EWEB

MEMORANDUM

EUGENE WATER & ELECTRIC BOARD

Rely on us.

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

FROM: Erin Erben, Power and Strategic Planning Manager

DATE: March 27, 2015

SUBJECT: Integrated Electric Resource Plan (IERP) Update

OBJECTIVE: Information Only and Recommended Reading

Issue

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. For now, the update is expected begin in 2016. This annual update will focus not only on the changes that are occurring in the regional and any change in EWEB planning assumptions, but also to update the Board on progress made toward the recommended action items from the IERP. This update will also summarize actions required to embark on the 2016 IERP update.

As reviewed in the 2014 Strategic Plan and IERP updates, 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 recommended strategies evaluated to date, but as with many new investments, has encountered some challenges and key learnings that can be summarized herein. Implementation challenges and a rapidly changing environment have presented some obstacles. While these have impacted elements of our plan, the strategies and learnings from the process are continuing to position EWEB well for entering the 2016 IERP process and the changing future that we see ahead.

Background

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 Current 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. There are also possible renewable portfolio standard (RPS) compliance considerations for such an event.

Much has changed since the Current 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.

These strategies were designed to enable EWEB to adapt to a changing planning environment and regional market. 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 and regional 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 and regulatory position determine what EWEB has available to sell or needs to purchase in order to meet retail customer demand. [1] Maintaining these key assumptions helps to enable near term contract optimization and planning decisions in the interim as we prepare for the next IERP. Updates to these key background assumptions used in power planning are included in Appendix 2.

Discussion

Though many of the underlying planning assumptions have changed since the IERP was written, the recommendations remain robust. However, after four years of working to follow the recommendations, some of the action items are presenting implementation challenges that must be resolved before proceeding with the next IERP. Specifically, documenting learnings from these efforts is a key part of the annual updates that will then be reviewed at the onset of the next IERP process.

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

Each of the recommended action items 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. To embrace this agility, some adjustments to the implementation in practice may be necessary. Below is a summary of each IERP action item, progress on that strategy, lessons learned, how the recommendation is impacted by the changes to underlying market conditions and load resource balance, and key action items for completion during 2015.

1. *Pursue Conservation to Meet All Forecast Load Growth*

After a brief hiatus in 2013 to re-craft the conservation program portfolio, EWEB has restored its conservation programs and is currently meeting all energy and peak growth with conservation. Load growth continues to be lower than anticipated in the IERP.

In 2014, the load forecast model was updated to reflect a business need to develop long-term, class-based energy forecasts as an alternative to the prior system level forecast. In addition to the more detailed class-based forecast, there are several other changes to the methodology in the 2015 forecast. First, the historical time period was shortened by moving the start date from 1990 to 2001. The shorter time period eliminates some of the relatively high growth periods in the 1990s; it provides a better fit between variables, by excluding the significant rate increases that followed the energy crisis and created a structural break in the energy demand. Second, the independent variables were segregated to the respective class forecast based on statistical tests for reasonable inclusion in the model. For example, population is a variable included in the residential customer class model and unemployment is included in the commercial classes' model. The model enhancements result in reduced long-term growth trend as seen in the table below. This forecast is consistent with regional and national industry trends[2].

The impact of these changes to the forecast model both impacted projected future growth trends. The updated forecast model projects roughly 0.5% load annual average growth, which is lower than the IERP forecast of roughly 1.0% load growth over a 20 year period. This more granular model (reflecting individual customer classes, rather than simply aggregate retail load) allows us greater ability to track forecast vs. actual, monitor revenue impacts, develop rate design strategies, and understand customer usage patterns.

EWEB uses the five-year average load growth forecast to set conservation targets. 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	2015 Forecast
5 year average growth	3.1 aMW	1.4 aMW	1.6 aMW	1.6 aMW
10 year average growth	3.1 aMW	1.7 aMW	1.8 aMW	1.4 aMW
20 year average growth	2.7 aMW	2.5 aMW	2.6 aMW	1.3 aMW

The changes to the forecast and the five year view for setting acquisition targets has reduced the

[2] The most recent Council forecast is in the 0.5 – 1.0% for low and high, PNUCC published a 0.9% growth, and the recent long term EIA forecasts project 0.6% for residential and 1.2% for commercial and industrial load growth.

conservation acquisition targets significantly from the longer term targets discussed in the IERP, reflecting a move to smaller bets and a dynamic strategy. This strategy is not without its challenges. Living with a lower savings target and meeting all load growth with conservation presents several impacts to EWEB Energy Management Services (EMS). From an internal perspective, EWEB has found that targets that change from year to year and the varying customer uptake of program offerings drive the need for flexibility to rebalance targets between sectors and adjust budgets. Looking outward, EWEB's ability to recover conservation funding from BPA may be in jeopardy if load growth projections and savings targets become any lower. These lessons learned have caused EWEB to create a band around the target during its program re-design to create more stability and mitigate some of these issues.

EWEB is committed to provide a minimum level of conservation service for residential, limited income, and small business customers regardless of load growth and target; however other business programs can fluctuate based on EWEB needs. Because we are trying to meet but not exceed the savings target, opportunities are sometimes lost, particularly in new construction, and the timing of large projects sometimes needs to be adjusted. Large projects that exceed savings or budget may need Board approval.

Perhaps the greatest challenge with conservation is the utility's ability to collect adequate rate revenue in the absence of load growth. For all energy that is saved, EWEB loses the margin on retail sales of those kWh and is not presently able to make that back in the wholesale market. EWEB, like all businesses, has some costs that are always increasing, so with flat sales there is the potential for a revenue shortfall. EWEB has continued to close this shortfall through rate actions, wholesale power sales and budget cuts. This dilemma has caused EWEB to rethink the no growth strategy. New construction is happening, but much of the new load is being served with natural gas. EMS is working to maintain the electric market share by offering incentives for efficient electric water and space heating options to new and existing customers for smart and efficient load. Because electricity is typically less carbon intensive than the customer's other fuel choices, this strategy is in line with the TBL goals of the IERP. EMS is also working with Key Accounts on strategies to make it more attractive for businesses to relocate or expand in EWEB's service territory.

EMS is currently tracking a single peak target that is highly coincident with the BPA peak. Unlike the energy target, the peak target is treated as a minimum acquisition threshold. Moving forward it may benefit EWEB to track additional peaks (e.g. summer) to more closely match demand side management (DSM) acquisition with EWEB needs. EWEB is also working to maintain the electric market share through business growth & retention and revenue enhancement programs, pursuing new technologies for conservation/load retention programs, and exploring rate designs that stabilize revenue needed to cover fixed costs. For these activities the desired outcome is smart load growth that stabilizes revenue without disproportionately affecting peak.

2. *Partner with Customers to Avoid New Peaking Power Plants*

Since 2011, the cross-departmental research and development team has continued to explore new opportunities to avoid the need for peaking power plants. In 2013, an annual budget of approximately $600,000 was formally approved and adopted by the EWEB Board of

Commissioners to execute this work. This was split 67:33 between labor and non-labor respectively. Due to economic factors requiring necessary budget reductions across the corporation, insufficient resources were available to be assigned to this effort. However, prudent management has ensured that, despite an underspend of the annual budget, continued progress of this project has been both realized and beneficial. Details regarding the status of these projects continue to be shared with the Board on a semi-annual basis. The team has concluded projects in all sectors that were designed to test our ability to shift load from peak hours. We learned that customers are willing to engage with EWEB to shift load away from peak. In many of our pilots, energy efficiency and demand response were used together to accomplish greater customer satisfaction and better load management for EWEB. A key learning was how critical good communication is for ensuring customer engagement throughout the pilots.

Since the adoption of the Current IERP, the region has experienced a significant increase of installed variable generation. So far, the region's flexible hydro resources have been utilized to integrate Variable Energy Resources (VER). BPA provides integration services or Balancing Reserves. However, hydro resources have reached their limits and there is an emerging need to find innovative ways to integrate VER into the regional power grid. Some Demand Response (DR) products have the potential to offer some VER integration services.

EWEB completed two residential water heater pilots. The first tested the ability of water heaters to store thermal energy and increase or decrease load in short time frames in response to a "Balancing Reserves Deployed (BRD)"signal. The BRD indicates the imbalance between demand and supply on the power grid. The BRD imbalance is exacerbated by VER on the grid. The technology worked well, however the cost at over $1,000 per site along with ongoing maintenance of the equipment and internet connection is too expensive to justify the approximately one to four kilowatts of power available to shift at any given time. The second pilot tested the ability to shift water heater energy use away from prescribed peak hours. Although there were some issues with the early versions of the controllers, this technology also worked well and is promising. However, the cost at about $500 per site plus ongoing maintenance was still more expensive than the value of energy shift to off-peak. These pilot efforts have shown that the concept of shifting load is technically viable; however, EWEB must partner with other in the marketplace to bring site costs down to lower costs to improve economics. EWEB has concluded the strategy holds significant promise and we anticipate that the technology may be integrated into home appliances in the future, which could make these strategies cost effective in out years.

EWEB also completed two commercial pilots designed to increase or decrease load at each facility in response to a communication signal, provided by BPA through a third party. Both facilities were able to respond within the required 10 minute response window. The fast response time is required so that DR products can economically compete with hydro and provide effective Balancing Reserves. We learned that customers are willing and able to engage with EWEB and learn how to control loads. The DR market in larger Commercial and Industrial sectors is expected to be cost effective in the foreseeable future. The two largest challenges are high initial cost and high level of necessary customer engagement. The BPA provided funding for much of the infrastructure costs[3] of the pilots, however looking forward we expect that an

[3] Capital costs for the DR portion of the two projects, above and beyond the investment for energy savings alone,

AMI system may reduce metering and telemetry costs. AMI can become the key technology to achieving mass scale and economic solutions so our customers can partner with EWEB to help manage this peak load issue. We continue to see significant benefit of imbedding DR ready control system capabilities in energy efficiency projects. Furthermore, as the market develops, we hope to be able to consolidate and control DR assets in aggregation.

The PNW is developing various DR aggregation strategies. The hope is to bundle and deploy DR assets in large or grid scale quantities of at least 25 MW and provide various DR products and a pay for performance strategy. BPA and Energy Northwest are developing an aggregation pilot to provide a fast response (10 minute) DR product. EWEB had hoped to deploy 1-2 MW of EWEB customer assets in this demonstration project. Unfortunately, we were unable to do so. The primary hurdle remains up from enablement cost. Enablement requires near real-time metering, telemetry, and cloud integration.

BPA and EnerNOC are developing a separate aggregation pilot designed for a seasonal transmission congestion DR product. EnerNOC is an international company that has been in the DR aggregation space for many years in more mature markets such as PJM, NEISO, ERCOT, and CAISO. EWEB explored this opportunity; however, this was not a good fit. Although EnerNOC would have covered all the enablement cost, they would retain ownership of the enablement system and have exclusive relationship with EWEB customers after the pilot end date. Though Grid scale DR aggregation hold promise, EWEB may be challenged, due to our modest size, to aggregate alone. EWEB may be able to engage with other aggregation products in out years should markets develop as anticipated.

In summation, the testing of technology in these projects was predominantly proof of concept in scope. There is a growing market share of connected devices and appliances, but overall it is still a very small percentage of the entire electronics market. Lack of communication and interoperability between manufacturers poses many impediments to full deployment; in addition, connecting these systems to EWEB's systems will also be an ongoing challenge. Due to the small scale of these pilot projects, many operational processes were manual and will not scale, as tested, to a full deployment. EWEB is optimistic that new open communications platforms (e.g. OpenADR) will greatly enhance the utility's ability to more efficiently and cost effectively engage in the "internet of things".

The residential time-of-use (R-TOU) study is the only active pilot. The primary objectives of the "Power Hours Pricing Study"(Study) include providing customers an opportunity to save money, testing metering and meter reading solutions for new meter data streams (e.g. interval, 15 minute, data, peak/ off peak usage), perform analysis of data to support load research and demand response applications, and finally evaluate customer responsiveness and acceptance of TOU rates. The Study is a conditional form of a randomized control trial design that establishes the population of interest as volunteers for TOU (as an alternative to the base rate) rather than all residential customers; the ability to extrapolate the results to the population of residential customers, is conditional –the results shall extend only to other would-be volunteers in the general population. There is a growing trend across the utility industry to better quantify the

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were $127,500 for ~200 kW of controllable load ($638 per kW) and $140,000 for ~500 kW of controllable load ($280 per kW).

behavior of customers; this Study should provide valuable data and insight as to how residential customers respond to price signals in EWEB's service territory, which when coupled with advanced metering infrastructure (AMI) can provide integrated solutions for customers to save money and for EWEB to better manage peak periods at the system level.
As of Q1 2015, the Study is in the sample recruitment phase. Several factors contributed to the delay in filling the sample: difficulty of recruiting customers during college football season, end of the year holidays, unanticipated technical difficulties with data management and meter installation challenges at the premises. The revised date for a completed sample set is June 2015.

Looking to the future, AMI enabled features and regional emerging market activities will help make these partnerships with customers more feasible. Next steps include testing customer behaviors resulting from pricing signals, assessing the achievable potential of this resource, and exploring the possibility of energy storage and/or micro grids as part of EWEB's system. EWEB will continue to explore the potential for partnerships with customers and develop internal process improvements to better balance supply and demand to position EWEB to be a utility of the future.

Key Lessons Learned

- There is growing customer interest in programs of this nature at this time and all of the participants in the research projects were satisfied with their experience.
- All of the participating customers were able to successfully shift load away from specified peak events.
- None of the residential technologies tested are likely to be economically feasible for EWEB to deploy in the immediate future; however, especially as control and communication technologies develop, commercial DR is more economically feasible.
- Partnering energy efficiency with demand response will offer greater financial enablement for customers across all sectors. Investments in controls that aren't cost effective just for energy efficiency will begin to make sense when peak shifting or DR benefits are considered.
- The three most prominent barriers to large scale implementation are 1) equipment costs, 2) lack of interoperability, both between devices and between utility and customer, 3) low cost of wholesale power market.
- EWEB needs to continue to monitor the activity in these sectors, as the technology is changing at a rapid pace. The overall achievable potential of these projects is largely dependent on emerging regulations, standards, controls, appliances, software, and interconnected platforms that can provide cost effective benefit to both utilities and our customers.

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 involved in a number of regional processes and initiatives in advocacy and analytical roles.
One effort that has engaged power planning staff over the last year is the Northwest Power Pool Members' Market Assessment and Coordination Initiative (NWPP MC).

The NWPP MC initiative aims to deliver comprehensive Northwest solution to:

- Manage variable energy resource operational impacts
- Share regional balancing diversity and capabilities
- Enhance reliability of transmission constraint management
- Mitigate compliance exposure and costs
- Leverage existing tools where expedient
- Preserve existing Reserve Sharing Group benefits
- Respect self-determination priorities

This effort is a multi-year initiative to increase regional reliability, coordination, and market efficiency. EWEB staff is participating in and influencing this process. The outcome of this initiative will likely have profound impacts to the PNW wholesale energy markets.

EWEB is also 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, carbon policy, renewable portfolio standards, California market interactions, and capacity markets in the northwest.

From a more traditional resource planning perspective, the Northwest Power and Conservation Council is diligently working to develop the 7th Regional Power Plan with plans to produce a final version at the end of 2015. EWEB management and analysts are participating in all Council Advisory Committees to engage in discussions on important information used in developing the power plan. This engagement is helping staff to further develop our own power planning assumptions and allow us to be consistent with the region as appropriate. EWEB has found the 7th plan analysis to be very helpful and is looking to align the next full IERP with data availability from the Council's 7th plan process. In addition, EWEB also maintain memberships in the Regional Technical Forum (RTF) and the Advisory Committee to ensure dialogue regarding new and emerging technologies that may also influence load.

4. *Pursue New Large Load Strategy, if Needed*

A key discussion in the Current 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 a 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.

In 2013, EWEB modified its tariff (Schedule G-4) for its large customers. The existing cost allocation methodology for EWEB's large customer rate (Schedule G-4) is derived using EWEB resources not contractually committed to load under its Bonneville Power Administration (BPA) 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 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. EWEB will also be considering partial requirements tariffs to address large loads.

Since the Current IERP was adopted EWEB has gained roughly 5 megawatts of BPA Tier 1 headroom[4]. This change increases EWEB flexibility in meeting incremental loads that are not defined as *New Large Single Load* under the BPA contract. Currently, there are some projections of load growth related to Measure 91 indoor agriculture, as well as incremental loads related to data centers and electric vehicles. To the extent these loads materialize and are not met with conservation EWEB will have to have resources to rely on to meet these demands.

To address potential risks associated with new large loads, EWEB is working to update risk management procedures to account for large changes in load and how they might impact short term RPS compliance exposure. Though the intent of G-4 is to ensure a new load would contribute a fair share of the cost of compliance, this methodology acknowledges that contract negotiations and customer specific rate design will take time, and accounts for the interim RPS compliance requirements that EWEB might be exposed to on a short term basis. RPS compliance is a key component of serving any new large load that was not considered in depth in the IERP. EWEB is working to address this issue internally as an important enhancement to the existing recommended New Large Load Strategy.

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. As assumptions have changed, EWEB has documented these changes and the potential impacts to EWEB over time. This has positioned EWEB well to approach the next IERP by ensuring that assumptions are up to date and regulatory and market risks are understood to the ability possible. More detail on the key assumption updates is included in Appendix 2.

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[4] The calculation of BPA Tier 1 entitlement is a function of EWEB net requirements and BPA system capabilities.

The metric that most commonly drives resource planning decisions is the annual, monthly, and peak load resource balance. Since the IERP, staff has developed a much stronger understanding of load resource balance during times of peak which has changed from the assumptions used in the 2012 IERP mostly in terms of the magnitude of peaks that are anticipated. The annual and monthly load resource balances have also shifted due to changes in load throughout the recession as well as changes to the supply. Though tight during times of peak, EWEB has at other times large energy surpluses especially during the spring months. EWEB's current above firm surplus is on average about 55aMW through 2030. This represents a significant imbalance in loads and resources and warrants portfolio reshaping actions such as asset sales. Sales of resources that do not match EWEBs load can improve EWEB's load resource balance on an annual and monthly sense, while not impacting the ability to serve peaks. This understanding, with consideration of other factors, is shaping EWEB's asset sales strategy.

EWEB has also worked over the last year to further develop our understanding of the obligations under the Oregon Renewable Portfolio Standard (RPS) and to enhance our compliance strategy going forward. Currently the standard requires 5% renewable resources, but beginning in 2015 it is moving to 15%, followed by 20% in 2020 and 25% in 2025. EWEB has more than sufficient renewable resources for meeting the RPS; however, the surplus of the portfolio creates the need to balance surplus Renewable Energy Credits (REC) sales with future compliance tradeoffs. The 2014 compliance report will be submitted to the board for approval in June of 2015. RPS and future environmental regulations and policy compliance will continue to be an important consideration for long term portfolio decisions in the future.

TBL Analysis

Triple Bottom Line analysis was included in the decision making process for advising the strategies that were recommended in the Current 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. Due to that foresight, each strategy is still valid and actionable even given the changes that have occurred since the adopting of the current IERP. . 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 “additional resources” and appendices for more information on the topics presented herein.

Requested Board Action

No Board Action is requested at this time.

Additional Resources for Reference:

EWEB 2011 Integrated Resource Plan ("Current IERP")
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)

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

APPENDIX 1: Resource Planning Key Terms and Definitions

Integrated Resource Plan- Defined in the Energy Policy Act of 1992, as "a planning and selection process for new energy resources that evaluates the full range of alternatives, including new generating capacity, power purchases, energy conservation and efficiency, cogeneration and district heating and cooling applications and renewable resources, in order to provide adequate and reliable services to ties electric customers at the lowest system costs…"

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.

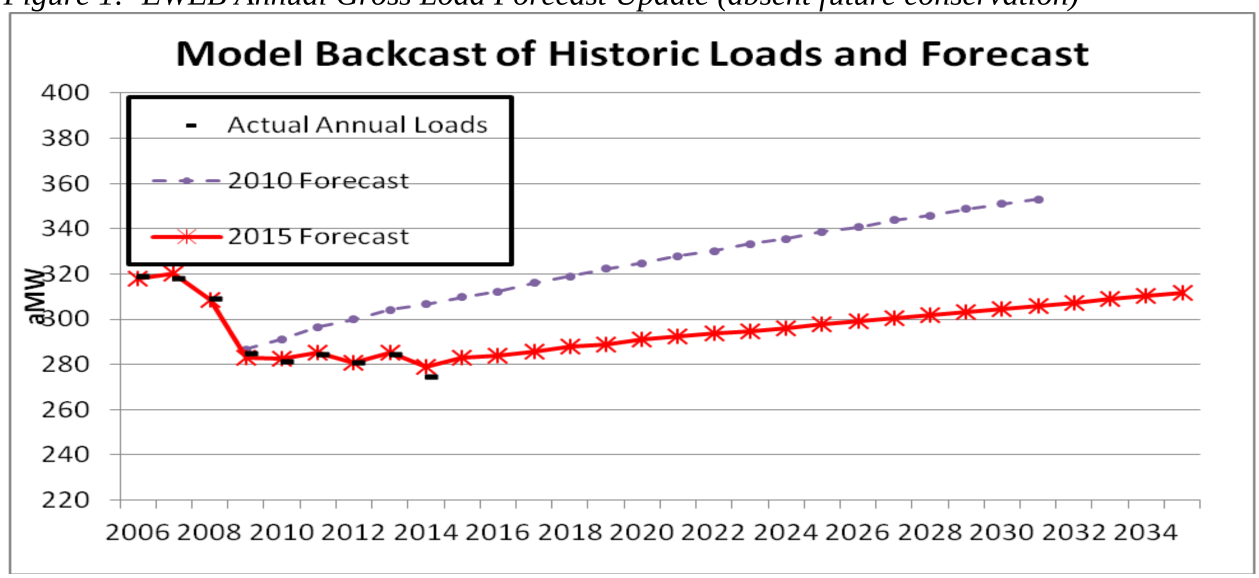
APPENDIX 2: Updates to Key Planning Assumptions

The Power and Strategic planning department updates long-term planning assumptions and forecasts at least annually in most cases or as significant changes are observed. Documenting these changes is important for staff to keep track of the changing landscape, but also serves to check in on assumptions that drove the resource plan recommendations or that impact other long term energy resource management decisions. This appendix summarizes 2014-15 updates to the key drivers in quantitative and qualitative forms. Updates to key assumptions will continue to occur throughout the year.

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, but may also be the result of heighten energy efficiency and fuel switching to natural gas for many applications within the region. 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.

Figure 1: EWEB Annual Gross Load Forecast Update (absent future conservation)[5]



Peak Load Forecast Update

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[5] 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.

The EWEB peak forecast varies depending on season; typically a winter and a summer peak forecast are 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. This expected increase is largely due to an increase in air conditioning load.[6] In addition, changes such as the decline in electric heating loads, because of fuel switching and energy efficiency, limit load growth during the winter. In the current forecast EWEB does not anticipate becoming a summer peaking utility; however, summer peaking is much more common nationally and therefore EWEB monitors these trends.

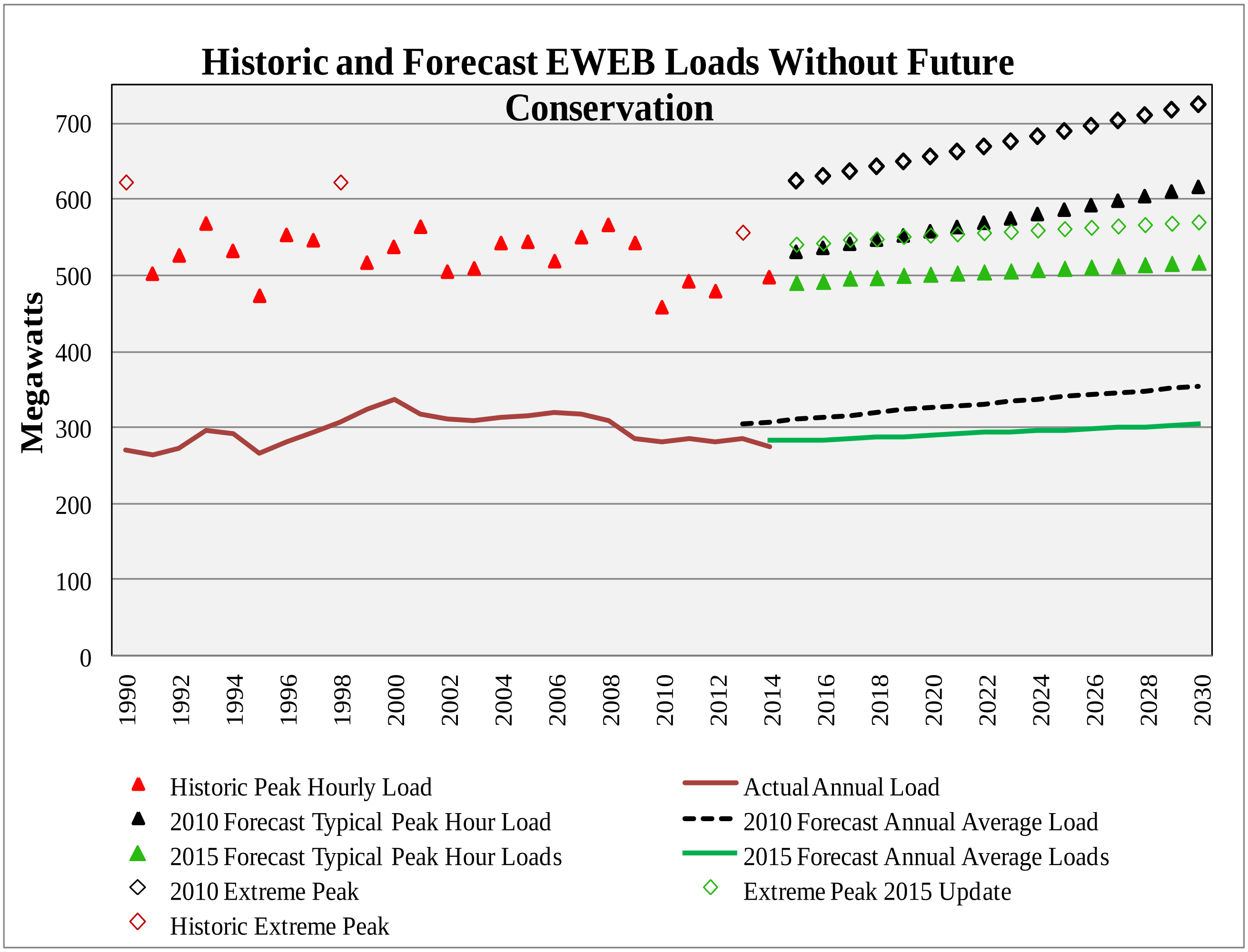
The winter peak is driven by heating load and the summer peak by cooling load. In the winter the peak can occur in either the morning or the evening, depending on the weather conditions. Typically, the winter peak occurs between 7:00 and 9:00 a.m. and/or in the evening between 4:00 and 7:00 p.m. The 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 Eugene climate typically experiences winter temperatures below eighteen degrees one in every two years. The low temperature typically occurs in January or December, but can occasionally occur in February or November. So we would expect the forecast of a typically peak, which is based on the median low temperature to be exceeded half the time and have lower peaks half the time.

EWEB also forecasts peaks based on extreme conditions. Once in every ten years Eugene experiences a winter low temperature of six degrees. In 2013, Eugene experience low temperatures of negative ten degrees. These extreme conditions were well below our expected or even our extreme winter forecast modeling.

[6] 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)

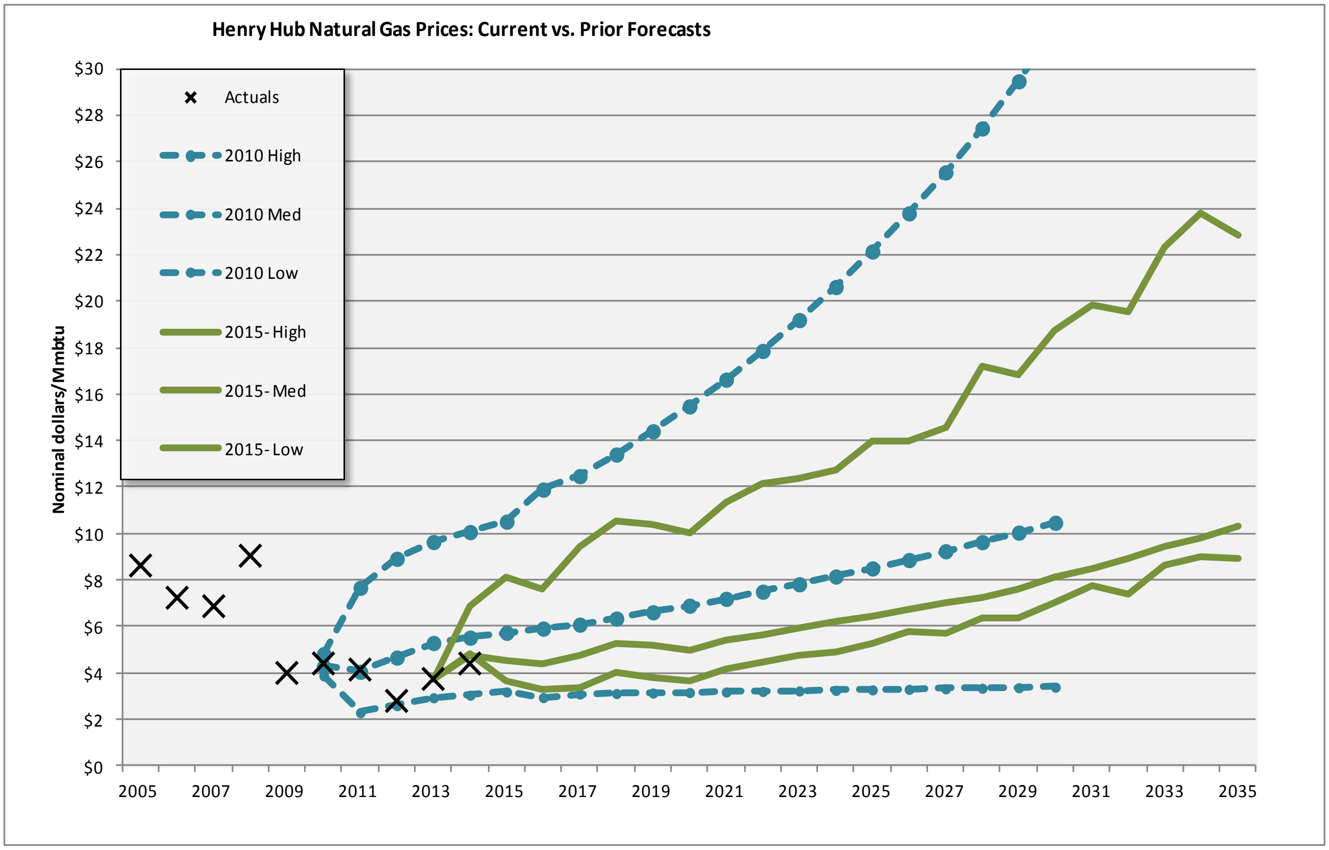


Natural Gas Prices-

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 2015 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, continues 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 2015[7]



The EWEB natural gas forecast is based on a 2014 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.

Since the middle of 2014, the price of oil has dramatically fallen by about 50%. Over production and weak demand has reduced the average oil price per barrel form over $100 to about $50. Historically, there has been a strong price correlation between oil and gas markets. However, due to the strong growth of hydraulic fracturing in the US, the price correlation has weakened. The two markets are now largely independent.

Carbon Pricing and Emission Controls
Another key driver of wholesale market prices that was evaluated in the IERP was carbon

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[7] 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.

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 waned during the recession and has largely been pushed at the state and local level. California and British Columbia have both implemented a state/province-wide carbon pricing mechanism, and Quebec recently joined the California cap and trade market. In June of 2014 however, the EPA released its landmark ruling regulating carbon emissions from the electric resource sector from new and existing generation sources, with an expectation that existing sources would reduce carbon emissions to 30% below 2005 levels by 2030 in aggregate. The final rule is expected to be issued in June of 2015.

For the implementation of section 111(d), states are required submit action plans for how they will achieve the expected level of emission reductions based on changes in 4 categories: redispatch of existing thermal resources, increased efficiency of older natural gas plants, new renewable generation, and new energy efficiency. States that link together to form a regional approach will be granted an additional year to submit their compliance plans. Though this ruling is facing legal challenge, it will be enforced throughout legal proceedings, which means states will still need to mobilize in the near term and take the initial steps towards compliance. The initial state action plans are due in June 2016. To further the requirement of action on the part of states, the ruling enables EPA to enforce a standard if a state does not voluntarily do so.

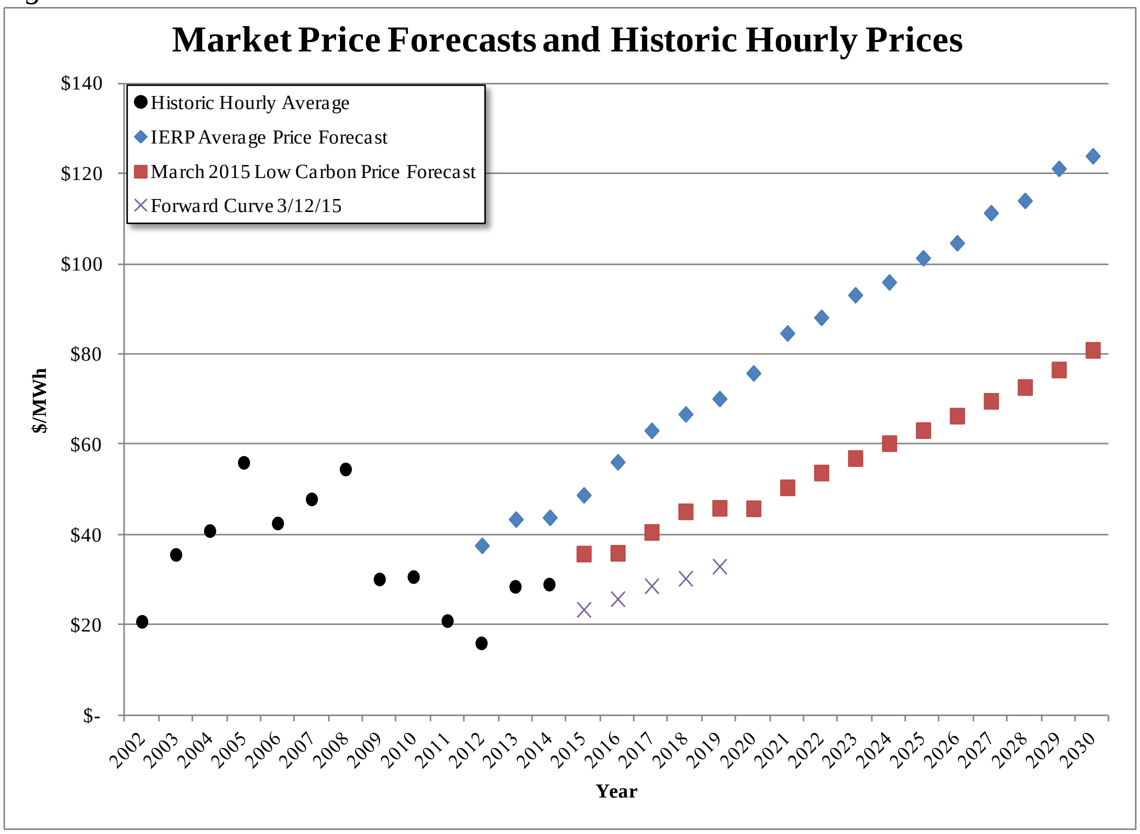
This call to action has led to some interesting discussions at EWEB and in the northwest region and continued advocacy for our Carbon policy position. The state of Oregon as well as Washington appear to have goals that align with EWEB’s policy position and are now both exploring Carbon tax or cap and trade to regulate the emissions in what is expected to be a more efficient and easier to implement approach. In general, states are expecting that a more aggressive approach that includes other sectors like the transportation fuels would be sufficient for the EPA’s requirements but would also serve state goals and new market development.

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. The 2015 update to Carbon Price forecasts will likely include a lag to better align with the EPA ruling timeline.

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 4). 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. The price forecast shown does not include additional carbon pricing.

Figure 4: Wholesale Power Price Forecast

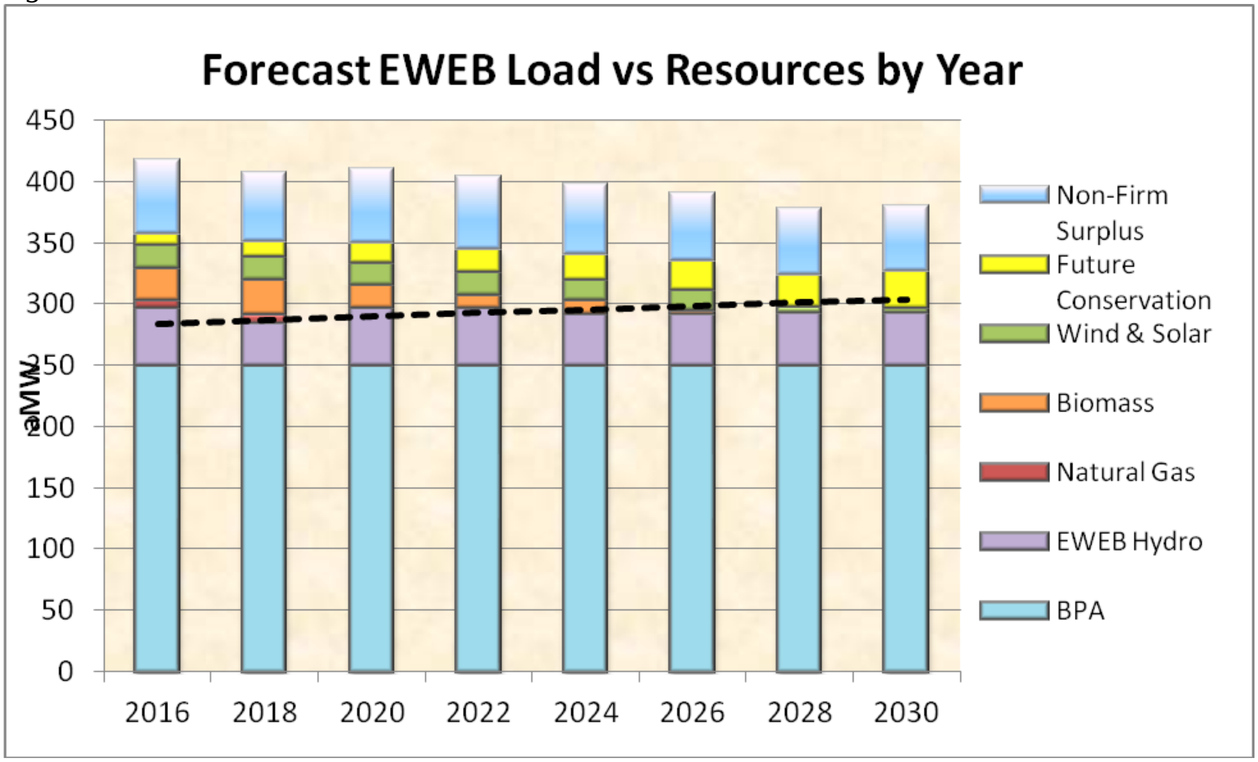


EWEB Load Resource Balance

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 5: 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 2014, 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 latest version of this analysis, which demonstrates insufficient resources to serve winter peak loads under 1 in 5 year winter peaks with expected hydro conditions. Summer peaks, while growing, did not arise as an area of concern for peak supply availability.

Figure 6: Peak Supply and Demand Under Median and Extreme Winter Peak Conditions

Condition	Duration	Load	Supply Carmen	Supply Slice	Supply Other	Supply Total	Adequacy shortfall or surplus (aMW)	Calculated Reserve Margin (Should be ≥ 0)
Average December Load with Firm Supply	1 mo aMW	357	16.6	140	199	355	-2	0%
Average December Energy Load with Expected Supply	1 mo aMW	357	28.7	158	216	403	46	13%
1 in 5 Winter Peak with Average Hydro	**1-Hour**	**503**	**91**	**204**	**205**	**500**	**-3**	**-1%**
	18- Hour	**476**	**58**	**190**	**205**	**453**	**-23**	**-5%**
	72-Hour	**423**	**24**	**152**	**200**	**376**	**-47**	**-11%**
Average August Load with Firm Supply	1 mo aMW	255	13.7	118	163	294	39	15%
Average August Energy Load	1 mo aMW	255	17.0	135	186	338	83	32%
1 in 5 Summer Peak with Average Hydro	**1-Hour**	**361**	**72**	**191**	**166**	**418**	**57**	**16%**
	18- Hour	**354**	**36**	**179**	**166**	**370**	**16**	**5%**
	72-Hour	**297**	**17**	**155**	**162**	**322**	**25**	**8%**

Early this year, the RMC approved the methodology that will soon be incorporated into EWEB's risk management procedures. Recommendations included adoption of a peak adequacy threshold and methodology for evaluating it, an expectation for engagement in regional reliability planning and market watch, as well as the expectation that this reliability threshold will be incorporated into long term resource planning decisions going forward. Further analysis will be required to evaluate the trading floor methodology for establishing adequacy and the incorporation of a long term firm energy surplus cap to ensure energy adequacy and balance in the future. EWEB will also continue to participate in regional resource planning to gain knowledge on best practices and alternative analytical approaches. How to balance peak supply and demand under numerous times scales and hydro conditions will be more directly incorporated into power planning decisions from here forward.