# SPRINGFIELD UTILITY BOARD
# INTEGRATED RESOURCE PLAN (IRP)

SPRINGFIELD UTILITY BOARD

*August 2011*

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## SPRINGFIELD UTILITY BOARD MISSION

Founded in 1949, Springfield Utility Board is an independently operated municipal electric and water utility governed by a locally-elected Board. Serving over 25 square miles in and around the city of Springfield, Oregon, the utility offers its customers some of the lowest electric rates in the Pacific Northwest, with equity in excess of $100 million, and with minimal debt.

"The Mission of Springfield Utility Board is to provide reliable, cost-effective, utility related services to the citizens and businesses of the Springfield community." In providing these services, the Board will require the principles of cost-effectiveness and continuous quality improvement to be applied to all programs, functions, and projects conducted by SUB, with recognition of the Board's long-term responsibility to deliver services.

## EXECUTIVE SUMMARY

This Integrated Resource Plan presents a long-term forecast of the lowest reasonable cost combination of resources necessary to meet the needs of Springfield Utility Board's (SUB) customers. This IRP has been prepared at a time when we face considerable challenges and uncertainty driven by an economic recession, and global concerns over $CO_2$ and other greenhouse gases.

The plan presented here will change as circumstances change, and actual resource acquisitions will take place in the real – rather than the hypothetical – marketplace.

This Integrated Resource Plan evaluates SUB's electric resource portfolio based on a very dynamic power-supply marketplace, and this plan integrates these options with forecasted energy demands of customers expected to be served by the Springfield Utility Board over the next several years. The purpose of this report is aimed at finding the resource portfolio with the best combination of cost and risk for SUB customers. This Integrated Resource Plan that provides balance between the least expensive power-supply portfolio and the most desirable way to meet all of our customers' energy needs.

Both supply-side and demand-side resources have been evaluated within this IRP, including a review of the potential benefits, costs, and risks, along with political and environmental considerations. The IRP expands the focus of this report from the specific electric rates to including information about monthly energy bills and customer comfort.
This Integrated Resource Plan is built upon previous plans, and is intended to be used as tool to support SUB's ongoing power resource planning and future decision making.

### Guiding Principles

In October 2007, the SUB Board provided the following resource guiding principles to SUB staff:

- Resources should be affordable and meet the community's standards for quality
- Resources should add value to SUB's customers
- Priority should be given to the least-cost resource

- Priority should be given to reliable resources
- SUB's resource portfolio should be competitive with other utilities and reflect customer's expectations of the kinds of power resources SUB purchases and the types of products and services customers desire
- Management of the resource portfolio should be effective and efficient
- SUB's power resource strategy must address State and federal resource policies

## BOARD FINDINGS

It is the SUB Board's decision that SUB continue with its current resource strategy, to remain a requirements customer of BPA, purchasing 100% of power from BPA through September 2019 and potentially beyond.

### Tier One – Short and Long Term Strategies

SUB's Board has previously elected to meet its Tier One obligation under a new Load Following power sales contract with BPA. The new power sales contract is effective from October 2011 through September 2028.

SUB will have the option to convert its Load Following contract with BPA to a Slice/Block contract in approximately 2017, and additional analysis will be done as the election period approaches.

### Smart Grid and Energy Efficiency Strategy

It is SUB Board's decision that SUB continues its investment in energy efficiency and explores cost-effective opportunities to reduce long-term Tier Two exposure.

Smart Grid infrastructure should continue to be developed with a focus on enhancing reliability, providing information to customers, and integrating data into cost of service analyses.

### Tier Two - Short Term Strategy

In the short term, it is SUB Board's finding that SUB meets its Tier Two obligation with BPA power resources. SUB's Board had previously elected to purchase Tier Two products from BPA through September 2014 consistent with BPA's notice requirements. BPA has an upcoming notice deadline of September 30, 2011 whereby customers of BPA must elect their Tier Two purchase for the October 2014 through September 2019 period. SUB's Board anticipates purchasing Tier Two power from BPA through September 2019 under BPA's Short Term Rate which may be converted to a Vintage Rate product at a later date.

**Tier Two – Long Term Strategy**

In the long term, the SUB Board directs Staff to continue to evaluate resource options that reflect load forecast changes, the economy, and reductions in load due to energy efficiency efforts.

**Demand Response Strategy**

The SUB Board directs Staff to continue to explore cost-effective demand response programs.

## APPENDIX A – KEY TERMS AND ACRONYMS

***Bonneville Power Administration (BPA)*** - Federal organization, part of the U.S. Department of Energy, who markets wholesale electrical power.

***Federal Energy Regulatory Commission (FERC)*** - An independent agency that regulates the interstate transmission of electricity, natural gas, and oil. The Energy Policy Act of 2005 also gave FERC the responsibility of implementing and enforcing regulatory requirements through imposition of civil penalties and other means.[1]

***Western Electricity Coordinating Council (WECC) –*** The Regional Entity responsible for coordinating and promoting bulk electric system reliability in the Western Interconnection. Assures non-discriminatory transmission access among members and provides a forum for resolving transmission access disputes.

***Energy Efficiency –*** Energy efficiency means using less power to perform the same tasks, either on a continuous basis or while that task is performed. Energy efficiency is aimed at reducing the energy used by end-use devices and systems, and reduces overall electricity consumption (reported in kilowatt hours or megawatt hours), often without explicit consideration for the timing of program-induced savings. Examples include high-efficiency appliances, efficient lighting programs, high-efficiency heating, ventilating and air conditioning.[2]

[1] http://www.ferc.gov/about/ferc-does.asp
[2] http://www.oe.energy.gov/DocumentsandMedia/Utilities.pdf

# APPENDIX B – OVERVIEW AND KEY FACTORS

## OVERVIEW

### City of Springfield, Oregon Charter Authority

Section 36 of the City of Springfield, Oregon Charter, *Utility Board Establishment* Functions, gives Springfield Utility Board authority to provide water and electric services: "There is hereby continued a board to be known as the City of Springfield Utility Board, hereinafter called the "Utility Board," which shall operate, maintain, supervise and control, for and on behalf of the City of Springfield, Oregon, all electric, water and gas properties, or any of them, which are now or which may hereafter be owned and operated by the City of Springfield, Oregon. Sewerage and sewage disposal property shall be operated, maintained, supervised and controlled by the Council and under its jurisdiction through the City Manager. The Utility Board may build, install, construct, develop, acquire by purchase or by condemnation/eminent domain, operate, maintain, manage, supervise, control, finance, improve and extend one or more cable communications systems." (10-9-50, Sec.I)[3]

### SUB Electric Service

Springfield Utility Board serves approximately 31,181 electric customers in Springfield. The annual peak electric load is 186 megawatts with 835,013 average annual megawatt hours being served over 215 miles overhead and 121 miles of underground transmission line. Electricity purchased from BPA travels to one of SUB's eight substations, where it is distributed along more than 4,600 transformers and 400 miles of transmission lines to residential, commercial, and industrial customers.

### SUB Water Service

SUB has more than 19,500 water customers. The majority of SUB water comes from a system of seven wellfields that tap groundwater from a vast aquifer that lies underneath Springfield. Supplementing this is water from the Middle Fork Willamette River. From these two sources, the water is pumped through 240 miles of distribution lines to SUB's customers. SUB also owns and maintains six pumping stations and seven reservoirs.

Because most of SUB's water comes from groundwater, it passes through numerous layers of sand, silt, and rock, all of which act as a natural filter, protecting and purifying it as it travels to the aquifer. Water from SUB's Willamette wellfield, and from the river, is mixed together at SUB's Slow Sand Filtration water treatment facility where it is treated with ultraviolet light to kill organisms sometimes found in river water and then lightly chlorinated for additional protection.

[3] http://www.qcode.us/codes/springfield/

## SUB Telecommunications Service

SUB provides dark fiber service (fiber provided without electronics or optronics) to Springfield businesses, public agencies, and telecommunications providers in all service territory served by SUB.

Dark fiber rates are based upon an indefeasible right of use of a portion of SUB's fiber system, rather than an ownership right. Existing fiber lease agreements remain unchanged unless modified by mutual agreement between SUB and the fiber customer. The dark fiber Monthly Rate is the sum of the Capital Rate and the Operations and Maintenance Rate. The monthly charge is the Monthly Rate multiplied by the lengths of fiber-pair mile (identified as an exhibit in the customer's contract).

## SUB Gas Service

SUB did explore providing retail natural gas service to the City of Springfield residents and securing gas supplies for possible local generation opportunities. To date, has not elected to offer pursue this type of gas service.

## SUB Historic Power Resource Mix

Prior to the mid-1990s, SUB received all its power to serve retail customers from the Bonneville Power Administration under its PF (Priority Firm) power rate. Through an involved series of events, SUB, along with other consumer-owned utilities, elected to pay an "exit fee" to BPA and seek alternative resources. SUB then entered into a period where approximately 75% of its power needs were not under the PF rate schedule. SUB retained 3rd party scheduling services and managed a portfolio that included a flexible capacity product, market purchases, market indexed purchases, and other resources. SUB converted its variable-priced, market indexed purchase after a few years and increased activities to mitigate risk exposure in an ever increasing (and increasingly volatile) power market. In 2000/2001 the energy crisis hit. SUB installed 25 MW of diesel generation in Springfield (on a temporary lease basis) to manage costs and took steps to secure just under 10 Megawatts of gas fired generation. The exit fee that SUB paid to BPA allowed SUB to return to BPA service given certain notice requirements and SUB transitioned back to a 100% BPA customer by the end of 2001. Subsequently, SUB sold its gas fired generation equipment with the former generation building now being used for a fleet shop.

## SUB Current Power Resource Mix

SUB currently purchases 100% of its power supply and transmission services as a full requirements customer of BPA. [4] The current power sales contract with BPA expires September 30, 2011. SUB has signed a new power sales contract with BPA for future years that is discussed in Appendix C.

[4] SUB is technically a partial requirements customer of BPA but is having its full requirements met.

## SUB Geographic Boundaries

SUB provides water and electric service, as well as limited telecommunications service within the Springfield City limits, as well as some areas outside. Areas surrounding Springfield, Oregon are also serviced by Emerald People's Utility District (EPUD) and Eugene Water & Electric Board (EWEB). If, for example, the City of Springfield city limits and associated development extended south into Emerald PUD's territory, EPUD would be the power provider for those customers. The issue of default electric service to in-city residents with a southern expansion of city development was resolved with Emerald PUD through discussions that ultimately led to legal proceedings. SUB is has agreements with Eugene Water and Electric Board and Emerald PUD regarding resolution of services within some areas currently served by EPUD and EWEB that would transition to SUB service. The primary point is that SUB's electric service area is relatively defined and finite.

## SUB Customer Demographic Information [5]

According to the US Census Bureau's 2005-2009 American Community Survey 5-Year Estimates, the population of Springfield is 56,554.

## Housing Statistics

According to the US Census Bureau's 2005-2009 American Community Survey 5-Year Estimates, the estimated number of occupied housing units is 22,666. Of those units, 81.4 percent are heated and fueled by electricity, 12.2 percent by utility gas, 4.3 percent by wood, and 1.8 percent by some other fuel source (solar, coal, kerosene, etc.). No fuel being used was reported by .3 percent of occupied housing units. The breakdown between owner-occupied and renter-occupied housing is as follows:

| **Owner Occupied** | **12,123** | **Renter Occupied** | **10,543** |
|---|---|---|---|
| Utility Gas | 2,286 | Utility Gas | 473 |
| Bottled, Tank, or LP Gas | 128 | Bottled, Tank, or LP Gas | 49 |
| Electricity | 8,677 | Electricity | 9,765 |
| Fuel Oil, Kerosene, etc. | 109 | Fuel Oil, Kerosene, etc. | 14 |
| Coal | 0 | Coal | 0 |
| Wood | 778 | Wood | 194 |
| Solar | 0 | Solar | 0 |
| Other | 129 | Other | 0 |
| No Fuel Used | 16 | No Fuel Used | 48 |

## Economic Statistics

[5] http://factfinder.census.gov/servlet/ADPTable?_bm=y&-geo_id=16000US4169600&-qr_name=ACS_2009_5YR_G00_DP5YR3&-ds_name=&-_lang=en&-redoLog=false

According to the U.S. Census, the median family income is $44,227, and the median non-family income is $25,730. The median earnings for workers were $22,827. The percentage of families whose income has been below the poverty level was 14.6%.

## KEY FACTORS

### Stakeholder Involvement

Springfield Utility Board conducted a Customer Opinion Survey in July 2002, July 2004, and most recently in September 2007. The purpose of the study was to assist SUB in determining customers' perceptions regarding SUB-offered services. Customers provided feedback related to SUB performance, rates, power and generation sources, and ways in which SUB could improve service. The next Customer Opinion Survey is planned for late 2011.

### Energy Market Pricing Trends

The two major factors pushing the costs of electric generation higher are increased fuel costs and increased cost for new construction. These factors affect all parts of the country, that is, higher future prices are likely to affect all regions.

### Electric Power Market

The Federal Energy Regulatory Commission (FERC) provides market oversight for the electric power markets. An overview of the Northwest power market is presented in FERC's October 2010 report, Northwest Electric Market: Overview and Focal Points (Attachment I).

### Natural Gas Market

Natural gas is the marginal fuel for dispatching power plants throughout most of the West. However, gas use is dependent on a complex set of factors: weather, storage inventory levels, pipeline capacity availability, hydroelectric resource availability, power-related imports, transmission line congestion, and other fossil-plant availabilities.

### Hydroelectric Market

According to BPA, the regional hydroelectric generation under critical water (low water years from all sources) represents close to 60% of the total firm energy generation in the Northwest. Within BPA's own portfolio, this figure is closer to 80%.

Hydro generation is snowpack dependant and early runoff forecasts are conducted in December of each year. The typical regional benchmark is measured for the forecast at The Dalles, Oregon. In December 2009, the winter snowpack in the Pacific Northwest and British Columbia reached just 70% of the historical average. The forecasts for runoff in spring and summer 2011 called for the 47th driest of 50 years of recorded data and the lowest since 2001. Over the early part of 2010, runoff conditions improved to near average conditions. For the current runoff year, as of April 2011, the runoff forecast has improved to 107% of average at The Dalles.

These Northwest hydro conditions may test Western power markets, but new market structures, moderated demand due to the recession and the availability of new gas-fired capacity to meet the generation shortfall should reduce the risk of a general market dysfunction. It should also be noted that the Bonneville Power Administration has reported that decreased flexibility in hydro dispatch that may limit the agency's ability to use hydropower resources for ancillary services during windy periods.[6]

## Coal Market

Coal is a readily combustible black or brownish-black rock whose composition, including inherent moisture, consists of more than 50 percent by weight and more than 70 percent by volume of carbonaceous material. It is formed from plant remains that have been compacted, hardened, chemically altered, and metamorphosed by heat and pressure over geologic time.

## Compliance-Related Factors

SUB is located within the boundaries of the Western Electricity Coordinating Council (WECC). WECC is one of eight regional councils of the North American Electric Reliability Council (NERC) and includes two provinces of Canada, portions of Mexico and all or most of 14 Western states. WECC is responsible for ensuring the overall reliability of the regional system, and does so by coordinating operational and planning activities in the region. The Planning Coordination Committee (PCC) oversees member adherence to the three processes relevant to transmission planning: regional planning, project rating and project reporting. These activities ensure that facility additions are communicated to WECC members, are provided ratings and meet reliability criteria. WECC also conducts regional economic studies on the transmission system through the Transmission Expansion Planning Policy Committee (TEPPC) and its subcommittees.

While WECC is a forum for coordinating planning activities, it does not perform the actual planning of facilities. This function resides with the utility planners and is further coordinated in sub-regional planning forums such as Northern Tier Transmission Group (NTTG) and ColumbiaGrid. In July 2007, FERC issued Order 890 which, in part, introduced new planning policies for the industry to follow, including the requirement to adopt an open, transparent and coordinated transmission planning process. Order 890 requires transmission providers to adhere to additional requirements, such as comparability, information exchange, dispute resolution, regional participation, processing of economic planning studies to address congestion or the integration of new resources, and development of a process for cost allocation. As a result of Order 890, existing regional planning groups have adapted their processes to implement the requirements of the Order and new sub-regional planning groups have formed. The regional and sub-regional planning groups that address issues relevant to SUB include TEPPC, NTTG, ColumbiaGrid, and the Transmission Coordination Work Group (TCWG).

Entities such as SUB are required to register with NERC based on the function(s) they perform, and Individual Reliability Standards which review potential impact to the Bulk Electric System

[6] http://www.ferc.gov/market-oversight/mkt-views/2010/05-20-10.pdf, p.10

(BES), apply to one, some or all registered-entity types. SUB is currently registered with NERC as a Load Serving Entity (LSE) and Distribution Provider (DP).

## Environmental Externalities

Electricity constitutes a critical input in sustaining the Nation's economic growth and development and the well-being of its inhabitants. However, there are by-products of electricity production that have undesirable effects on the environment. Most of these are emissions introduced by the combustion of fossil fuels, which accounts for nearly 70 percent of the total electricity generated in the United States. The environmental impacts, or damages, caused by these emissions are labeled environmental "externalities." Included in the generic term "externality" are benefits or costs resulting as an unintended by-product of an economic activity that accrue to someone other than the parties involved in the activity.

## Renewable Portfolio Standards (RPS) and Goals

On June 6, 2007, Oregon adopted a Renewable Portfolio Standard (RPS) (ORS 469A). SUB is classified as a "smaller" utility under the RPS definition. The Oregon RPS requires that 10% of "smaller" utilities' load be served by qualifying renewable resources by 2025. Legislation further provides that tradable Renewable Energy Credits (RECs) or Green Tags may be used to fulfill the RPS targets if independently verified and tracked. SUB has purchased RECs from qualified wind generation projects to meet a portion of RPS requirements.[7]

***Qualifying resources include*:**

- Wind
- Solar photovoltaic and solar thermal
- Wave, tidal, and ocean thermal
- Certain types of biomass
- Biogas from organic sources such as anaerobic digesters and landfill gas
- New hydro facilities not located in federally protected areas on wild and scenic rivers, and incremental hydro upgrades
- Up to 50 aMW per year of energy generated from certified low-impact hydroelectric facilities

## Large Hydroelectric: Non-Qualifying Renewable Resource

[7] RECs are the separable renewable attribute associated with energy generated by qualified renewable power resources. RECs have a market value and, if unbundled and sold, the green energy associated with such RECs is reclassified into undifferentiated energy as though it were generated from a non-renewable power source. Typically, one REC equals one MWh of generation from a qualifying renewable project. These can be sold into the market over various time periods. For example, a 10 MWa wind project which sold its RECs for one year would generate (10 MW * 8,760 hours) = 87,600 RECs during that time period.

Large hydroelectric generation sources are not qualifying renewable resources under the Oregon RPS. Small hydro generation is eligible for qualification. According to SUB's customer surveys, large hydroelectric generation is considered slightly more renewable than small hydroelectric generation.

**Northwest Power and Conservation Council Targets**

The Power Northwest Electric Power Planning and Conservation Act of 1980 is intended to; assure the Pacific Northwest of an adequate, efficient, economical and reliable power supply; provide for the participation and consultation of the Pacific Northwest states, local governments, consumers, customers, users of the Colombia River System (including federal and state fish and wildlife agencies and Indian tribes), and the public; ensure development of regional plans and programs related to energy conservation; renewable and other resources; protecting, mitigating, and enhancing fish and wildlife resources; facilitating the planning of the region's power system; and providing environmental quality. The Act also is intended to protect, mitigate and enhance the fish and wildlife, including related spawning grounds and habitat, of the Columbia River and its tributaries, particularly anadromous fish[8].

The Act directs the Northwest Power and Conservation Council (Council) to adopt and transmit to the Administrator within two years a regional conservation and electric power plan. The plan is to set forth a general scheme for implementing conservation measures and developing resources to reduce or meet the Administrator's obligations relating to environmental quality and the acquisition of electric power resources. The Act sets forth elements the plan must contain, including model conservation standards, and authorizes the Council to recommend to the Administrator a surcharge on specified customers.

The Council's 6th Northwest Power Plan was issued in February 2010. The Council target for regional acquisition of conservation over the first five years of the plan is 1,200 average megawatts. The Council defines conservation as improved energy efficiency, meaning that less electricity is used to provide the same level of services. The Council will monitor the actual conservation savings acquired by the region by conducting reviews of the region's progress each year during the initial five-year planning horizon of the Sixth Power Plan.

**Transmission Constraints and Resource Integration**

The Bonneville Power Administration owns and operates a bulk of the high voltage transmission system in the Pacific Northwest. As resources and loads have developed, BPA has identified a number of transmission paths that are constrained which require additional infrastructure investment to deliver power from resource areas (e.g. Northeast Washington) to load centers (e.g. Springfield, Oregon). In addition, variability of resource generation output requires different levels of resource integration services. As intermittency of resource output increases, transmission providers such as BPA provide power and transmission products to convert an intermittent resource to a firm delivered power schedule.

[8] Fish that hatch in fresh water, migrate to the ocean to mature, then return to fresh water to spawn (ex: salmon).

# APPENDIX C – ENERGY RESOURCES

## ENERGY EFFICIENCY RESOURCES

SUB's Energy Efficiency program has been active since the 1980s. It has changed over time to track the cost effective measures that are an outgrowth of the Northwest Power and Conservation Council's power plans (created every five years).

### SUB Past Efforts

*Super Good Cents™ Manufactured Homes Rebate* – SUB offered a $600 incentive to customers for getting a Super Good Cents™ upgrade with the purchase of their new manufactured homes.

*Low-Flow Showerheads* – In the 1980s SUB did residential direct installs of low-flower showerheads. More recently, SUB customers were offered coupons for self-installs.

### SUB Current Efforts

*Compact Fluorescent Lighting Programs (CFL)* – Switching from a 60-watt incandescent light bulb to a 14-watt energy-efficient CFL gives the same amount of light but saves customers more than $25 over the life of the bulb. SUB offers CFL coupons and regularly provides other CFL incentives to customers.

*Window Weatherization* – Zero percent loans up to $4,000 are available for qualifying SUB customers to install energy efficient windows. Customers must have permanently installed electric heat, and must have a fully-insulated home.

*Appliance Rebates* – SUB offers rebates on a wide range of appliances such as qualifying water heaters, clothes washers, dishwashers, refrigerators, and freezers.

*Duct Testing and Sealing* – SUB has a duct testing and sealing program designed to increase comfort and provide energy savings to SUB customers at minimal or no cost. The program is available for manufactured and site-built homes that heat with an electric forced air furnace or heat pump system, but not gas heat.

*Ducted Heat Pumps* – SUB customers may receive a zero-interest loan or $500 rebate to help pay for the purchase of an energy –efficient heat pump, which are two to three times more efficient than electric furnaces.

*Ductless Heat Pumps* – SUB customers may receive a zero-interest loan or $1500 rebate to help pay for the purchase of an energy –efficient ductless heat pump, which are two to three times more efficient than electric resistance zonal heating such as ceiling heat or electric wall heaters.

*Energy Smart Design*™ – SUB will perform an energy analysis, make recommendations, and offer financial incentives to help pay for improvements on new or existing commercial facilities for increased energy efficiency.

*Energy Smart Design*™ *(Office)* – SUB offers an incentive for new Energy Smart Design™ offices and major office remodels in an effort to reduce the cost of building a new energy efficient office space.

*Insulation Rebates and Loans* – SUB customers may receive a zero-interest loan or a 50% rebate on the cost of insulating the walls, ceiling and floor of their home. SUB qualifies customers by conducting an energy analysis, recommending improvements, helping through the loan or rebate process, then inspecting the completed work. For income-qualified customers, SUB offers a 100% rebate on insulation.

*Refrigerator Decommissioning* – SUB will pick up customer's decommissioned refrigerators for no charge, as well as issue a credit to the customer's account.

Commercial & Industrial Lighting

SUB offers the following incentives for commercial and industrial lighting:

*New Construction Lighting Rebate* – For new construction lighting rebates for upgrades of new lighting systems in commercial and industrial facilities undergoing new construction or major remodel.

*Commercial Rebate for Existing Lighting* – For existing lighting for one-for-one upgrades of existing light fixtures in commercial and industrial facilities. The maximum rebate is currently $1,500.

*Commercial Lighting Implementation Program* – SUB's program provides an incentive for upgrades to existing lighting systems in commercial and industrial facilities.

## Potential Future Efforts

*LED Lights* – Lighting in the U.S. uses about 25% of the nation's electricity and North Americans spend over $40 billion per year on energy to light homes, factories, and places of business. Solid State, LED, lighting could reduce lighting energy fifty percent by 2025.[9]

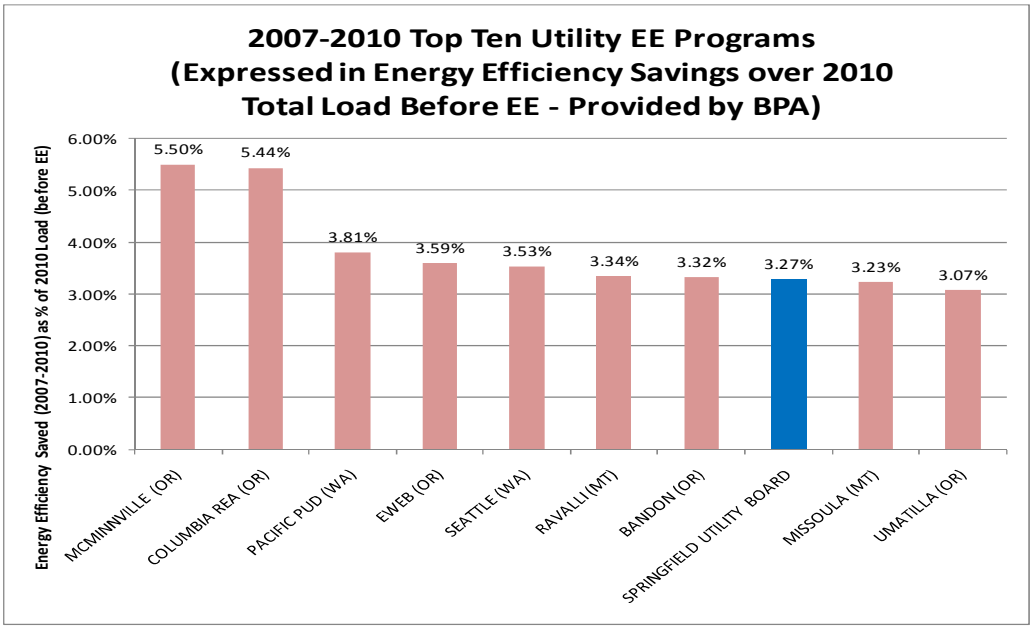
*Private Lights* – Private light service is a function of the City of Springfield, and is driven by customer demand, however, SUB does provide the light fixture, ballast, and bulb. SUB continues to look at ways to provide the highest quality and most efficient light options.

[9] http://www.management.energy.gov/documents/LEDPresentation.pdf

*Street Lights* – Like private light service, Springfield street lights are a function of the City of Springfield. SUB does provide the light fixture, ballast, and bulb. SUB continues to look at ways to provide the highest quality and most efficient light options.

*Commercial HVAC Systems* – Bonneville Power Administration is currently working on projects to improve commercial HVAC processes and program structures that will support utilities in capturing higher volumes of HVAC savings. SUB continues to follow BPA's efforts, and will look to implement a process if and when appropriate.

**2007-2010 Energy Efficiency Activities**



## BONNEVILLE POWER ENERGY RESOURCES

### BPA Products and Options

BPA is part of the U.S. Department of Energy (DOE) and markets wholesale electric power from 31 federal hydro projects in the Columbia River Basin, one non-federal nuclear plant, and several other small non-federal power plants. About one-third of the electric power used in the Northwest comes from BPA. BPA's service territory includes Idaho, Oregon, Washington, western Montana, and small parts of eastern Montana, California, Nevada, Utah, and Wyoming. SUB currently purchases 100% of its power supply and transmission services as a full requirements customer of BPA. [10]

### Regional Dialogue Policy[11]

BPA's current wholesale power contracts expire in September 2011. BPA created a "Regional Dialogue Policy" (Policy) that defines how BPA will market and sell wholesale power beyond 2011, and to ensure BPA will do it in a way that meets regional and national energy goals. The Policy covers new 20-year contracts and also introduces tiered rates.

### Tiered Rate Methodology (TRM)

The Tiered Rate Methodology is BPA's methodology for establishing a two-tiered rate design. This approach provides each public utility customer with a High Water Mark (HWM), which defines its right to buy power at a Tier 1 rate. The Tier 1 rate will be based on the cost of the existing federal system. If SUB, a BPA preference customer, chooses to buy more power from BPA beyond its HWM, this power will be sold at a Tier 2 rate, set to fully recover BPA's costs of securing additional resources to serve this load.

BPA developed new 20-year power sales contracts along with a long-term Tiered Rates Methodology. Through the contracts and rate methodology, each public utility receives a High Water Mark (HWM) which defines its right to buy power at a Tier 1 rate based on the cost of BPA's existing system. Power above the HWM must be purchased from new non-federal resources or from BPA at a higher rate reflecting BPA's full cost of acquiring additional power. BPA will not subsidize its Tier 2 power rate with its existing system, but will otherwise make its best efforts to provide Tier 2 options for customers who choose not to secure their own resources to meet load growth.

SUB does have alternatives to BPA's Tier 2 Power. These options could be to acquire resources or to purchase power on the market.

Consumer-owned utilities were offered Tier 1 products and contracts for the period beginning October 2011 through September 2028. After review if different Tier 1 product options, the Board elected to purchase the Load Following Tier 1 product from BPA.

[10] SUB is technically a partial requirements customer of BPA but is having its full requirements met.
[11] http://www.bpa.gov/power/PL/RegionalDialogue/Implementation/Documents/2010/2010-06-04_RDproductsratesguidebook_Revised.pdf

**BPA Resource Mix**[12]

Sustained 1-Hour Peak Capacity (January) 13,485 aMW*

Hydro: 12,006 aMW (89.0%)

Nuclear: 1,150 aMW (8.5%)

Firm Contracts & Other Resources: 329 aMW (2.5%)

Firm Energy (12-Month Annual Average) 8,549 aMW

Hydro: 7,038 aMW (82.3%)

Nuclear: 878 aMW (10.3%)

Firm Contracts & Other Resources: 633 aMW (7.4%)

## OTHER CONVENTIONAL ENERGY RESOURCES

### Renewable Energy Sources

#### *Wind*

A wind turbine obtains its power input by converting the force of the wind into torque (turning force) acting on the rotor blades. The amount of energy that the wind transfers to the rotor depends on the density of the air, the rotor area, and the wind speed.
The electricity generated by wind turbines is used for many applications, from large, utility-scale power plants to small, single turbines for residential use. Wind energy's popularity has grown because of its many benefits: wind energy generates pollution-free electricity; the fuel source, wind, blows steadily in many areas; wind energy costs compete with the conventional fossil-fueled power plants in some areas; and cost continue to drop as technology improves.

In the United States, wind experienced record growth in 2009 and nearly 10 GW of new capacity was added. The cumulative capacity-weighted average price of wind power, including the production tax credit, was about 4.4 cents per kilowatt hour (kWh) in 2009, a price that competes with fossil fuel-generated electricity.[13]

Despite the number of wind turbine suppliers opening new manufacturing plants in North America, competition for wind turbines and related components is expected to remain high for the foreseeable future due to anticipated U.S. and global demand-supply tightness. Turbine costs are also expected to increase in part due to increases in commodity costs for steel, oil, and related materials.

Beyond turbine availability, potential uncertainties and barriers for increased adoption of wind power include transmission availability and integration costs. The most viable Pacific

[12] http://www.bpa.gov/corporate/about_BPA/Facts/FactDocs/BPA_Facts_2008.pdf
*Average megawatts
[13] http://www.nrel.gov/docs/fy10osti/48178.pdf, p.57

Northwest wind sites are on the east side of the Cascades. Incremental firm transmission from these areas in the mid and lower Columbia River Gorge area is limited. Montana and Wyoming offer significant wind resource opportunities, however, construction of new transmission lines adds significant cost to these resources.

Wind generation itself largely unpredictable. Uncertainty arises when the forecasted generation output of a particular wind plant is scheduled into the system resource mix on a day-ahead or hour-ahead basis and the subsequent actual generation causes the utility's day-ahead and hour-ahead position to be either long or short. The utility must then react to that position either by re-dispatching its owned resources up or down, or by buying or selling into the market. The first resource of choice for re-dispatch from a physical point of view is hydro, since it is a form of storage which is also exceptionally flexible. However the ability for hydro to integrate wind into the Northwest system is constrained and alternate energy storage options are under consideration[14].

***Reardon Wind Project – Example***

The Board authorized staff to submit an expression of interest in a share of the output of a potential wind project located in Northeast Washington (Reardon Wind Project). This project was coordinated by Energy Northwest on behalf of its member agencies (primarily Washington PUDs). While SUB is not a member, Energy Northwest sought participation beyond its core group. Due to transmission constraints and other issues, SUB subsequently did not re-commit to the project.

***Solar Photovoltaic (PV)***

Solar collectors can gather solar thermal energy in almost any climate to provide a reliable, low-cost source of energy for many applications including hot water for homes, residential heating, and hot water for industries such as laundry and food processing. In recent years, utilities have begun to use solar thermal energy to generate electricity by boiling water and using the steam to drive a turbine that generates electrical power.

Benefits of solar power include no fuel cost, direct pollution or $CO_2$ emissions and coincidental summer peak period production benefits. The chief disadvantage of any solar installation is availability. In Oregon, the length of the day varies considerably from summer to winter, with winter peak load periods receiving the least amount of insolation.

Solar energy electricity generation has nearly quadrupled between 2000 and 2009, but still represents a very small part of overall U.S. electricity generation. Countries with aggressive solar policies—such as Germany, Spain, and Japan— lead the world in solar photovoltaic (PV)

[14] Please refer to the section on energy storage later in this document.

deployment. Similarly, U.S. states with aggressive solar incentives lead the United States in installations (California, New Jersey, Nevada, and Colorado). [15]

The cost of small-scale solar generation has dropped significantly. A few years ago, the installed cost of a smaller system was around $10 per watt. Today, these smaller systems are available at around $4 per watt.

### ***Solar Thermal***

Solar thermal devices use direct heat from the sun, concentrating it in some manner to produce heat at useful temperatures. The modern solar industry began with the oil embargo of 1973-1974 and was strengthened with the second embargo in 1979. The growth of the solar industry during this period of fuel shortages and high prices (1974-1984) soared from 45 solar collector manufacturing firms to 225 firms. The solar market was helped during this period by government assistance, both Federal and State. Currently, solar thermal devices do everything from heating swimming pools to creating steam for electricity generation.[16]

### ***Geothermal Energy***

Geothermal energy is the heat (thermal) that is extracted from hot water or steam that is mined from geothermal reservoirs in the earth's (geo) crust and used for electricity generation, among other uses.

U.S. geothermal energy generation has remained relatively stable from 2000 to 2009, with the past 10 years experiencing an average of 1.2% growth, and generates power for between five and 10 cents per kilowatt-hour. As a base-load source of energy, geothermal is distinct from other renewable such as wind and solar, because it can provide electricity 24 hours a day, 365 days a year.[17]

Geothermal energy offers an environmentally benign source of electricity that is reliable and cost effective. Hydrothermal power plants with modern emissions controls release little to no carbon dioxide and have minimal impact on the environment.

> ***Glass Mountain Geothermal Project - Example***
> In the 1990's SUB pursued a 9aMW share of the Glass Mountain geothermal project (located near Vale, Oregon) via an agreement with the Bonneville Power Administration and Trans-Pacific. After testing the initial wells it was later determined that the resource could not be developed on a cost effective basis. Parties settled their participation in the project and SUB has no obligation or affiliation with the site.

[15] http://www.nrel.gov/docs/fy10osti/48178.pdf, p.75
[16] http://www.eia.doe.gov/cneaf/solar.renewables/page/solarthermal/solarthermal.html
[17] http://www.nrel.gov/docs/fy10osti/48178.pdf, p.67

***Small Hydro***

Small hydro is the development of hydroelectric power on a scale serving a small community or industrial plant. The definition of a small hydro project varies but a generating capacity of up to 10 megawatts (MW) is generally accepted as the upper limit of what can be termed small hydro.

***Biomass***

Biomass electricity primarily comes from wood and agricultural residues that are burned as fuel for cogeneration in the industrial sector, such as in the pulp and paper industry. In 2009, biomass produced about 38% of total renewable electricity generation, excluding hydropower. Biomass project costs may vary significantly depending on fuel type availability, as well as particular site and host characteristics.

**Thermal Energy Sources**

***Nuclear***

Nuclear power plants generate electricity through the fission of uranium. Water is heated, and steam from the boiling water turns turbines and generates electricity. The main difference in the various types of steam-electric plants is the heat source. Heat from a self-sustaining chain reaction boils the water in a nuclear power plant.

As nuclear power generation has become established since the 1950s, the size of reactor units has grown from 60 MWe to more than 1600 MWe, with corresponding economies of scale in operation. At the same time there has been many hundreds of smaller power reactors built for both naval use (up to 190 MW thermal) and as neutron sources. The International Atomic Energy Agency (IAEA) defines "small" as under 300 MWe, but in general 500 MWe might be considered an upper limit to "small". Modular nuclear production is discussed further in Emerging Technology section of this plan.

Today, due partly to the high capital cost of large power reactors generating electricity via the steam cycle and partly due to the need to service small electricity grids under about 4 GWe, there is a move to develop smaller units. These may be built independently or as modules in a larger complex, with capacity added incrementally as required.[18] The interest in small nuclear power reactors is driven by both a desire to reduce capital costs and to provide power away from large grid systems. Nuclear capacity (100 GW) is currently ten percent of the total U.S. generating capacity.

The attraction of nuclear energy has been its low fuel costs compared with coal, oil and gas-fired plants. Uranium, however, has to be processed, enriched and fabricated into fuel elements, and about half of the cost is due to enrichment and fabrication. In the assessment of

[18] http://www.world-nuclear.org/info/inf33.html

the economics of nuclear power, allowances must also be made for the management of radioactive used fuel and the ultimate disposal of this used fuel or the wastes separated from it. Despite the fact that nuclear energy offers great benefits as an alternative source of electric power, nuclear energy as a whole, is still a controversial issue in many countries. The reasons for this center round the issues of safety, waste, and nuclear weapons.

### ***Combustion Turbines (CT)***

Combustion turbines have been used for power generation for decades and range in size from 1 MW to over 100 MW. They are devices in which air is compressed and a gaseous or liquid fuel is ignited. The combustion products expand directly through the blades in a turbine to drive an electric generator.

Combustion turbines have relatively low installation costs, low emissions, high heat recovery, infrequent maintenance requirements, but low electric efficiency. With these traits, combustion turbines are typically used for cogeneration.[19]

### ***Cogeneration***

Cogeneration refers to the use of a power station or a heat engine in order to generate both useful heat and electricity. It combines the use of power and heat (CHP), and is considered as the most common form of energy recycling. The heat created through cogeneration is emitted by the conventional power plants as by-product to the natural environment through means of flue gas, cooling towers, or other means. The generated heat is in form of electricity.

Cogeneration is not a new technology; some steam turbines have been in use for many decades. The heat released in generating electrical power is used to produce high pressure steam that drives a turbine that produces additional electricity. In district heating installations, the waste energy from a power plant is piped, in the form of hot water or steam, to a network that supplies heating for buildings or a nearby city.

### **Energy Storage**

Stored energy can be used in more than one way. One use is *load leveling*, which is holding energy produced when demand is low and using it when demand is high. This would minimize SUB's demand charge. Another use is *ramping*. Energy from renewable sources such as wind typically rises and drops off faster than typical firm-energy generators can ramp down or up to meet the change. Stored electricity can be used to fill in the differences.

Energy storage falls into four main categories:

- Electrochemical process: batteries and fuel cells
- Mechanical: compressed air, flywheel, and pumped storage hydroelectric
- Thermal process: molten salt and solar pond

[19] http://www.energysolutionscenter.org/distgen/Tutorial/TutorialFrameSet.htm

- Chemical process: hydrogen

***Batteries***

The several battery types for energy storage are sodium-sulfur (NaS), flow batteries, lead acid/lead carbon, lithium ion, NiMH, and NiCad.

Sodium-sulfur (NaS) batteries are based on a high-temperature electrochemical reaction between sodium and sulfur, separated by a beta alumina electrolyte. They have a highly efficient charge/discharge, appear to have a long cycle life and are made from inexpensive, non-toxic materials. It operates at high temperatures of 300° to 350°C and contains highly corrosive sodium polysulfide which, according to the U.S. Department of Energy, has proven safe under extreme conditions.

Based on a 2008 Department of Energy market analysis, the estimated cost of NaS battery storage for 1 MW is from $1.5 – 3M total capital costs and $15,000 – 90,000 annual O&M costs. The summary is based on a 5,000 – 20,000 cycle life and 12-20 year service life.[20]

***Pumped Storage***

Pumped-storage projects differ from conventional hydroelectric projects. They normally pump water from a lower reservoir to an upper reservoir when demand for electricity is low. Water is stored in an upper reservoir for release to generate power during periods of peak demand. For example, in the summer water is released during the day for generating power to satisfy the high demand for electricity for air conditioning. At night, when demand decreases, the water is pumped back to the upper reservoir for use the next day.

These projects are uniquely suited for generating power when demand for electricity is high and for supplying reserve capacity to complement the output of large fossil-fueled and nuclear steam-electric plants.

***Fuel Cells***

Fuel cells are electrochemical devices that convert a fuel's energy directly to electrical energy. Fuel cells operate much like continuous batteries when supplied with fuel to the anode (negative electrode) and oxidant (e.g. air) to the cathode (positive electrode). Fuel cells forego the traditional extraction of energy in the form of combustion heat, conversion of heat energy to mechanical energy (as with a turbine), and finally turning mechanical energy into electricity. Instead, fuel cells chemically combine the molecules of a fuel and oxidizer without burning, dispensing with the inefficiencies and pollution of traditional combustion.

[20] http://www.netl.doe.gov/energy-analyses/pubs/Final%20Report-Market%20Analysis%20of%20Emerging%20Electric%20Energy%20Sto.pdf

***Pumped Storage Hydroelectric (PSH)***

Pumped storage hydroelectricity is a method of storing and producing electricity to supply high peak demands by pumping water to a reservoir at a higher elevation during off-peak periods and producing electricity using flowing water during on peak periods. This storage process requires adequate close land areas divided by adequate elevation, as well as an adequate water supply.

### *Metrics for Evaluating Energy Storage Projects*[21]

Performance

- Duration
- Efficiency
- Peak power capability
- Cycle life and calendar life
- Operation at temperature

Cost

- kWh cycled (over lifetime)
- Dollar per kWh, delivered
- Integrated power delivered
- Total lifecycle cost

### Energy Storage Challenges

The challenges of energy storage are cost, reliability of energy storage systems, the cost/benefit ratio, and regulatory treatment of energy storage.

## LOCAL GENERATION RESOURCES

### Net Metering

Net metering provides customers with an incentive to install renewable generation. It is the measurement of the difference between the electricity supplied to an eligible customer by SUB and the electricity generated by an eligible customer's net metering facility and fed back to SUB over the applicable billing period. A net metering facility is a customer-generating facility meeting the requirements as outlined in Senate Bill 84, or its successor.

For electric customers who generate their own electricity, net metering allows for the flow of electricity both to and from the customer – typically through a single, bi-directional meter. When a customer's generation exceeds the customer's use, electricity from the customer flows back to the grid, offsetting electricity consumed by the customer at a different time during the same billing cycle. In effect, the customer uses excess generation to offset electricity that the

[21] http://arpa-e.energy.gov/LinkClick.aspx?fileticket=k-81ITzfv34%3D&tabid=259

customer otherwise would have to purchase at the utility's full retail rate. Net metering is required by law in most U.S. states, but these policies vary widely.[22]

**Distributed Generation**

At one end, DG could include only small-scale, environmentally friendly technologies – such as photovoltaic (PV), fuel cells, small wind turbines, or more conventional technologies like micro-turbines or reciprocating engines fueled by renewable fuels such as landfill gas – that are installed on and designed primarily to serve a single end-user's site. At the other end, DG could encompass any generation built near to a consumers' load regardless of size or energy source. The latter definition could include diesel-fired generators with significant emissions and large cogeneration facilities capable of exporting hundreds of megawatts of electricity to the grid.

Other definitions of DG include some or all of the following; any qualifying facilities under the Public Utility Regulatory Policies Act of 1978 (PURPA), any generation interconnected with distribution facilities, commercial emergency and standby diesel generators installed, for example, in hospitals and hotels, residential standby generators sold at hardware stores, generators installed by a utility at a substation for voltage support or other reliability purposes, any on-site generation with less than "X" kW or MW of capacity. "X" ranges everywhere from 10 kW to 50 MW, generation facilities located at or near a load center, demand side management (DSM), energy efficiency, and other tools for reducing energy usage on the consumers' side of the meter.

**Cogeneration**

*Swanson* – Swanson (formerly Springfield Forest Products) operates a plywood plant in Springfield. This plant was originally established in Springfield by Georgia-Pacific Corporation, but was taken over by Springfield Forest Products in mid-1989. McKenzie Forest Products acquired Springfield Forest Products and Swanson assumed ownership of McKenzie Forest Products in 2007.

In the mid-1980s, SUB sponsored a series of studies on local generation options. At the time the study for the Swanson facility was conducted, the study made the following findings:

- The plant is equipped with veneer dryers that are steam-heated. In addition to the dryers, the plant operates log vats and hot processes which are also steam-heated. Steam is generated at two 70,000 pound per hour each Sterling boilers.
- The burners are pile-on grate units with induced draft fans.
- The flue gas system includes multi-clone collectors.
- Boilers are rated at 225 psig and are operated at 200 psig.

This plant presents an opportunity for the use of a back-pressure turbine/generator system.

[22] http://www.dsireusa.org/glossary/

*Rosboro Lumber Company* – Rosboro Lumber Company has operated since the 1930s. The plant includes sawmills, dry kilns, a planing mill, plywood plant, laminated beam plant, and on-site steam powerhouse. The plant is a large energy user with power being provided by SUB. Thermal energy needs are fulfilled through the use of process steam generated from hog fuel developed as residue from the manufacturing operations.
Earlier studies suggested that a power-generating operation strategy at Rosboro would be to equip their existing boilers with state-of-the-art gas clean-up equipment and then operate the boilers at capacity. The steam in excess of process needs, nominally 65,000 pounds per hour, would be available to drive a turbine/generator. New equipment would include the air quality control system and the power-generating devices.

*Kingsford Company* – Kingsford manufactures charcoal from woody feedstock using a multi-hearth furnace. In the process, moisture and hydrocarbons in the wood are driven out by means of heat. Temperatures in the range of 212°F cause the moisture in the wood to turn into vapor or steam, which diffuses out of the wood. Once the water is driven out, temperatures are increased to levels which cause the volatiles in the wood to gasify. The process is referred to as *pyrolitic distillation*. Once all of the hydrocarbons are displaced, the remaining material is carbon, which is charcoal. The charcoal is processed into briquettes, bagged, stored, and shipped.

Kingsford utilizes a feedstock dryer to reduce moisture content prior to the material being used in the process. Therefore, the amount of moisture in the off-gases is low. Those gases consist primarily of hydrocarbons. These gases are capable of sustaining combustion and they are routinely burned.

Kingsford's gas stream is at a high enough temperature to generate high-pressure steam. There is an abundance of gas flow which enables a sizeable amount of steam generating capability. In this steam generating, off-gases are taken from the existing Kingsford stack and drawn through a waste heat recovery boiler system. Steam generated in the process could be routed to a turbine/generator where power is developed.

**Small Hydro**

*Springfield Mill Race and Mill Pond* – Back in 1988, SUB petitioned the Oregon Water Resources Commission to allow the development of a plan to optimize the waters of the Springfield Millrace to the highest and best use in accordance with ORS 536 by placing an existing dam, built in 1966, back into production service. This would allow power production of greater than 7 ½ theoretical horsepower at the dam.

Springfield Millrace is no longer being considered as a generation facility. Instead, one of the key elements of today's concept for the Mill Race is increasing water quality.

## EMERGING RESOURCE TECHNOLOGIES

### High-Altitude Wind Generation

A wind turbine converts wind energy into grid-quality, utility-scale electricity using tethered wings outfitted with turbines. Power is extracted from this motion by the wing-mounted turbines and transmitted to the ground through an electrically-conductive tether. However, because the wing is not constrained to rotate about a hub, it can sweep a much larger section of the sky than a conventional wind turbine and fly at a higher altitude where the wind is both stronger and more consistent. These advantages result in a system that can deliver a capacity factor of 60% and with lower overall mass and reduce the cost of electricity compared to conventional horizontal axis wind turbines.

### Tidal In-Stream Generation (Ocean Energy)

*Wave energy* is the capacity of the waves for doing work. Ocean waves are generated by the influence of the wind on the ocean surface first causing ripples. As the wind continues to blow, the ripples become choppy, fully-developed seas and finally swell. In deep water, the energy in waves can travel for thousands of miles until that energy is finally dissipated on distant shores.

*Tidal in stream energy* occurs due to the moving mass of water with speed and direction as caused by the gravitational forces of the sun and the moon, and centrifugal and inertial forces on the earth's waters. Due to its proximity to the earth, the moon exerts roughly twice the tide raising force of the sun. The gravitational forces of the sun and moon and the centrifugal/inertial forces caused by the rotation of the earth around the center of mass of the earth-moon system create two "bulges" in the earth's oceans: one closest to the moon, and the other on the opposite side of the globe.

*River in stream energy* occurs to the hydrokinetic energy of the moving river water. A tidal signature can be seen in rivers up to a hundred miles or so from where the river empties into the ocean. In these cases, it is not important whether the site is called a tidal site or a river site. The velocity of the river current is a function of the slope of the reach and the effect of gravity and the roughness of the riverbed and the effect of frictional forces slowing the current. [23]

### Small Scale "Modular" Nuclear Reactors

Today, due partly to the high capital cost of large power reactors generating electricity via the steam cycle and partly to the need to service small electricity grids under about 4 GWe,[24] there is a move to develop smaller units. These may be built independently or as modules in a larger complex, with capacity added incrementally as needed. There are also moves to develop small units for remote sites.

[23] http://oceanenergy.epri.com/

[24] A general rule is that no single unit should be larger than 15% of grid capacity

Generally, modern small reactors for power generation are expected to have greater simplicity of design, economy of mass production, and reduced siting costs. Many are also designed for a high level of passive or inherent safety in the event of malfunction.[25]

**Hydrogen Production**

Hydrogen can be produced from diverse domestic feed stocks using a variety of process technologies. Hydrogen-containing compounds such as fossil fuels, biomass or even water can be a source of hydrogen. Thermochemical processes can be used to produce hydrogen from biomass and from fossil fuels such as coal, natural gas and petroleum. Power generated from sunlight, wind and nuclear sources can be used to produce hydrogen electrolytically. Sunlight alone can also drive photolytic production of hydrogen from water, using advanced photoelectrochemical and photobiological processes.

The Department of Energy (DOE) Hydrogen Program is activity focused on advancing cost-effective, efficient production of hydrogen from renewable, fossil and nuclear energy resources.[26]

**Hybrid Generation Technologies**

Hybrid energy systems combine different power generation devices or two or more fuels for the same device. When integrated, these systems overcome limitations inherent in either one. Hybrid energy systems may feature lower fossil fuel emissions, as well as continuous power generation for times when intermittent renewable resources, such as wind and solar, are unavailable.

Potential hybrid combinations include generators (e.g., fuel cells that use hydrogen; and natural gas-powered turbines, microturbines, and reciprocating engines) that work in conjunction with renewable energy (e.g., solar concentrators, photovoltaics, wind turbines, or geothermal technologies). The cost and environmental advantages of these advanced-power generation technologies can be improved by using “opportunity” fuels, such as bio-generated gases and biomass, to supplement or replace conventional natural gas.

Hybrid energy systems can be used in commercial power parks, industrial plants, renewable energy-integrated buildings, remote (off-grid) power sites, and brownfields. Hybrids can also provide electricity grid support and stabilization.[27]

**Smart Grid**

The century-old power grid is the largest interconnected machine on Earth consisting of more than 9,200 electric generating units with more than 1,000,000 megawatts of generating capacity connected to more than 300,000 miles of transmission lines.

[25] http://www.world-nuclear.org/info/inf33.html#Notes
[26] http://www.hydrogen.energy.gov/production.html
[27] http://www.p2pays.org/ref/20/19541.pdf

The US Department of Energy defines Smart Grid Investments broadly as "technologies, tools and techniques available now to bring knowledge to power – knowledge capable of making the electric grid work more efficiently".

Smart Grid is a broad term covering a variety of utility policies and investments. SUB has invested in Smart Grid infrastructure and is expected to continue to invest in Smart Grid infrastructure in the future. Examples of Smart Grid deployment at SUB include, but are not limited to:

- Increased use of digital information and controls technology to improve the reliability, security, and efficiency of the electric grid:
  - *SUB has invested in transmission, substation, and distribution level upgrades, including controls technology, to improve the reliability, security, and efficiency of SUB's system.*
  - *SUB has invested in Automatic Meter Reading (AMR) to improve the efficiency of SUB's operations, communication with customers, and the safety of SUB employees.*
- Deployment and integration of distributed resources and generation, including renewable resources:
  - *SUB's Board has adopted interconnection standards to promote the integration of customer-owned, distributed, and renewable resources.*
- Development and incorporation of energy efficiency resources, demand response, and demand-side resources:
  - *SUB has a long record of developing and incorporating energy efficiency and demand-side resources as part of the service to its customers.*
- Deployment and integration of advanced electricity storage and peak-shaving technologies, including plug-in electric and hybrid electric vehicles, and thermal-storage air conditioning:
  - *SUB's Board authorized the General Manager to pursue ARRA funding for electric vehicles and charging stations for the utility.*
- Identification and lowering of unreasonable or unnecessary barriers to the adoption of Smart Grid technologies, practices, and services:
  - *In response to customer requests, SUB's Board enhanced the Board's net metering policy by increasing the allowed installed capacity for qualifying net metering resources to support customer-owned, distributed, and renewable resources.*

The Springfield Utility Board's policy regarding Smart Grid Investments is that staff is encouraged to consider investments and policies to support Smart Grid within SUB's system while recognizing that Smart Grid must be balanced with other objectives.

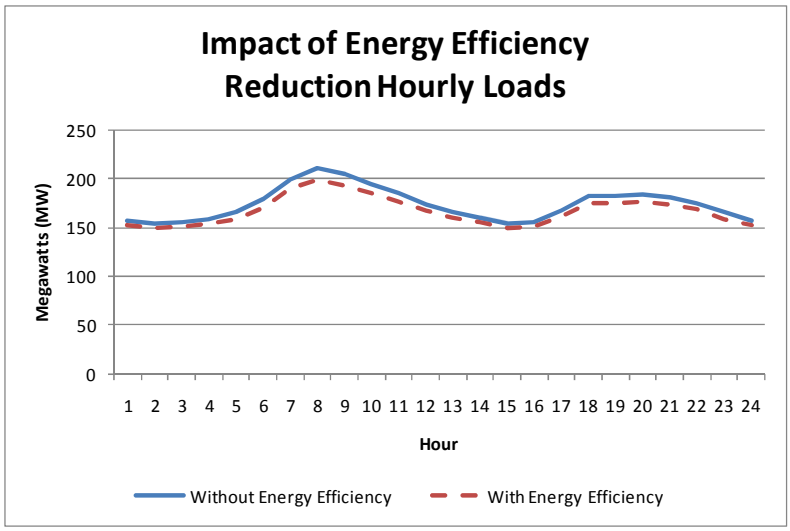
## Demand Response

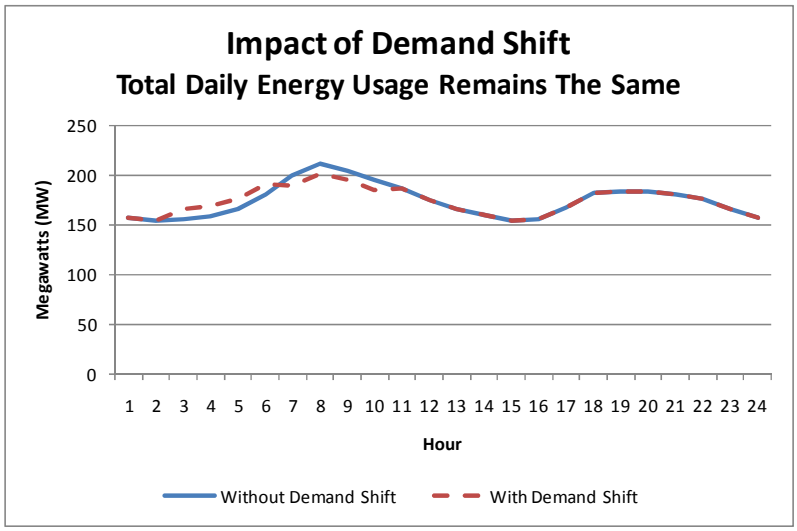
Demand Response is the amount of consumer load reduction at the time of system peak (the maximum load during a specified time period) due to utility programs that reduce customer load during many hours of the year. Examples include utility rebate and shared savings activities for the installation of energy efficient appliances, lighting and electrical machinery, and weatherization materials.

Demand response is similar to dynamic demand mechanisms to manage customer consumption of electricity in response to supply conditions. For example, having electricity customers reduce their consumption at critical times, or in response to market prices. The difference is that demand response mechanisms respond to explicit requests to shut off, whereas dynamic demand devices passively shut off when stress in the grid is sensed. Demand response can involve actually curtailing power used or by starting on-site generation that may or may not be connected in parallel with the grid.

## Energy Efficiency vs. Demand Shift

Energy Efficiency reduces energy and demand usage. Demand shift (which falls under Demand Response) may not reduce overall energy usage but alters the peak period.

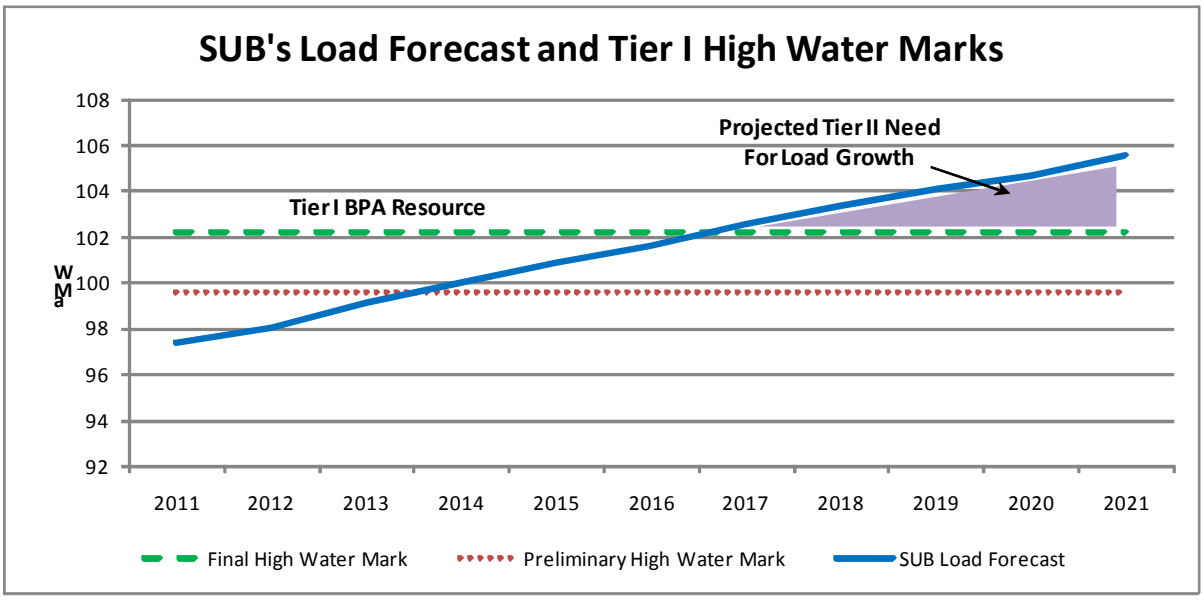



Impact of Demand Shift
Total Daily Energy Usage Remains The Same
Megawatts (MW)
250
200
150
100
50
0
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24
Hour
Without Demand Shift
With Demand Shift

## APPENDIX D - SUB'S RESOURCE MIX AND LOAD PROFILE

### RESOURCE MIX

SUB's Load Following product with BPA becomes effective on October 1, 2011 and extends through September 30, 2028. BPA recently published the final High Water Marks for each utility (which can vary through time based on the generation capability of the Federal system). SUB's HWM is 102.028 aMW. The Load Following agreement establishes notice provisions for a utility's election of Tier 2 resources. After review of Tier 2 options, the Board selected BPA's short-term Tier 2 product through 2014 (the initial Tier 2 selection window). At the time of the Tier 2 selection, BPA forecasted that SUB would have Tier 2 purchases beginning in 2014. Based on the updated HWM, SUB is not currently projected to have Tier 2 purchases until around 2017 (subject to change as load forecasts change). The graph below shows SUB's load forecast and High Water Marks.




### New Large Single Load Policy

In May 2010, the Board modified SUB's New Large Single Load Policy. The NLSL policy requires loads above 5aMW to purchase power outside of SUB's melded cost pool. Prior to the change, the threshold was 10aMW. SUB can secure resources to meet these large loads and conceptually the cost of those resources would be passed on to the individual customers. This provides rate protection to SUB's remaining customers. The Board may modify this policy and staff or customers could bring proposals for the Board's consideration in the future.

**Long Resource Position**

The Board could elect to direct Staff to secure long term resources in excess of SUB's forecasted needs. These resources would be used to mitigate any potential future resource cost increases, however, there is a carrying cost. To the degree SUB's resource mix remains in excess of its retail needs, Staff would remarket these excess resources. The price received for the resale of this excess power could be less than the original purchase price.

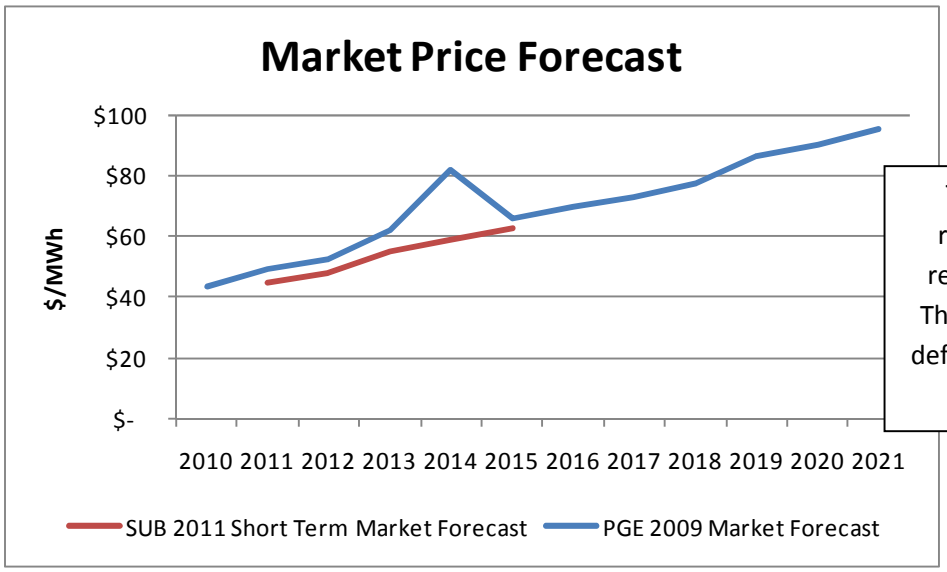
Absent a Long Resource Position, new loads that increase SUB's overall loads would accelerate the need to acquire Tier 2 resources over time. Power will be available in the region to meet load growth, but the timing of acquisition as well as the type of resource selected will affect SUB's overall cost mix.

**Impact of Electric Vehicles**

Staff has followed extensive national and regional discussions on conversions from conventional petroleum-based vehicles to alternative, efficient vehicles. Included among the types of vehicles consumers can purchase are electric vehicles. Studies have shown that residential electric vehicles would typically be charged at home. Local trips might involve additional charging to "top off" the charge. Longer trips would require use of commercial charging stations. There are three issues:

1) Absent Board direction, Staff is not seeking to provide incentives for electric vehicle conversion or the conversion to any other non-petroleum based transportation system.
2) Purchase of personal vehicles by Springfield residents would predominantly be captured through rates charged for residential service.
3) Transitory electric charging by non-Springfield entities in Springfield is an area of concern given SUB's relatively low rates. While local purchases of electric vehicles may not push load, use of SUB's electric system to charge vehicles passing through or residents of neighboring utilities accessing charging in SUB's territory may be addressed.

## MARKET PRICING




The bump up in PGE's pricing reflects the timing of expected resources being brought on line. The short term modeled resource deficit creates a short term spike in market pricing.

The market price forecast is important for a number of reasons:

### Impact on Tier 1 Load Following Product

BPA's Load Following product is based primarily on the cost of the federal system resources. However the product provided by SUB requires BPA to purchase and sell power on the market to balance the output of the predominantly hydroelectric BPA system to SUB's winter peaking load. There are periods where the price BPA sells excess power is less than the price BPA purchases on the market to provide Tier 1 power to SUB.

### Tier 1 Marginal Capacity

One of the billing determinants that impact the cost of SUB's Load Following product is the cost of incremental capacity. As SUB's load grows and changes, the "peakier" the load becomes the more exposure that SUB has to Tier 1 Marginal Capacity pricing. Marginal Capacity pricing will be used as part of the basis for determining the cost effectiveness of demand response programs.

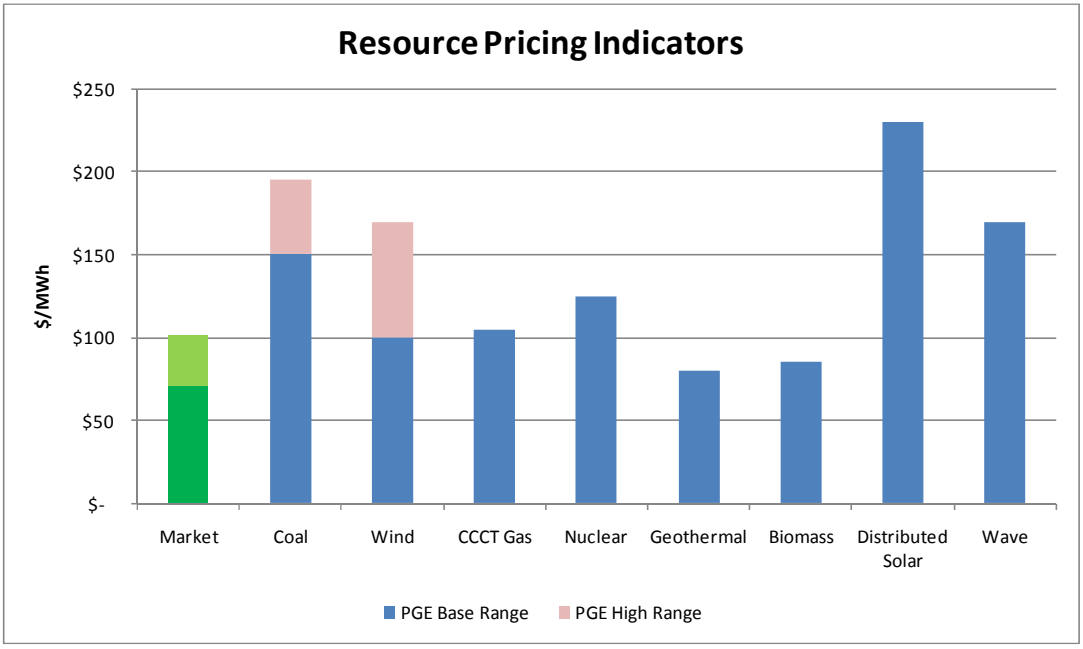
### Tier 2 Benchmark

Market pricing is also used as an alternate resource compared to acquisition of a physical or other contract resource to provide SUB's Tier 2 needs associated with load growth.

## RESOURCE PRICING INDICATORS

The following shows indicative pricing for various resources using PGE's 2009 Integrated Resource Plan which assumes impacts such as resource integration and environmental externalities. SUB's Tier 2 exposure is relatively small at this time and adding Staff's assessment

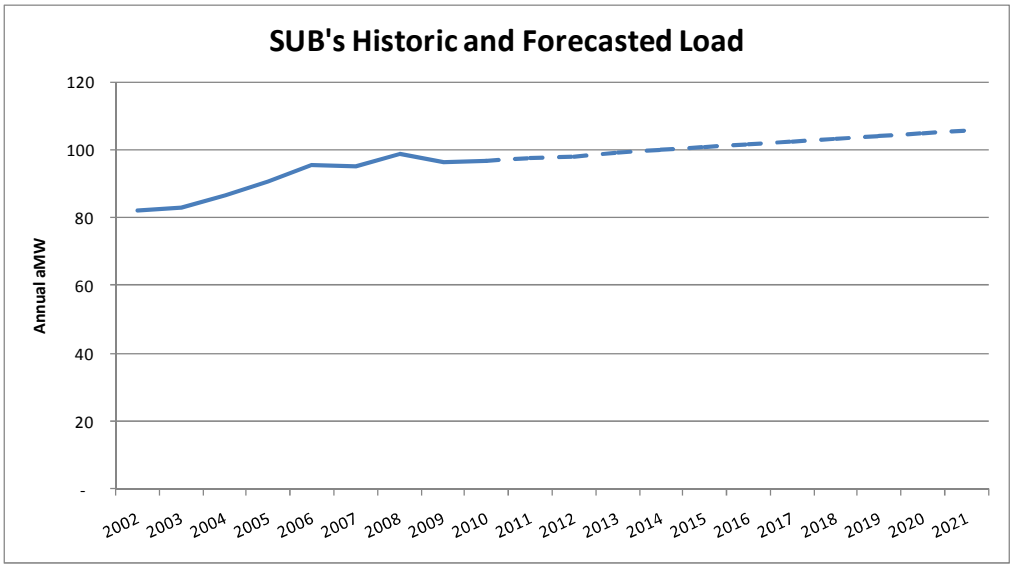
is that additional analysis specific to SUB would not provide information that is materially different for decision-making purposes.




## SUB'S LOAD PROFILE

The following graph shows the recent history of SUB's total load as well as the most recent load forecast coordinated between SUB and BPA. This is expressed in total annual energy in average annual megawatts (aMW) delivered to SUB's points of delivery for service to SUB's customers.

## Load Forecast



**Winter and Summer Loads**

SUB is a winter-peaking utility. The following graph shows SUB's recent highest peak was in December 2009, as well as a summer 2010 load profile (shown in MW per hour over a 24-hour period.