



DATE: May 25, 2015

TO: Mayor Balducci and City Councilmembers

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City Manager's Office
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SUBJECT: Independent Technical Analysis May 4th questions and answers

This memorandum provides written responses to questions raised during the May 4, 2015 Study Session where Council considered the Independent Technical Analysis (ITA) of Energize Eastside project provided by Utilities Systems Efficiencies, Inc.

Responses are provided to questions raised by Councilmembers and from community stakeholders. All questions have been sorted under one of the three report objectives of **need** for Bellevue, **reliability** for Bellevue, and [effect of] **regional** grid flows. Some of the questions address similar topics, so subtopic areas (e.g. forecast methodology, Demand Side Resources (DSR) and conservation) were created to group similar questions.

Responses to each question also note whether the answer is: 1) in the ITA; 2) appropriate for study in the EIS; or 3) outside of the scope of the report requiring additional analysis and funding. Where appropriate, explanatory text was added.

Other tools are also available to Council regarding the ITA. These include Council questions answered in the ITA briefings and the stakeholder questions and answers which were included by topic in the applicable ITA section itself.

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- 26. The transmission line will pass through many residential neighborhoods along its 18-mile route. Residents are concerned about the impact this will have on their neighborhoods, and wonder if they are bearing an unequal share of this burden. Can you tell me what percentage of the growth in electricity demand is coming from these neighborhoods? [This is important because the City’s land use code requires an alternatives analysis that would put new lines in the areas they are primarily designed to serve, so we need to understand this in order to have a proper alternatives analysis performed.] (Council).....13
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Need for the project to address growth in Bellevue

1. How was the forecasting methodology validated? (Council)

PSE forecasts electric demand with a methodology based on an economic and demographic model developed by Dick Conway¹ for the region. Such “econometric” forecasting models are commonly used by both investor- and municipally-owned electric utilities. The key feature of such models is that they allow for a mathematical analysis of the relationships between data inputs driving the growth and the “thing” being forecasted, to account for the variability inherent in these relationships. It is a given that there is both variability in the analysis and in the outcomes: A good forecast needs a sound methodology and expert judgement.

The analysis is called regression analysis and the equations used in PSE’s load forecast are documented in the 2013 IRP at Appendix H. This appendix details the equations and input sources to the regression analysis which produces the peak load growth rate. These inputs are sourced from population, jobs, and PSE data such as customer counts and historical peak load growth.

“Forecasters have various opinions about the elasticity of the relationship between electric consumption and economic growth. Some believe the two move in parallel; some believe that electric consumption will outpace growth rates, and some believe that the relationship between the two has been ‘decoupled’ in light of conservation efforts and an altered industrial base has been permanently changed.” (Rand—A Short Guide to Electric Utility Load Forecasting)

Because there is variability in the relationship between econometric inputs to growth and their influence on electric demand, and because forecasters have a range of opinion about the elasticity of the relationship between electric consumption, demand and economic growth, the city hired USE—an industry expert—to analyze PSE’s forecast and its methodology. The city did this to confirm that the **need** for Bellevue, the effect on **reliability** and the impact of **regional** demand were all held to a standard common for this type of load forecast.

Reference in the Independent Technical Analysis Report

- 5.1 Simplified Description of the Forecasting Procedure pp. 11-14
- 6.5 PSE’s Forecast pp 31-34 (and 2013 IRP - Appendix H)
- Q31 p. 39 Stakeholder Q&A

¹ Dick Conway has been an economist and forecaster for business and government since 1981, when he founded Dick Conway & Associates (B.S. in engineering-Stanford University; M.B.A. in business economics-UW; and a Ph.D.--University of Pennsylvania in regional economics.) He has developed a national reputation for his research on regional forecasting methods, having written more than twenty articles in economic journals and books.

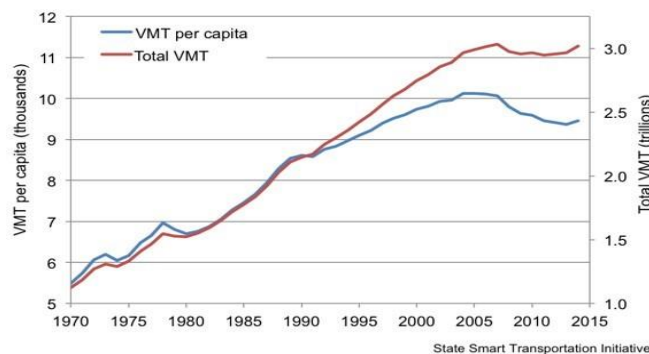
2. How was the 2.4% peak load demand forecast calculated? (Council)

PSE used reasonable methods to develop the 2014 peak load forecast by following industry practice. It shows a 2.4% average annual rate of growth in electrical demand for the Eastside area from 2014-2024, and a 2.5% growth between 2014 and 2031. This demand is projected to grow significantly faster in the Eastside portion of PSE’s service area rather than in King County as a whole, which is in line with the Vision 2040 Regional Growth Strategy report.

The city asked USE to validate the methodology underlying these changes. In the ITA, USE concluded that the methodology was appropriately applied (see the Executive Summary) to determine the forecast, and thus the need. USE then went further, and independently tested PSE’s assumptions. The ITA affirmed that the 2.4% average annual growth in peak load demand was predicated on the same basis that predicts growth in the Puget Sound region—and specifically Bellevue and the Eastside. The 2.4% rate is already moderated by the influence of Demand Side Resources (conservation investments), and is a reasonable forecast based on industry standards and based on the same econometric modeling that PSRC uses to forecast growth rates that we rely on as a city.

The ITA affirmed PSE’s documentation of electric demand outpacing population and employment growth because this growth is much higher in the concentrated service areas of the Eastside and Bellevue. Projected peak demand grows faster than population and employment growth due to the compounding effect of a growing customer base with a growing peak demand usage. The chart below illustrates this effect by showing that in a growing area, vehicle miles driven per person can flatten (due to increased fuel efficiencies, increased transit) while overall miles driven continue to rise—simply because more people driving. So, more electric customers using commensurately more things, even if those things are energy efficient, will result in demand increasing faster than its base.

Miles Driven (in Red) and Miles Driven Per Person (in Blue)



Reference in the Independent Technical Analysis Report

- Section 6.6 and Figures 6.18 and 6.19
- Q31 p. 39 Stakeholder Q&A

3. Citizens are confused by the fact that electricity demand on the Eastside is growing at twice the rate that Seattle is expecting on the other side of Lake Washington. There are a lot of skyscrapers going up around Lake Union. Why is the difference in growth rates

so large? Can you explain how electricity demand is projected to grow at 2½ times the rate of population growth on the Eastside? (Council)

The city confirmed the PSE assumption that peak demand would outpace growth by comparing PSE's forecast to Seattle City Light's load forecast. The city looked at the growth in the specific service areas of each utility driving the demand by comparing similarities in population and employment growth through targets, then accounted for the difference in the base demand of each area before concluding that each utility had *comparably* forecast demand from these growing metropolitan centers.

PSE's 2.4% peak load demand forecast (representing 18.2 megawatts on average each year) and SCL's 1.2% (representing 16.2 megawatts on average each year) was based on comparable growth assumptions and produced similar demand because of SCL's much larger existing load base. For example, ten units added to 100 units is a 10% increase. Ten units added to 50 units is a 20% increase. It's the same units (growth in demand) being added to different bases. A reasonable conclusion then is these utilities' forecasts similarly measure the effect of growth on electrical demand.

Reference in the Independent Technical Analysis Report

- Section 6.6 and Figures 6.18 and 6.19
- Q31 p. 39 Stakeholder Q&A

4. What did the Independent Technical Analysis conclude? (Council)

The ITA tested PSE assumptions about *peak* load demand (2.4%) outpacing general growth by modeling cases where 1) historical use influenced peak load demand (2.2%); and 2) by reducing peak load demand to a level comparable to population and employment growth (1.5%). In each case, sensitivities modeling Federal standards for adequacy and reliability showed that the existing grid's capacity to reliably deliver that power would be compromised by the winter of 2017-2018. The ITA affirmed that even a 2.2% rate derived from the influence of 2010-2017 actual historical data only moves the need timeline about six months along.

Even at 1.5% demand the grid fails to reliably deliver the power in time to avoid deliberate and unintentional outages. The ITA modeled this level because PSE can't take the risk that infrastructure is not in place when load demands it.

Under all of the modeling cases, peak load demand exceeds the point on the line where the grid (system) has capacity to meet it, first at overload (load shedding) and second at power loss (customer) points. There is variability in the peak demand as inputs to the forecast are adjusted. Because the need is being driven by the service areas' strong growth, delaying the project does not outpace pressure pushing up on demand from area growth.

Reference in the Independent Technical Analysis Report

- ITA Executive Summary pp. 1-6

5. USE did not explain how population and employment trends lead to PSE’s projections of demand growth. (Stakeholder)

PSE did a specific Eastside area forecast for 2014 which showed significant difference between growth on the Eastside compared to PSE’s loads in all of King County and compared to PSE’s system as a whole. The 2014 Load forecast drilled down into subareas, noting growth trends in the PSE System and King County (areas absent Seattle and Eastside) areas but noting that the Eastside is where load projections increased.

Reference in the Independent Technical Analysis Report

- 6.5 PSE’s Forecast pp 31-32

6. Demonstrate where USE got its numbers – was information gathered independently from PSE or solely based on PSE’s numbers. How does that influence conclusions? (Stakeholder)

The region’s growth forecasts are developed by the Puget Sound Regional Council. PSRC develops policies and makes decisions about transportation planning, economic development, and growth management throughout the four-county Seattle metropolitan area. It develops forecast products for use by cities, towns, counties, transit agencies, port districts, Native American tribes, and state agencies to address regional issues. As such, it was the logical source for PSE when the utility examined regional growth in relation to Energize Eastside.

Reference in the Independent Technical Analysis Report

- Executive Summary pp. 1-6

- 7. Are the [DSR elements] put into the assumptions on conservation? (Council)**
- 8. I understand that 56 MW of energy savings was found by PSE’s contractor E3. I don’t see any mention of these savings in [the] report. Is there a problem with E3’s methodology? (Council)**
- 9. Individual families are seeing their electricity use falling as they buy LED lights and more efficient appliances and computing devices. Is PSE properly accounting for these energy efficiency trends? How did you verify this part of PSE’s forecast? (Council)**

PSE incorporated an appropriate set of assumptions around conservation and energy efficiency, based on extensive data sets analyzed for PSE by an independent company (Cadmus). PSE’s assumptions reflected an appropriately robust set of Demand Side Resource measures. This “end-use” data is evaluated in the Integrated Resource Plan (IRP), where a utility examines both supply-side and demand-side options with the objective of providing reliable and least-cost electric service to its customers while addressing applicable environmental, conservation and renewable energy requirements.

The cumulative impacts of DSR and conservation are then brought back from IRP and used as end-data to calculate the normalized peak load demand forecast. The ITA concludes PSE conducted this appropriately. Conservation and DSR slow down the rate of peak load demand. It does not eliminate the need for additional capacity to address the projected peak demand because there isn’t enough of it. In comparison, a percentage of people driving

electric cars slows down increases in per capita VMT but there aren't enough of them to address total VMT.

The funded city streetlight conversion program would reduce the impact on Eastside demand from 0.44% to 0.12%.

LED programs were not specifically identified in the 2013 IRP; they'll be a component of the 2015 IRP. While helping a great deal with consumption, like streetlights, they will not impact peak load demand.

Reference in the Independent Technical Analysis Report

- LED/streetlights in Stakeholder Q2-Q4 p. 25
- End-Use Data, p. 13, pp. 24-27, p. 53

10. The ITA cites 39 projects in downtown Bellevue and the Bel-Red corridor that will increase electricity demand. Are there big projects in other Eastside cities that are producing corresponding increases? What are these projects and can you provide a list of these? (Council)

PSE acquires data on major load additions from cities as well as directly from developers; some of this data is considered confidential and was not shared. PSE did provide a list of over fifty Eastside Block Load projects (unnamed) with estimated MW load and the expected year when the load would be fully realized. The project list for Bellevue was provided as an illustrative list showing the types of projects that produce block loads that are anticipated in the forecast.

Reference in the Independent Technical Analysis Report

- Major Loads pp. 27-30

Project needed to address grid reliability on the Eastside

11. Is the Project needed to address the reliability of the electric grid on the Eastside? (Council)

The Executive Summary reviews this on p. 6 and the details of the analysis of PSE's conclusion that grid reliability will be compromised unless the project is built as timed are in Chapter 7.

Councilmembers inquired as to how the ITA addresses reliability and how the project is linked to the Electrical Reliability Study (ERS). The project is referenced in the ERS implementation matrix under Future System 3: Major Project Planning on pp. 6-7.

Reference in the Independent Technical Analysis Report

- Reliability Standards Applicable to Energize Eastside p. 6 and pp. 42-47

12. Can we be provided with peak loads for individual substations? This data is needed to understand the need for Energize Eastside and come up with viable alternatives for the EIS (Council)

Details on the modeling are not provided due to Critical Energy Infrastructure Information (CEII) restrictions.

Reference in the Independent Technical Analysis Report

- Appendix B OTA pp. 63-68

13. It would be helpful to have a more accurate and up-to-date version of PSE's map of electricity demand on the Eastside. Can this be prepared? (Council)

14. Useful to know where the growth is coming from; can you update the [heat] demand map on a micro scale? (Stakeholder)

15. How can we develop that information? (Stakeholder)

This cannot be answered without additional scope and funding. One can obtain usage (kWh) data at a detailed level, but that doesn't show the peak demand which drives the project need (the analogy of the odometer and speedometer described in Energy versus Demand on p. 9).

USE attempted to make a replacement heat map, and created a map of substation peak demand, using spatial interpolation between the substations, but the accuracy wasn't sufficient for the granularity of detail that is desired. Because substations aren't necessarily located right where the heaviest load is USE didn't feel the result gave a sufficiently clear representation of the area load and so did not include it. (Stakeholder Q19 answer p. 37)

16. PSE ran most of their power flow simulations with all local generation turned off. My understanding is that most of this generation was built so PSE could cover its peak load on a very cold day. Can you explain why it makes sense to nullify that resource in these studies? (Council)

17. Apparently, PSE was criticized by one of its own contractors for this decision to zero out local generation, so PSE did one study with local generation turned on, and

overloads were significantly reduced. Was this study this study used as the basis of the analysis, or was the power flow simulation run independently? (Council)

As part of the reliability requirements set forth by NERC, utilities must model reasonable scenarios that occur operationally including various generation dispatch scenarios. Those scenarios include turning on or off various generators, often referred to as the high or low generation scenarios. USE did evaluate various generation scenarios.

USE did study increasing local (or “westside”) generation power flow simulations in the Optional Technical Analysis. Results of the OTA are found in Appendix B on pages 63-68. The need for the project was not eliminated by increasing generation west of the Cascades. Whether or not the addition of local generation or additional conservation could affect the solution for Energize Eastside was beyond the scope of USE’s engagement and may be evaluated through the EIS process.

Reference in the Independent Technical Analysis Report

- Appendix B OTA pp. 63-68

18. With local generation turned on, it appears that the biggest remaining overloads are on lines owned by Seattle City Light. If Seattle were to fix these overloads, how would overloads on PSE’s infrastructure be affected? (Council)

The claim that the biggest remaining overloads are on Seattle City Light lines is not an accurate statement. Essential PSE Eastside facilities remain overloaded.

Reference in the Independent Technical Analysis Report

- Tables B.1-B.3 on p.65-66.

19. Did USE actually run load flow simulations for this report? If so, did you use as a starting point the Base Case database that is posted on the Puget OASIS² website, or did you start with something else? If you started with the OASIS website Base Case, what changes did you need to make in order to match up with PSE’s cases run for Energize Eastside? (Council)

USE ran load flow simulations for the report. USE started with WECC base case scenarios and made the adjustments listed in PSE’s initial needs assessment and additional adjustments as described in the supplemental (2015) Eastside Needs Assessment Report.

Reference in the Independent Technical Analysis Report

- Appendix B OTA pp. 63-68

² PSE’s Open Access Same-Time Information System (OASIS) is a registered portal customers desiring to obtain transmission services from PSE, and to view documents regarding PSE’s rules, procedures and practices relating to the provisioning of transmission service. It does not contain original data.

Need for the project to address regional flows, with Imports/exports to Canada (ColumbiaGrid)

20. Is the Project needed to address regional grid power flows, and specifically power flows on the Northern Intertie (to and from Canada)? (Council)

Councilmembers inquired as to the range of local vs regional need of the project—basically, has PSE proposed a “Big Gulp” or a regular soda? The city commissioned the OTA to essentially “slide the bar” between all local and all regional need. When USE independently modelled these sensitivities, their conclusion was that even without Canada power, the project was still needed to respond to growth in Bellevue and the Eastside.

Reference in the Independent Technical Analysis Report

- p. 6 and pp. 51-53

21. Is there a potential to serve Canada flows on the SCL lines? (Council)

Although the ITA answered this question from a local perspective, power flows on the Northern Intertie could be answered in the EIS.

22. How are the ColumbiaGrid options addressed? Keeping the 115kV wouldn't meet regional need? Is this about flow to Canada? (Council)

Columbia Grid determined that the Energize Eastside project at 230kV is the preferred alternative of all of the options studied because of its dual purpose for regional objectives and local load service.

Reference in the Independent Technical Analysis Report

- p. 6 and pp. 55-57

23. It's interesting that reducing flow to Canada eliminated 4 of the 5 overloads that justify the need for Energize Eastside. From this, it seems like transmission of electricity to Canada is not just a minor side-effect of this project. Can the actual number of megawatts used for Canadian transmission in the ITA power flow simulations be identified? (Council)

24. Could an additional transformer at the Talbot Hill station relieve the overload seen in the case of reduced flow to Canada? (Council)

The OTA studied a scenario with flows to Canada at 1500 MW and a scenario with flows to Canada set to 0 MW. Under the worst contingency condition (N-1-1), the reduction in flow on the Talbot Hill - Lakeside lines was 22.5%. Under the worst contingency condition (again N-1-1); the reduction in flow on the Talbot Hill 230/115 kV transformer was 2.6%. These results are before Energize Eastside and reflect the effects on the current transmission system serving the Energize Eastside area. As is seen from these results, the impact of flows to Canada on the Talbot Hill 230/115 kV transformer (the main driver of the need for Energize Eastside) is not significant.

However, this is not the amount of power flowing through the Eastside system. The power flow models study the entire interconnected system and these are the flows on the system as a whole.

On Page 65, the USE OTA showed the overload that remains is the Talbot Hill 230kV to 115kV transformer. The transformer overloads are the most critical problems for reliably serving Eastside load. Transformer outages are the most severe. Repairing transformer outages can take weeks to months depending on the severity of the problem. NERC rules require that a transformer outage be remediated. Setting the flow to zero is not a realistic scenario and does not meet NERC Reliability Standards.

Reference in the Independent Technical Analysis Report

- OTA Appendix B pp. 63-68

25. When you zeroed out flow to Canada, what was the load on the final transformer as a percentage of its maximum rating? How overloaded was it when you simulated zero flow to Canada *and* local generation turned on? (Council)

As stated in Q9, the indication on Table B-2 is that Talbot Hill #2 transformer overloads when you simulate zero flow to Canada and local generation is turned on. Overload (OL) as defined for Table B-2 is $\geq 100\%$ of emergency limit. The value of that overload is only applicable in determining if regional requirements were driving the need.

As stated in the USE report page 64...although this scenario is not actually possible due to extant treaties, it was modeled to provide data on the drivers for the EE project, to examine if regional requirements might be driving the need. The results showed that in winter 2017/18, even with the Northern Intertie adjusted to zero flow, the Talbot Hill 230/115 kV transformer #2 is still overloaded by several contingencies. This indicates there is a project need at the local level.

Reference in the Independent Technical Analysis Report

- OTA Appendix B pp. 63-68

Other questions for study in the Environmental Impact Statement

- 26. The transmission line will pass through many residential neighborhoods along its 18-mile route. Residents are concerned about the impact this will have on their neighborhoods, and wonder if they are bearing an unequal share of this burden. Can you tell me what percentage of the growth in electricity demand is coming from these neighborhoods? [This is important because the City's land use code requires an alternatives analysis that would put new lines in the areas they are primarily designed to serve, so we need to understand this in order to have a proper alternatives analysis performed.] (Council)**
- 27. Are you aware of a previous Columbia Grid proposal to upgrade Seattle City Light lines to serve Canadian load for a cost of \$16 million? Would that reduce the amount of Canadian flow on PSE's line? Would the reduction be enough to avoid most of PSE's overloads? What about if it were combined with local generation turned on and E3's savings realized? Could we solve our problems with small amounts of additional local generation? (Council)**
- 28. Many residents were intrigued by the announcement of battery storage products from Tesla last Thursday night. Many people would like to see the Eastside leading in innovative and environmental solutions to our energy challenges. Elon Musk mentioned a utility that has already contracted with Tesla for 250 MW of grid storage. How much storage capacity would the Eastside need to defer the need for a transmission line for 10 years? (Council)**

The load forecast by PSE does not forecast load growth by neighborhood. PSE's load forecast is developed for PSE's system, counties within PSE, and the Eastside area.

As stated in the USE report, the need for the Eastside area is a transmission capacity deficiency, which is the lack of 230 kV to 115 kV transformer capacity to the Eastside area. A 230 kV to 115 kV transformer cannot be added without connecting to 230 kV transmission sources, which are located at Sammamish and Talbot Hill 230 kV substations. Transmission lines are primarily designed to transmit power to a load area where distribution lines are primarily designed to transmit that power from the load area to the customer and Transformers are used as the device to interconnect the two systems because they are at different voltage levels. The Energize Eastside project is a transmission project, which is designed to transmit additional capacity to the entire eastside area and not individual customers. The entire Eastside customer base is at risk of outage due to this problem not just the areas that are experiencing extraordinary growth.