply marketing power, the BPA can acquire the needed resources for its Northwest citizens. The Act prioritized how to determine which new resources the BPA should acquire. In order of priority they are: Conservation, Renewable Resources, Co-generation, and Thermal Resources. Finally, the ACT gave a 10% cost advantage to conservation measures over any other resource type, helping to support the market efficiencies of conservation practices.

The Act mandated that the Northwest Power Planning Council adopted a 20-year load forecast and a 20-year resource plan to meet the energy requirements of the forecast. The Council recognized that accurately forecasting future loads over a 20-year period was impossible. Therefore, the NPCC issues period reviews and updates of the region's forecasts. The latest version of the NPCC plan is the 5th Power Plan (http://www.nwcouncil.org/energy/powerplan/plan/Default.htm).

In regards to land-use and urban form, a key element of the Plan is the Model Conservation Standards. These are construction standards for new residential and commercial buildings. The Act directed the Council to develop these standards which "must secure all the power savings that are cost effective to the region. In addition, they must be economically feasible for consumers." The 1983 Plan called for these standards to be implemented by the region's utilities, local governments and code agencies by January 1, 1986 and required BPA to develop a surcharge policy to be levied on utilities not implementing these standards by the deadline.

Table A.2: Metered Sales for North Wasco County-PUD, 2004

Customer Type	MegaWatt Hours (mWh)	Percent
Residential	131,341	54.3%
Commercial	16,558	6.8%
Industrial	59,021	24.4%
Irrigation District	32,017	13.2%
Other	3,051	1.3%
Total	241,988	100.0%

Source: OPUDA, 2005

APPENDIX B: ENERGY EFFICIENCY AND RENEWABLE ENERGY PROGRAMS AVAILABLE IN THE DALLES AND IN OREGON

Current Energy Conservation Programs

The NWC-PUD currently provides residential, commercial and industrial auditing and rebate services. For renewable energy generation, they also offer a net-metering program.

Residential customers who utilize electric heat are eligible for a home weatherization program that offers a free audit and a 25% rebate for recommended improvements including insulation, new windows and duct sealing. The utility also offers rebates for energy efficient electrical appliances such as heat pumps, waterheaters, refrigerators, dishwashers, clothes washers and dryers.

Commercial and Industrial customers are also eligible for free audits by the NWC-PUD energy specialists. They utilize the BPA protocols for assessment and energy savings estimates. Available rebates are approved by BPA and vary for each project, determined by type, size and extent of energy savings.

Finally, the utility offers a net metering policy for renewable energy generation (wind, solar, biomass, or approved small hydro) units that are 25 KW or smaller. The utility installs a two-way meter and provides a one-time annual billing that credits the owner for all the power put into the grid. (Holmes, 6/1/06)

Northwest Natural Gas (NW Natural) provides The Dalles residential, commercial and industrial customers natural gas. NW Natural conservation partner is the Energy Trust of Oregon, Inc., which is an independent nonprofit organization that helps Oregonians to enjoy the benefits of clean energy. The Energy Trust offers programs to NW Natural residential and commercial customers. (Energy Trust and NW Natural Gas websites, 6/1/06)

Energy Trust and NW Natural offers the following residential programs:

- Home Energy Savings Program: existing homes and apartments are eligible for free energy audits and receive rebates for improvements.
- Efficient New Homes Program: allows new home buyers to invest in an ENERGY STAR® qualified home which uses a "whole-house" integrated approach to design and build for maximized energy efficiency.
- Efficient Home Products Program: Energy Trust offers rebates for qualified purchases of ENERGY STAR® rated appliances.
- Solar Water Heating Program: Provides consultation and referral to qualified solar hot water contractors and up to $1,500 cash rebate on the installation of a solar hot water heater.

Oregon Department of Energy Programs

The following programs are managed by the Oregon Department of Energy.

Business Energy Tax Credit (BETC)

ODOE offers tax credit for businesses that can be used or transferred within Oregon for tax liability. Currently, it is 35%, but Gov. announced increasing to 50%. Taken in one year for projects under $20,000, for larger projects 10% is taken the first and second year, with 5 % each year following.

Residential Energy Tax Credit (RETC)

ODOE currently offers: "Up to $1,500 for solar and wind systems; up to $900 for geothermal systems. Tax Credit based on energy savings and cost for highly efficient refrigerators, clothes washer, dishwashers, and certain water heating, space heating, cooling and ventilation systems and for sealing duct work. Up to $750 for alternative-fuel vehicles and $750 for charging/fueling systems (a total of $1,500 for hybrid gasoline-electric vehicles). Up to $1,500 for fuel cells" (ODOE, 2004)

State Home Oil Weatherization Program

Offers the Home Energy Checklist and rebates for weatherization and heating measures. Oil companies serving Oregon customers fund the program.

Energy Efficient Manufactured Homes

Manufactured homes do not need to meet Oregon State building code. They are regulated by federal codes which are very low in terms of energy efficiency. ODOE works with 20 regional manufactures to certify energy efficient homes through the Super Good Cents® or Energy Star. More than 60% of Oregonians buying a manufactured home purchase a certified home.

Transportation Program

ODOE encourages commuter alternatives for businesses and communities, many times by utilizing the BETC.

Building Codes

Residential: State wide implementation in 1974. Require minimum insulation levels in walls, ceilings, and floors. Recently updated in 2003 to include standards for space heating, cooling, ventilation, water heating, lighting and building envelope. These standards result in a 5 to 10% energy savings.

Commercial: HVAC and Building envelope standards adopted statewide in 1978. Most recently updated in 2003. Oregon's code is approx. 5% more energy efficient than the national standard.

Large Electric Consumer Public Purpose Program

Part of SB1149, PGE and PacifiCorp are required to collect 3% public purpose funds (Energy Trust of Oregon). Large consumers (over 1MW) may be eligible to self-direct where and how the funds are used. ODOE administers this program.

Energy Efficient New State Buildings

Legislative action in 1990 set state buildings to the standard of 20% more efficient than the building code.

Alternative Fuels

BETC and RETC reflect incentives for producers of alternative fuels (1991) and for consumers owning alternative fuel vehicles (1997). These incentives may change in the 2007 legislative season.

Schools

PGE and PacifiCorp service area supports energy efficient schools, funds are administered by ESD. Funds are for energy audits and then to fund measures outlined in the audit. ODOE provides technical support. Reduced cost of energy by 30 to 50% compared to similar non modified classrooms.

State Energy Loan Program (SELP) enacted in 1980

Offers low interest, long term loans for projects that: conserve energy, produce energy from renewable sources, utilize recycled material to create value-added products, use alternative transportation fuels, provide conservation and renewable resource loans.

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