MEMORANDUM

EUGENE WATER & ELECTRIC BOARD

Rely on us.

TO: Commissioners Brown, Mital, Helgeson, Manning and Simpson

FROM: Erin Erben, Power and Strategic Planning Manager; Sibyl Geiselman, Energy Resource Analyst; Adam Rue, Energy Resource Analyst

DATE: February 21, 2014

SUBJECT: IERP Update and Recommended Reading

OBJECTIVE: Information Only

Executive Summary

The Power & Strategic Planning Department has committed to provide the Board with an annual update on the status of the Integrated Electric Resource Plan (IERP) with the expectation that the plan would be updated no later than five years after its adoption in February 2012. As reviewed in this year's Strategic Plan update, the recent past shows that uncertainty in our industry is increasing. In addition to traditional areas of uncertainty such as the economy and customer load growth, we now face new uncertainties caused by fundamental changes in natural gas markets, declining distributed generation costs, uneven roll-out of carbon regulation, and the impacts of intermittent resources on electric grid operations and wholesale market prices.

As with our bigger picture Strategic Plan strategies, the IERP relies upon a shift from large investments in new central station generation plants, to a focus on distributed supply strategies such as conservation and demand response. This approach was supported by the public advisory committee and has prompted EWEB to engage in some pilot program activity to help confirm the viability of a strictly demand-side approach to incremental resource supply. Working closely with our customer-owners is a key element of this strategy.

EWEB has had good success with the supply strategies evaluated to date. Some of the key changes covered in this document include the dramatic decline in projected load growth and the delay in the emergence of a carbon pricing construct for the state of Oregon. While these have impacted elements of our plan, such as the amount of conservation we acquire each year to meet load and the expected wholesale market price, we still believe that the current plan is applicable to our current situation and is meeting EWEB resource supply needs.

Issue
EWEB's integrated electric resource plan (IERP) was created over a two year process that began in 2010, wherein EWEB evaluated its current and forecasted need for new generating resources and worked with a 13 member public stakeholder group to develop a plan for how EWEB would meet any future resource needs over the next 20 year period. As an outcome of that process, EWEB identified key actions that would help to meet the EWEB customer demand for electricity over the next five years. The 2011 IERP concluded that EWEB had no immediate need for new resources, and recommended using energy efficiency programs to meet future customer load growth over the five year period. The only instance in which EWEB was forecast to have a potential supply shortage over the 20 year period evaluated was in the instance of an extreme (one in 10) weather event.

Much has changed since the IERP analysis was completed in 2011, but EWEB's strategy still appears to be adaptive and prudent given the circumstances the utility is facing in the immediate future. This update serves to refresh key assumptions that drive resource planning decisions, summarize how changes impact the actions recommended in the IERP, and report on progress toward each of the recommended strategies. The underlying assumptions, though different from the IERP, have not changed dramatically from the last update presented to the Board early last year. The recommended IERP action items include:

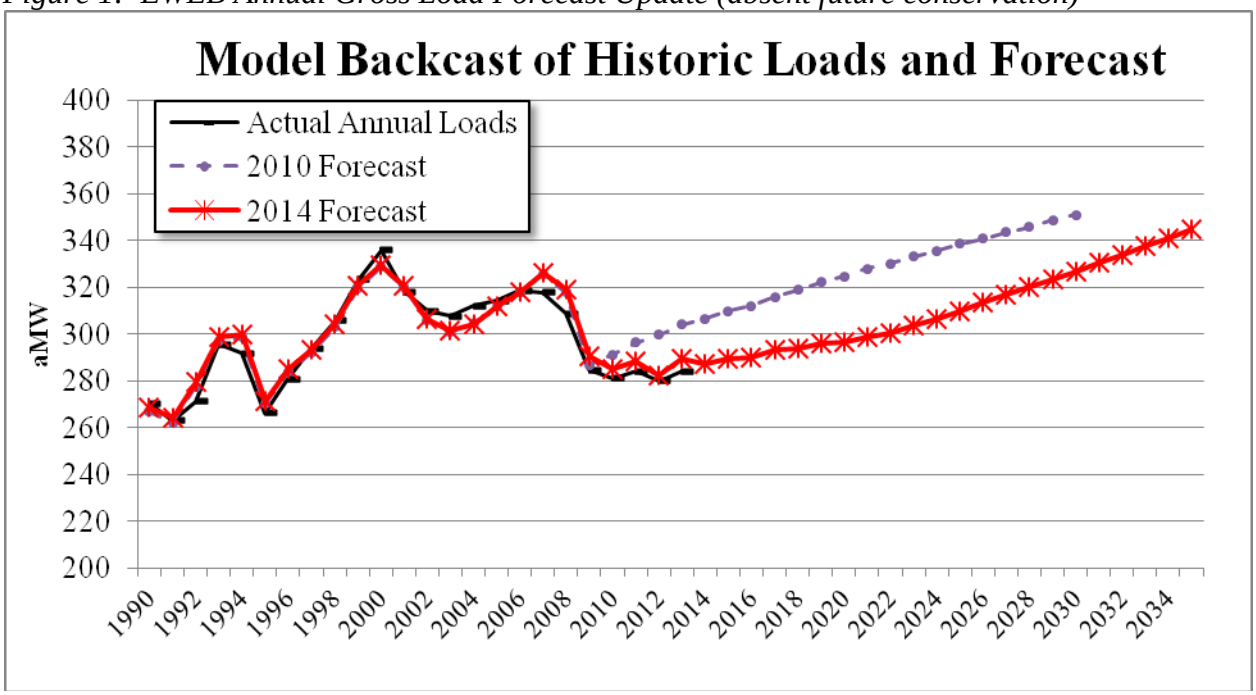
1. Meeting load growth with conservation
2. Working with our customers to avoid peaking power plants by using new demand side management and demand side response programs
3. Continuing to cultivate regional partnerships
4. Enacting a new large load strategy if needed, and
5. Annual updates of key planning assumptions.

Background
The key drivers that influence the findings from the IERP include EWEB and regional customer load growth, EWEB and regional supply availability, natural gas prices, and regulatory constraints such as renewable portfolio standards and carbon pricing mechanisms. These factors impact EWEB's load-resource balance and the regional market prices that EWEB receives when it sells or buys from the wholesale market. EWEB's load-resource balance determines what EWEB has available to sell or needs to purchase in order to meet retail customer demand. [1]

Economic Recovery and Loads
The EWEB load growth recovery post-recession has been much lower than previously anticipated. This is largely due to a slower regional economic recovery than previously seen. The key economic drivers that also drive load growth are population growth and employment and both have experienced much lower growth than forecast at the time the IERP was completed. (EWEB uses external forecast sources for both.) Other factors impacting load growth rates and forecasts include: customer price elasticity, natural gas substitution, prevalence of net metering, conservation, technology changes, and the effect of codes and standards. The combined result is a retail load forecast that is much lower than what was evaluated in the IERP.

[1] Please see Appendix 1 for common planning definitions that may be useful while reading this document.

Figure 1: EWEB Annual Gross Load Forecast Update (absent future conservation)[2]



Peak Load Forecast Update

The EWEB peak forecast varies depending on season; typically a winter and a summer peak forecast is developed. Although in absolute terms the summer peak is lower than the winter peak, the summer peak is expected to increase faster than the winter peak over time with changes such as the decline in electric heating loads and an increase in air conditioning load.[3] In the current forecast EWEB does not anticipate becoming a summer peaking utility; however, nationally summer peaking is much more common among utilities and therefore EWEB monitors these trends.

The winter peak is driven by heating load and the summer peak by cooling load. In the winter the peak can occur in either the morning or the evening, depending on the weather conditions. Typically, the winter peak occurs between 7:00 and 9:00 a.m. and/or in the evening between 4:00 and 7:00 p.m. The summer peak occurs late midday between 4:00 and 6:00 p.m. Due to the fact that the peaks are largely weather driven, the forecast is developed for normalized conditions and "extreme" climate conditions. The normalized forecast is based on median temperatures and should be exceeded 50 percent of the time. The extreme forecast is based on a 10 percent probability of being exceeded.

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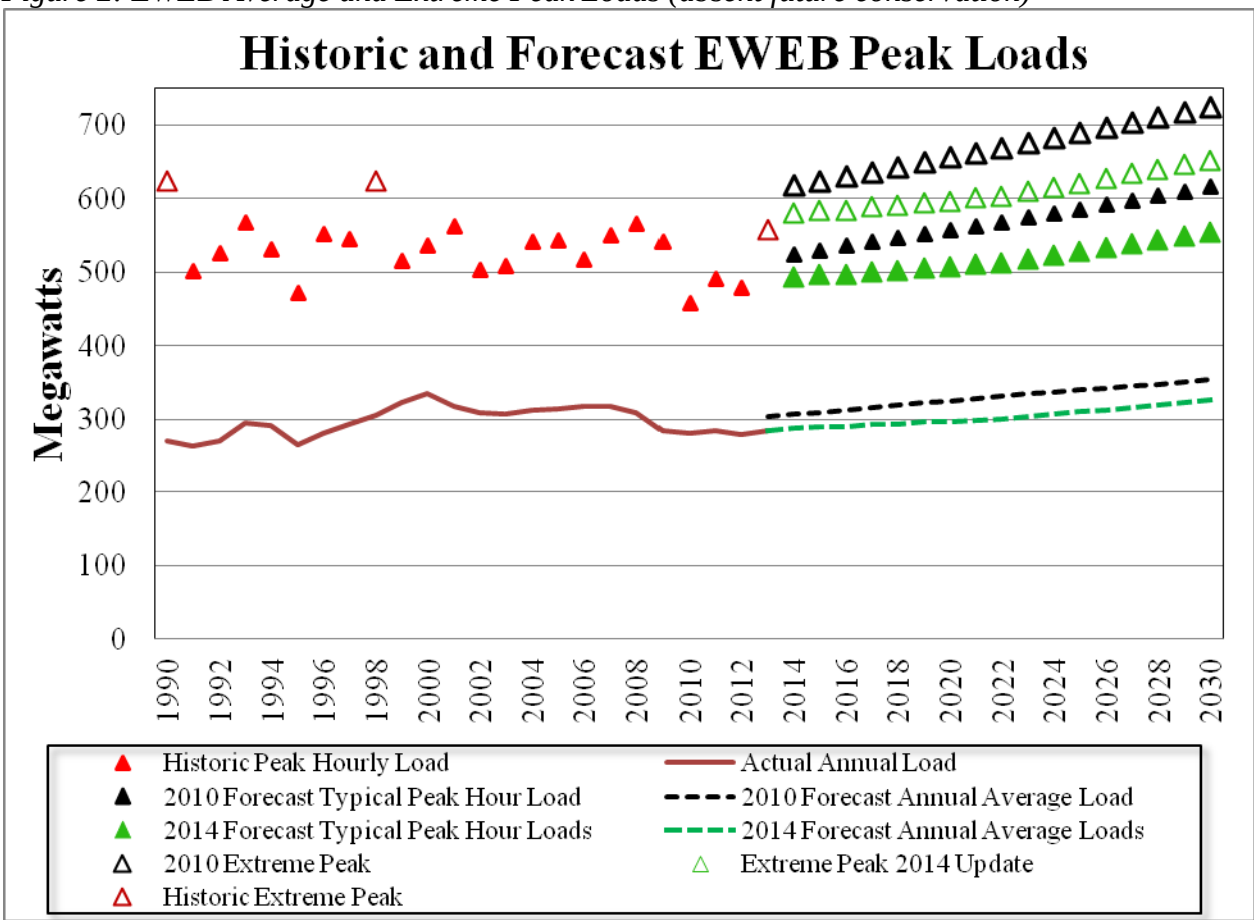
[2] Power planning forecasts customer loads absent future conservation to establish goals for conservation acquisition for meeting the IERP recommendation. The 2014 forecast is an average of 20aMW lower that the 2010 forecast, ~10aMW from conservation that was acquired since the IERP, and ~10aMW from other drivers including population growth, unemployment rates, system rates, and weather. The backcast is included to demonstrate goodness of fit of model.

[3] Under median weather conditions a typical one hour summer peak is forecast at 362 MW whereas a winter peak is forecast at 491 MW. Even with summer peaks growing faster than winter, much would have to change for EWEB to become a summer peaking utility.

Figure 2: EWEB Average and Extreme Peak Loads (absent future conservation)

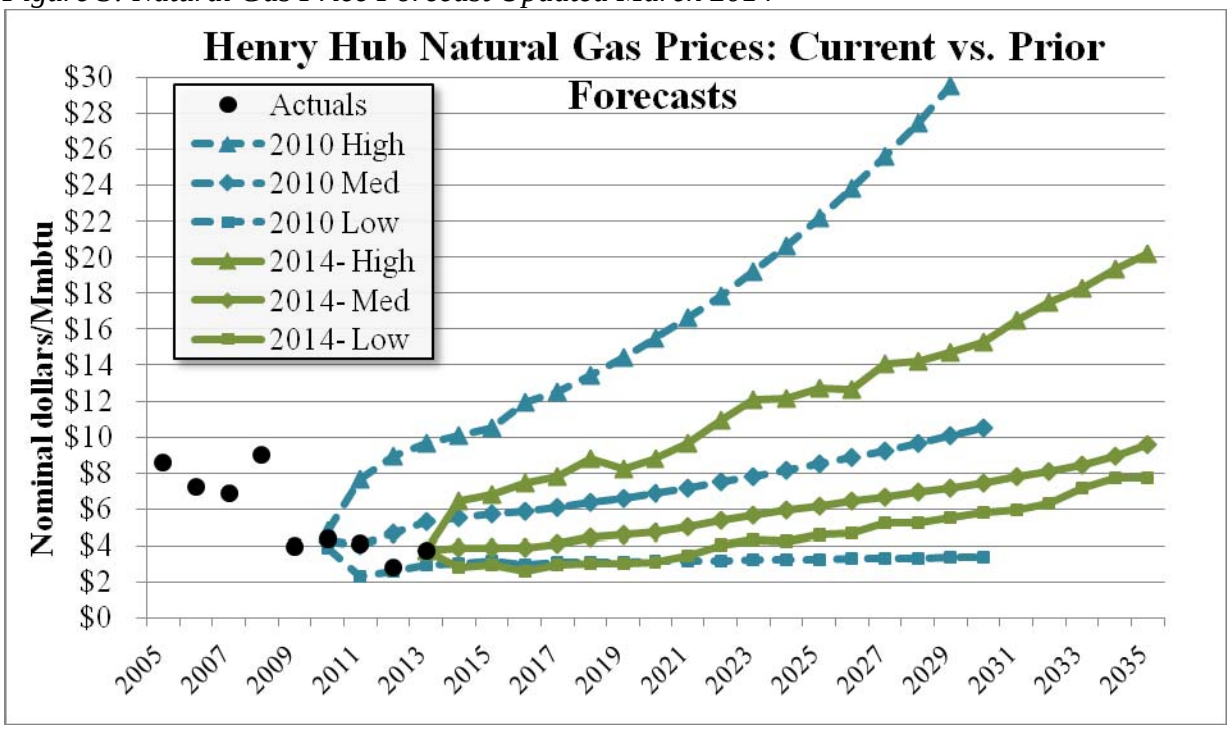


Natural Gas Prices

The forecast of natural gas prices was initially updated in late 2010 for the IERP public process that began in early 2011. The forecast prepared at that time was preceded by a period of volatile and historically high prices. The hydraulic fracturing technology ("fracking") was relatively new and the impacts were not yet known.

The forecast was subsequently updated in 2012 and in this 2014 update. Both the 2012 and the current forecast reflect the changed market dynamics created with fracking. Though much uncertainty remains going forward from here, near term price forecasts have been reduced significantly to reflect the fracking phenomenon, which then results in lower wholesale market price forecasts. Robust analysis of a range of natural gas prices, and potential impacts of changes in supply and demand, continue to be a key component of resource planning. Figure 3 below compares the range of natural gas prices that were evaluated under the IERP to the new forecast of low, medium, and high natural gas prices.

Figure 3: Natural Gas Price Forecast Updated March 2014[4]



The EWEB natural gas forecast is based on a 2013 U.S. Energy Information Administration ("EIA") Annual Energy Outlook forecast for Henry Hub Natural Gas Prices. This forecast was chosen as it is readily available and widely cited in regional and national resource planning documents. Several other gas forecasts were considered as part of this analysis including the Northwest Power Planning Council and California Energy Commission.

Regional Supply and New Renewable Resources

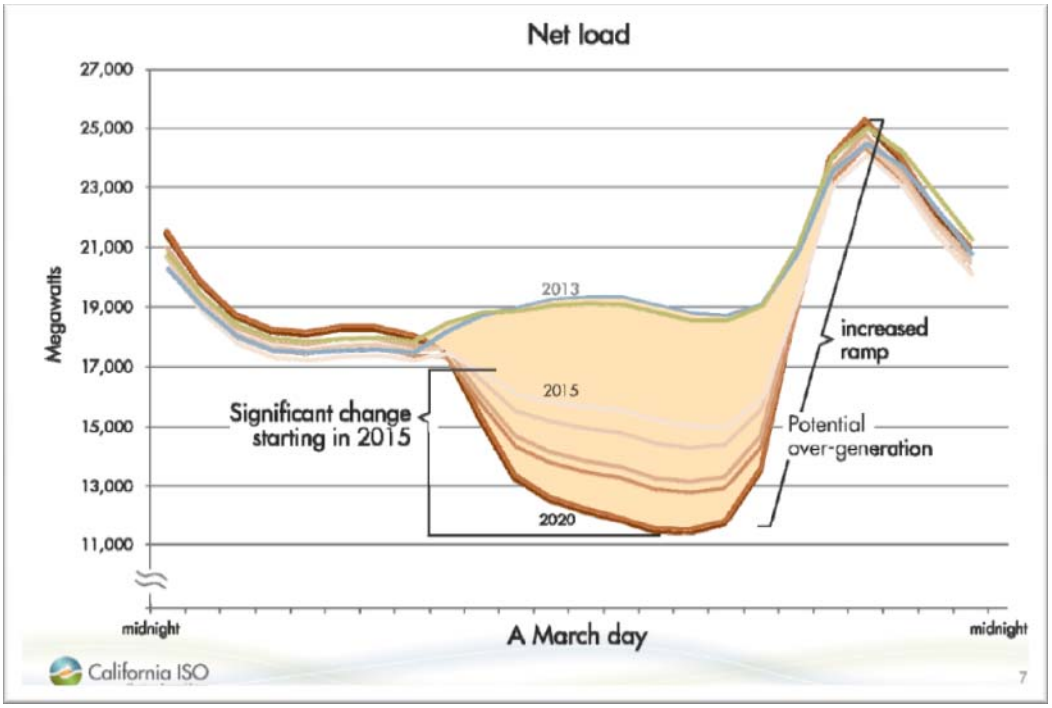
Along with reduction in natural gas prices impacting long term price outlooks, the region has experienced incredible growth in new renewable resources adding to the pool of generators that rely on a zero cost "fuel". Resources in this category include hydro, wind, and solar. Zero fuel cost resources are generally considered "must run" because they have no incentive to respond to market prices when there are no fuel savings to achieve by reducing generation. Must run resources that receive production tax credits or have forward REC sales, or that must run because of operational constraints (such as flows for fish) can force spot market prices down, even causing negative prices at times.

In addition to negative and volatile prices, the generation of renewable resources can vary significantly and are presenting new operational challenges by requiring more flexibility from the existing loads and resources. Figure 4 below shows a projected increase in California ramping capability to serve net loads with higher solar penetration. Each year in the chart shows

[4] The Aurora model analyzes a range of possible futures that vary from year to year based on historic volatility. The low, medium, and high forecasts shown represent the 90th, 50th, and 10th percentiles of prices, respectively, in any given year. None of these specific scenarios was analyzed in the 180 games because they do not show the sort of volatility that actual natural gas prices have demonstrated historically, they merely represent the range of possibilities analyzed.

a March load shape net of must-run resources. By 2020, the evening ramp, as darkness sets in and solar generation drops off rapidly, is expected to require extreme flexibility from the other assets on the grid. There are also a significant number of planned retirements with an uncertain replacement strategy. The resulting reliability concerns, and impacts to pricing, will likely impact Pacific Northwest markets in complex and unforeseen ways.

Figure 4: Forecasted Ramping Needs in the CALISO 2020[5]



The region is working to better understand future needs and the associated value of flexible resources, such as EWEB's own Carmen Smith and the BPA slice product. This need is difficult to incorporate into planning activities because there are many different types of flexibility. For example, the variable applications and no comparable market products make it difficult to identify value or replacement costs. With weak energy prices and no capacity market in the northwest, new flexible resources, such as demand response and flexible hydro, can be hard to justify on an economic basis. New natural gas plants and planned coal retirements also impact the regional mix and exploration of capacity and flexibility markets. The recommended reading section at the end of this document includes more information on the growth of renewable resources and the need for flexibility.

Carbon Pricing and Emission Controls

Another key driver of wholesale market prices that was evaluated in the IERP was carbon pricing. In 2010 there was significant regional and national momentum towards addressing climate change through comprehensive carbon policy. The IERP evaluated a wide range of carbon price scenarios starting as soon as 2014. This momentum has clearly waned at a federal

[5] Casey, Keith. "California's Evolving Energy Market." PowerPoint. 2013. 2 February 2014. <http://www.nwcouncil.org/media/6877063/K-Casey-CA_Symposium_RI_RA_Sep5.pdf>

level. At present, other policies are driving towards some of the same goals. California and British Columbia have both implemented a state/province-wide carbon pricing mechanism, and the EPA has developed new emissions standards for new coal units. As a precursor to policy enactment, many utilities are also following stricter emissions reporting protocols.

Though federal carbon pricing does not look likely in the next couple of years, EWEB continues to evaluate portfolio decisions based on the possibility of a carbon price, which also serves to monetize the environmental impacts of various resource choices in resource planning analysis. Since the 2013 IERP update, EWEB has formally released a policy statement supporting the exploration of more direct policy mechanisms to reduce carbon. EWEB has expressed a preference for a Federal policy, but would support Oregon proceeding cautiously at the state level.[6] In the near term, the lack of comprehensive carbon policy has reduced the value of EWEB's existing low carbon resources.

The most recent update of carbon prices used for long term planning and analysis includes three scenarios: 1) zero carbon tax, 2) a medium tax (based on mimicking British Columbia's model of tax), and 3) a high tax (based on the EPA's latest version of societal costs of carbon). The medium and high scenarios are significantly lower than the medium and high prices evaluated during the IERP; however, the recommended strategies acknowledged that direct carbon pricing was a large source of uncertainty and that the ideal strategy would perform under any possible carbon policy. This conclusion does not change with the update to the carbon pricing scenarios at this time. The range of impacts from the updated carbon price scenarios is reflected in Figure 6.

Wholesale Market Prices and Impacts on Utilities

A lack of direct and consistent carbon prices, low demand, low natural gas prices, and an abundant supply of energy resources have all contributed to low wholesale prices in the near term and a reduced market forecast under various carbon price scenarios. Based on this analysis, the current market prices do not appear to be including carbon price impacts in forward transactions (Figure 6). While low market prices persist, they negatively impact hydro dominated utilities such as EWEB and BPA through reduced surplus sales revenues. In the past, EWEB and BPA were able to use surplus sales revenue to help offset rate increases and to contribute to fixed costs. The market reduction to below retail rates has reduced the value of existing resources and increased the risk associated with over-supply and diminished customer demand.

Part of the reason the IERP forecast is so much higher, is that at the time carbon legislation was much more likely and the modeling that EWEB did represented it accordingly. Figure 7 shows the relative impact of carbon prices on the market under the updated carbon scenarios. Some of the price difference is also a result of reduced natural gas prices and other regional drivers.

[6] The policy paper is included in the recommended reading section at the end of this memo.

Figure 5: Wholesale Power Price Forecast

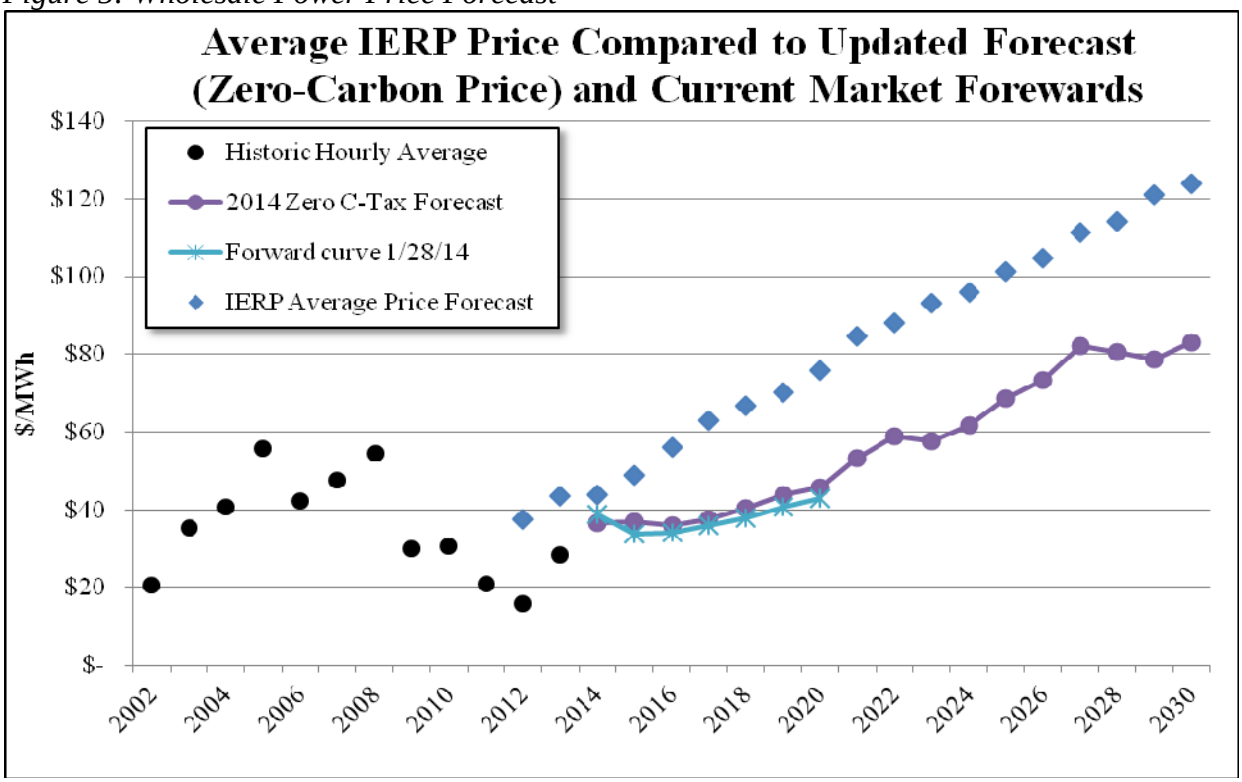
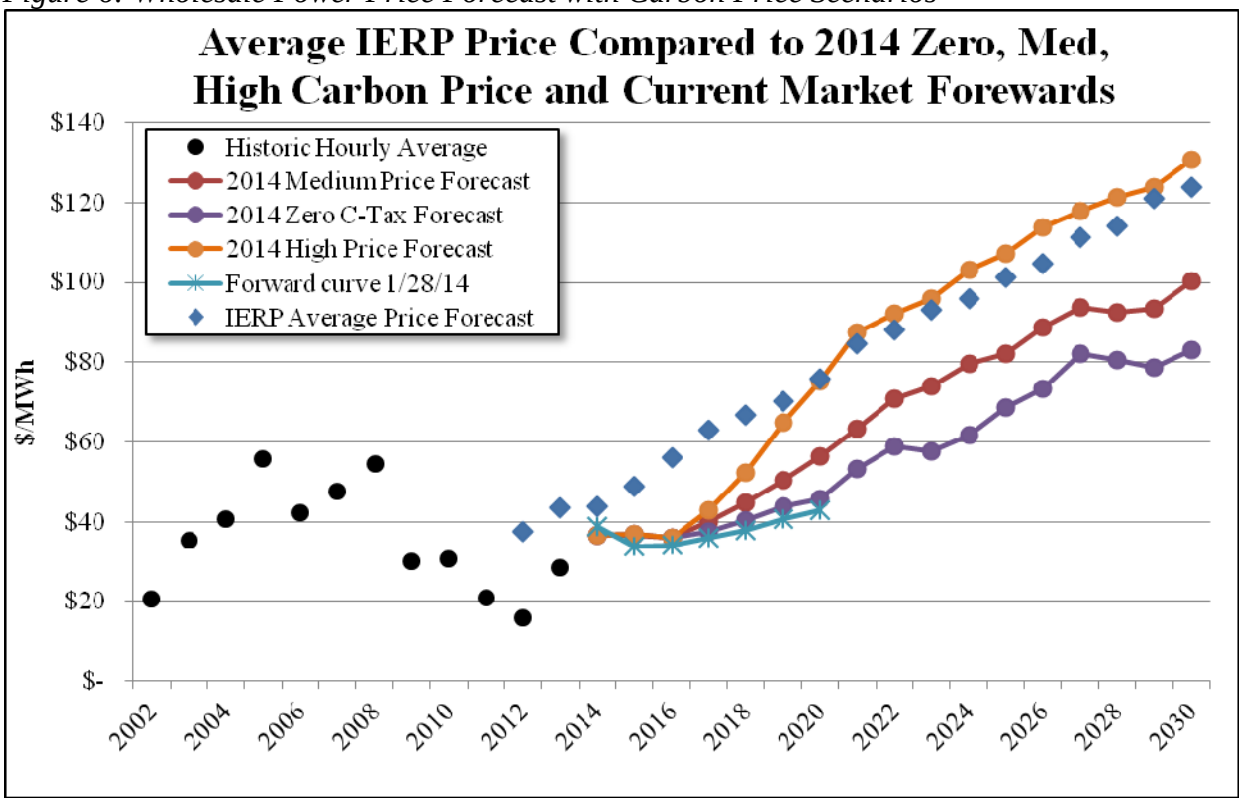


Figure 6: Wholesale Power Price Forecast with Carbon Price Scenarios

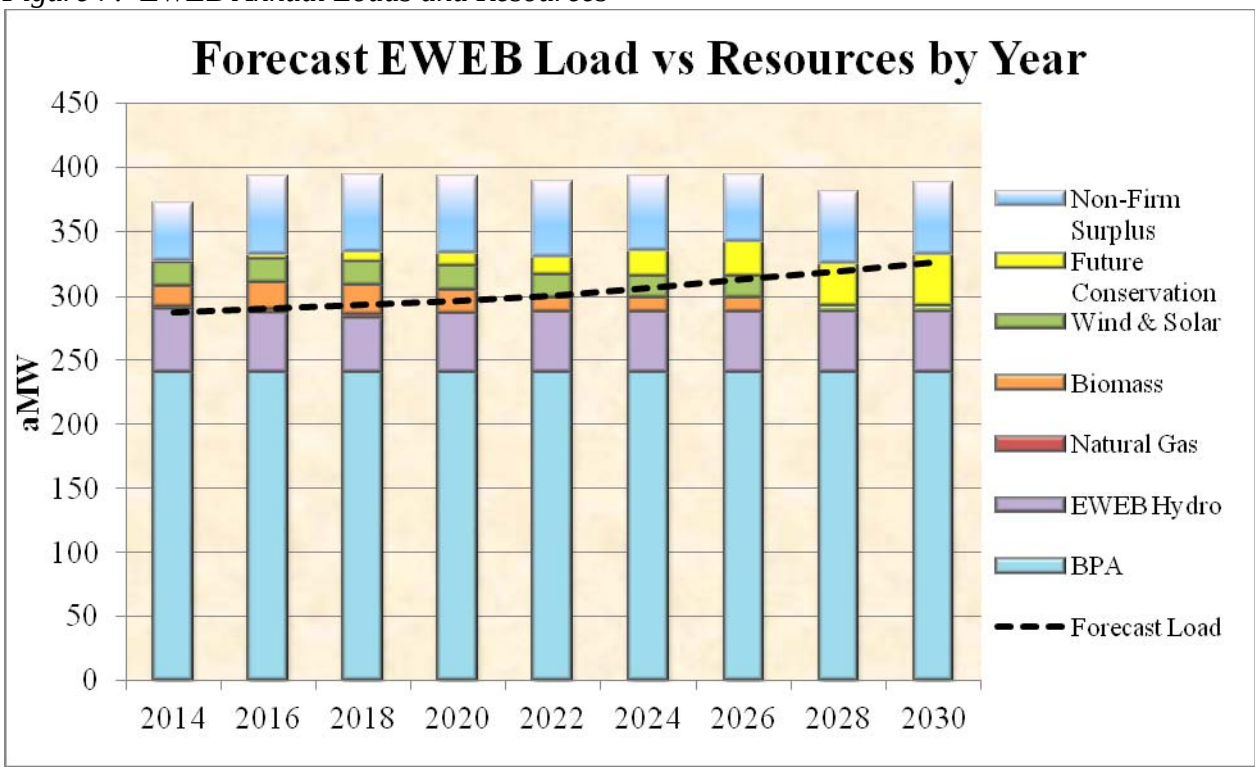


EWEB Load Resource Balance

Resource adequacy on a planning and operational basis is the main goal of integrated resource planning. If EWEB's proposed strategy was no longer sufficient for maintaining resource adequacy then a new IERP would be warranted. Figure 7 shows EWEB's annual energy supply from different resource types, the annual load forecast, and future energy efficiency acquisition compliant with the current resource plan recommendation.

On an annual basis, EWEB has more than sufficient resources to serve load even under drought conditions. Monthly variations in resources are handled through EWEB's Power Operations group by trading activities in compliance with short term risk guidelines. In most years EWEB is expected to have a significant surplus in generation as compared to load; however EWEB is still concerned with long term price trends and regional landscape changes that could influence the value of our existing portfolio of generation assets and long term power purchase agreements. These changes and other sources of uncertainty are considered while making decisions regarding long term asset management.

Figure 7: EWEB Annual Loads and Resources



EWEB Peak Supply and Loads

Beyond annual and monthly energy sufficiency, the IERP evaluated EWEB's resource capability during times of peak consumption. In 2013 Power Planning explored regional standards for peak supply adequacy and developed a methodology to evaluate EWEB's peak supply capability under summer and winter peak conditions over a single hour, multiple hour, and multiple day peaking events. Figure 8 shows the initial results of this analysis, which demonstrates

insufficient resources to serve winter peak loads under extreme conditions and expected peak conditions. Summer peaks, while growing, did not arise as an area of concern for peak supply availability.

Further analysis is required to establish EWEB's willingness to rely on the wholesale power market for this peak supply and how a long term peak adequacy metric would be incorporated into operational hedging activities required to reduce market length on an energy basis. The impact of variable energy resources such as wind on EWEB's peak supply adequacy also requires further analysis. The peak supply shortage demonstrated herein supports the continued need for research of demand response and a focus on energy efficiency that reduces peak loads; it also supports continued participation in regional forums exploring the future value of flexible resources and regional resource adequacy analysis.

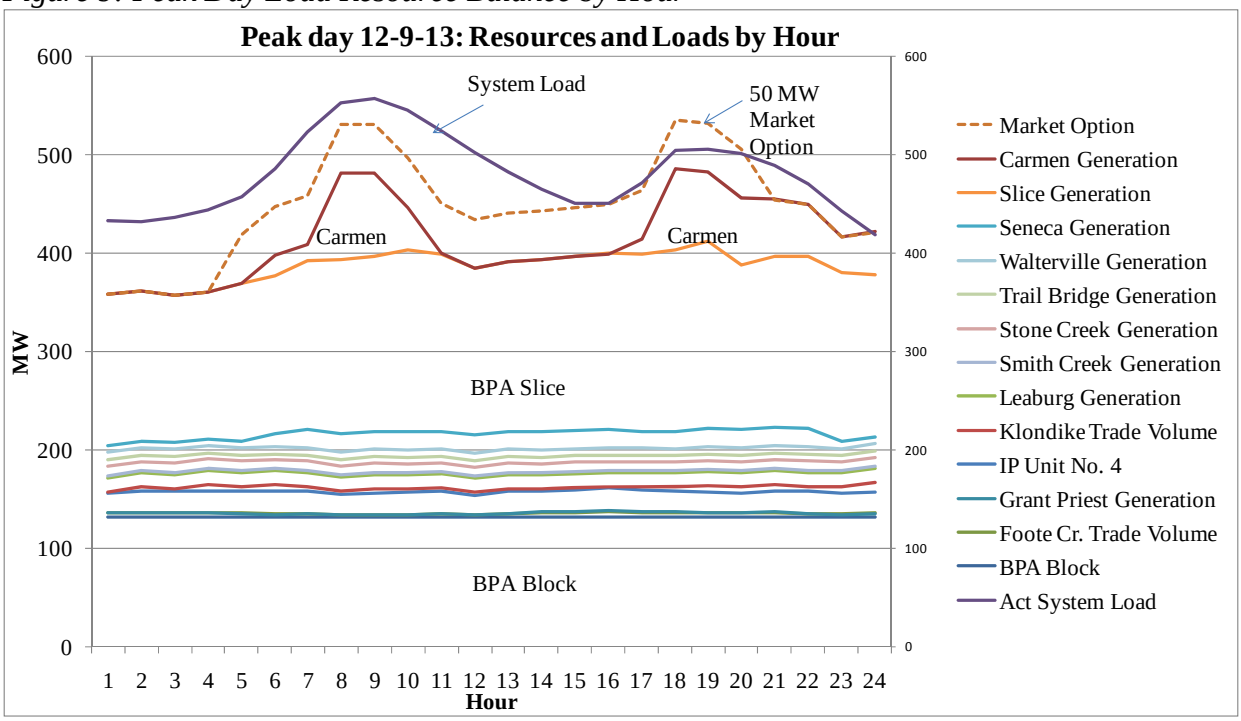
Figure 8: Peak Supply and Demand Under Median and Extreme Winter Peak Conditions

Condition[7]	Duration	Peak Load (MW)	Peak Supply (MW)	Remaining Supply Available (MW)	Calculated Reserve Margin	Likelihood of Condition or worse
Median Winter Peak	1-Hour	491	501	10	2%	1 in 4 years
	18- Hour	458	454	-4	-1%	
	72-Hour	408	376	-33	-8%	
Extreme Winter Peak	1-Hour	545	501	-44	-8%	1 in 10 to 20 years
	18- Hour	507	454	-53	-10%	
	72-Hour	453	376	-78	-17%	
Median Summer Peak	1-Hour	362	422	60	17%	1 in 4 years
	18- Hour	346	374	28	8%	
	72-Hour	278	324	46	17%	
Extreme Summer Peak	1-Hour	383	422	39	10%	1 in 10 to 20 years
	18- Hour	364	374	10	3%	
	72-Hour	286	324	38	13%	

The following chart represents EWEB's relative peak supply adequacy from a stacking order perspective during the 2013 multi day extreme peak event. You can see that EWEB needed to purchase additional resources in the market to meet peak need. You can also see the value of the flexibility of owned resources as a tool to following changes in customer load.

[7] Peak supply is based on average hydro conditions. Median peak loads assume a 50% probability of loads exceeding those provided and extreme peak loads assume only a 10% probability of exceedance. The methodology for this calculation is similar to one used in Tacoma Power's 2012 IERP update.

Figure 9: Peak Day Load Resource Balance by Hour



Discussion

Though many of the underlying planning assumptions have changed since the IERP was completed, the plan conclusions and recommendations are still valid. The recommended IERP action items include:

1. Meeting load growth with conservation
2. Working with our customers to avoid peaking power plants by using new demand side management and demand side response programs
3. Continuing to cultivate regional partnerships
4. Enacting a new large load strategy if needed, and
5. Annual updates of key planning assumptions.

Each action item has a component of adaptability embedded that aids EWEB in cost effectively meeting customer needs in as agile a manner as possible given our existing resource portfolio. Below is a summary of each IERP action item, progress on that strategy from the past year, and how the recommendation is impacted by the changes discussed.

1. Pursue Conservation to Meet All Forecast Load Growth

Near term growth has been slower than expected leading to lower annual targets than what were anticipated in the IERP. EWEB is still learning how to make conservation programs adaptable to ramping and how to best incorporate larger industrial energy efficiency projects into the lower annual targets while maintaining the benefits of smaller residential, general service, and limited income programs. Comprehensive program evaluation and a new focus on meeting peak

demands will hopefully lead to more effective conservation acquisition going forward. Rebalancing the conservation acquisition targets and program offerings to incorporate peak analysis can re-establish EWEB as a regional leader in conservation, energy efficiency, and demand response activities.

The load forecast update that will be used to establish 2015 acquisition targets is very similar to the 2013 load forecast update, but has not returned to the growth figures used to set the initial targets after the IERP was completed in 2011 (approved in 2012). The forecast load growth at the customer level on a 5, 10 and 20 year basis is as follows:

Time Period	**2010 Forecast**	**2013 Forecast**	**2014 Forecast**
5 year average growth	3.1 aMW	1.4 aMW	1.6 aMW
10 year average growth	3.1 aMW	1.7 aMW	1.8 aMW
20 year average growth	2.7 aMW	2.5 aMW	2.6 aMW

EWEB's financial situation over the past few years, in conjunction with the low wholesale market prices, promoted management to use first the 10-year view, and then the five-year view, of the load forecast to establish the annual conservation target. This change, in coordination with the lower overall load forecast, prompted EWEB to suspend its conservation programs in March 2013, upon meeting its annual acquisition target. In response, EWEB established an internal, cross-functional team to redesign EWEB's conservation programs to include components of peak acquisition in the target, in addition to creating a sustainable construct that provides minimum conservation levels even in times of low load growth.

2. Partner with Customers to Avoid New Peaking Power Plants

Since 2011, the cross-functional research and development team has continued to explore new opportunities to avoid the need for peaking power plants. Detailed notes regarding the status of these projects are shared with the Board on a quarterly basis. These projects include 1) demand response initiatives, by sector, designed to shift load from peak hours, 2) sector specific rate design initiatives that can help modify the overall shape of customer demand such as time of use, and 3) gathering data and performing analysis that supports the reserve margin research and the capacity value research and how it compliments peak reduction program design.

Continuing to gain a better understanding of customer interests and willingness to participate in these programs, as well as the ultimate demand reduction benefits of the programs, are critical pieces of knowledge sought through these efforts that provide additional customer choice, benefit, and control. In addition, the R&D work is being incorporated into AMI Opt-in planning so that the information coming from this R&D work will better position EWEB to be a utility of the future.

Beyond exploring demand response and customer partnership opportunities, EWEB continues to work on better understanding the need for additional peaking resources and the value associated with these resources. Key planning work in 2014 will require working closely with operations and risk management to develop stronger, long term peak adequacy guidelines and associated value of capacity resources, such as demand response and flexible hydro. The most recent update to the peak load forecast and peak resource adequacy assessment was the first step in the process of better understanding peak needs and developing associated planning guidelines.

3. Continue to Rely on and Expand Regional Partnerships

As many regional utilities and BPA face similar cost pressures, advocating for our needs and finding allies in the region becomes ever more important for helping to generate mutually beneficial solutions to arising regional challenges. As Oregon's largest public utility, EWEB has an important role to advocate for our customer owners in the region and work with BPA to preserve the regional legacy of our shared resources. Staying involved in regional planning efforts and maintaining awareness of other utility's positions on issues will help EWEB to influence the region in a direction that reduces risk to our customers.

EWEB is working closely with its counterparts in the Public Generating Pool (PGP), which is made up of 10 large public utilities in Oregon and Washington. Through the PGP activities we strive to understand, address, and support changes that will impact our business, such as distributed generation, resource adequacy, and capacity markets in the northwest.[8]

The Northwest Power and Conservation Council (NPCC) is starting to develop the 7th Regional Power Plan with plans to produce a final version at the end of 2015. EWEB staff is participating on several Council Advisory Committees to engage in discussions on important information used in developing the power plan. This engagement will help staff further develop our own power planning assumptions and allow us to be consistent with the region as appropriate.

We are also working with regional partners on issues and analysis surrounding renewable portfolio standards, carbon taxes, and developing capacity markets and constraints. These activities are critical for informing Renewable Energy Credit transactions and proceeding with demand response activities. These partnerships have helped EWEB identify additional cost effective solutions, enabled knowledge sharing, and gain understanding of where we align with other utilities in the region.

4. Pursue New Large Load Strategy, if Needed

A key discussion in the IERP was how to serve a new large load. The conclusion was to do as much conservation as feasible during the design and build phase of the new customer's site development and augment any remaining need with market purchases. The loss of Hynix as a customer has left Eugene with a prime site for a potential new large customer. The key account managers communicate status updates to power planning regarding interest in the site (or any other potential applicable site) for large loads. EWEB has a rate currently available for new large loads that is intended to hold existing customers harmless should any new load join EWEB's service territory. Typically, EWEB serves these customers under a separate contract and not the default rate, as large customers bring unique risks and opportunities for EWEB and its customers that make negotiating and executing contract terms worth the time and resources.

The existing terms of EWEB's large customer rate (Schedule G-4) is derived using EWEB resources not contractually committed to load under its Bonneville Power Administration contract. The provisions require the customers served under Schedule G-4 to accurately forecast load and allows EWEB the ability to enact a Power Cost Adjustment ("PCA") if EWEB secures resources to meet customer's forecasted demand and results in excess resources as a result of the

[8] A draft of some of the materials PGP has been working on is included with the board materials.

forecast inaccuracies. Furthermore, EWEB requires customers under its Schedule G-4 bear the cost of compliance associated with non-traditional cost of service, such as Renewable Portfolio Standard compliance ("RPS") resulting from the additional new large load.

5. Review Progress and Key Assumptions Annually

Power planning staff continues to monitor its key planning assumptions for use in resource planning analysis such as asset sales evaluation and relicensing work. The key planning assumptions include: EWEB and regional loads, natural gas prices, renewable generation, hydro generation, and carbon tax policy. These variables are combined to generate a distribution of possible market price futures that can be used for resource planning and risk analysis. Forecasts of our own load and resources are used to develop an understanding of our load resource balance. The board can look forward to another annual IERP update in 2015.

TBL Analysis

Triple Bottom Line analysis was included in the decision making process for advising the strategies that were recommended in the IERP. Though much has changed, the IERP included looking at risk and uncertainty and discussed the value of adaptive strategies that could be molded in light of current conditions. Each strategy is still valid and actionable even given the change that has occurred since the analysis. For further reading on the tradeoffs that were discussed in the IERP and the official TBL analysis for the strategies please see the IERP document.

Recommendation

This background is for information purposes only. Staff recommends the following reading for more information on the topics presented herein.

Requested Board Action

Continue with implementing recommendations of the 2011 IERP.

Additional Resources for Reference:

EWEB 2011 Integrated Resource Plan
http://www.eweb.org/public/documents/ierp/2011ierpfinaldraft.pdf

- Executive Summary (p.6)
- Guidelines and Recommended Strategies for the 2011 IERP (p.44)
- Conclusion (p.47)

2013 IERP update (Date on document is incorrect, presented to the board April 16, 2013)
http://www.eweb.org/public/commissioners/meetings/2013/130416/WS1_IntegratedElectricResourcePlanUpdate.pdf

Recommended Policy on Carbon
http://www.eweb.org/public/commissioners/meetings/2013/130507/Corr_EWEBBoardPolicyPositiononcarbonpricing.pdf

E3 study on 50% RPS in California
http://www.ethree.com/documents/E3_Final_RPS_Report_2014_01_06_ExecutiveSummary.pdf

Quarterly update on DR work
http://www.eweb.org/public/commissioners/meetings/2014/140204/Corr_RD_Pilots_Q4Update.pdf

APPENDIX 1: Resource Planning Key Terms and Definitions

Integrated Resource Plan- Document and public process completed every 5 years and as needed to guide EWEB's strategies for how best to supply customers power needs. Strategies can include both supply and demand side resources.

Average Megawatt (aMW) - One MW averaged over a longer time frame, usually a year or 8760 hours. Example: EWEB 2013 Forecast Load= 285 aMW. In some hours it may reach 500 MW in others it may be as low as 150 MW but across the year the load adds up to 2,496,600 MWh. 2496600MWh/8760 hours per year = 285 aMW.

Load- EWEB customer usage at any time. Load can be reflected in MW (instantaneous), MWh (1 MW of demand for 1 full hour), or aMW(load averaged over a period of time).

Peak Load- Total EWEB customer usage during the single highest hour of the year.

Resource Portfolio- EWEB's owned and contracted electricity generating assets.

Firm Generation- Generation that can be relied on even in the driest hydro years, lowest wind years, and with a conservative rate of thermal forced outages. This energy can be relied on for planning purposes because it does not change from year to year. From a reliability standpoint we would not plan to go very far below having a "firm power supply" sufficient to meet expected loads.

Expected Generation- Generation from the resource portfolio in a year with average hydro, average wind, and normal thermal forced outage conditions.

Surplus Energy- Any energy above Firm. In an average year the Surplus Energy is the difference between the "Expected Generation" and the "Firm Generation." Surplus energy changes from year to year depending on conditions such as precipitation, snowpack, and wind speeds.

Firm Length- Firm generation above expected load in a given time period. On an annual basis for 2015, EWEB's firm length is ~33 aMW. This is higher and lower during different times of the year.

Demand Side Resources- Energy production or savings that come from working with customers to change (usually reduce) load through behavior changes and technology.