Demand Forecast Advisory Committee
Webinar Minutes: January 29, 2014

Trends in Regional Electricity Demands 1995-2012

Facilitator: Massoud Jourabchi, Council Staff; **Participants** list attached.

Massoud Jourabchi called the Webinar to order at 2 p.m. and welcomed the participants. He explained that the topic for the day's presentation and discussion is observed trends in electricity demand in the last 18 years. We'll talk about the reasons for the gap between regional system energy loads and retail sales, Jourabchi explained. He clarified that the load data is measured at the bus bar and sales at customer meters.

Slides 3 to 6: For the region's energy loads, we are hovering around 20,000 average megawatts (MWA) with little growth since 1995, Jourabchi pointed out. The data shows the average annual growth rate is 0.4 percent from 1995 to 2012, he said. We have netted out the effect of the DSIs, he added. The growth has been faster for retail sales, Jourabchi said. When we compare the trajectories, we see that loads are growing at 0.4 percent and retail sales at 0.9 percent, he said. This raises the question, which is correct? But both may be correct, Jourabchi said.

Slides 7 to 10: He proceeded to explain how both loads and sales are measured, describing how Pacific Northwest system energy loads are derived from WECC data. Jourabchi explained how loads for western Montana and Idaho South are determined. We work with data provided by Northwestern Energy and PacifiCorp to get to the loads that are inside the Council's footprint, he said. BPA provides figures for DSI load, Jourabchi said.

He explained how the Council derives retail sales. Utilities report their annual retail sales by customer class to the Department of Energy and we adjust that data to the Council's footprint, Jourabchi said. Northwestern Energy supplies data on its annual retail sales in Montana, which the Council divides into those inside and outside the Council footprint, he said, noting that the accuracy of annual retail sales in general depends on the accuracy and frequency of meter readings.

Slides 11 to 14: Losses are defined as energy loads minus retail sales, Jourabchi explained. From 1995 to 2012, average annual system losses were 2,094 MWA or about 11 percent of load, he said.

A comparison of loads and sales suggests the gap between the two is shrinking over time, Jourabchi said. That's what has been happening over the past 18 years, he said. The losses have been as high as 2,800 MWA and as low as 1,200 MWA, with an average of about 2,100 MWA, Jourabchi pointed out. As a percent of load, the losses have been as high as 14 to 15 percent and as low as 5 to 6 percent, with an average of just over 10 percent, he said.

<u>Possible Reasons for Decline</u>

Slides 15 to 16: Jourabchi listed several possible reasons for the shrinking gap, including issues with the accuracy of measurement and improved efficiency and/or a change in the mix of sales. The system may also be improving in terms of efficiency of generation, transmission, and distribution, he said.

There are a number of factors that can reduce losses, Jourabchi continued. A change in the mix of sector-level sales can affect losses; if there are more industrial sales compared to residential or commercial sales, losses will be lower, he said. A change in the urban/rural mix is another factor since there are higher losses with more line miles, Jourabchi said. A change in temporal characteristics – peak versus off-peak loads – is a possibility, as are increases in purchases from the market, he said.

The change in metering technology could also be a factor, Jourabchi said. New more accurate automated meter readers (AMRs) could cause sales figures to go up without an increase in loads, he said. Conservation could also have an impact since there are zero associated transmission and distribution losses, Jourabchi said. Another possible impact is having generation located closer to load, he explained. There could be more use of geographically closer combustion turbines and renewables compared to more-distant base-load coal and hydro, Jourabchi explained.

Terry Morlan asked if the point is that these trends are causing the change or are they things to consider as a possibility. For the most part, these are factors that would tend toward reducing losses, Jourabchi responded. Morlan pointed out that residential load is growing faster than commercial or industrial. Industrial load went down in the recession, but it is now going back up, Jourabchi responded. With more industrial sales, you would expect fewer losses, he stated.

Your point about conservation reducing losses is not incorrect, but that also applies to all line losses, Ham Nguyen commented. Depending on the sector, the line loss goes up and down, he said.

That's true, Jourabchi agreed. On the industrial side, we have lost a lot of motor loads, he said, adding that new industries are not as motor intensive.

Slide 17: Jourabchi next listed factors that shift retail sales upward without changing system loads. One such factor is the increased use of AMRs, he said. As meters age, the readings aren't as accurate, Jourabchi pointed out. The changeover to an AMR is a one-time shift rather than a continuing trend, he added. Jourabchi also noted that the automated systems may be less susceptible to electricity theft.

Greg Mendonca pointed out that the new meters go in over a period of time. A utility could have a two-year build-out to replace meters; it isn't one big switch, and that could cause the trend you are seeing, he added. Nguyen also said there is quicker shutoff with the new meters. More efficient implementation of a cutoff tends to reduce line losses, he said.

Jourabchi said street lighting could also be a factor. Street lights are not individually metered and changes in street lighting could influence sales but not loads; this could be an area where loads and sales have different trajectories, he said.

Slide 18: An EPRI study showed that the accuracy of electromechanical meters declines as the meters age, Jourabchi reported. We want to know if there is justification for saying that sales but not loads would go up with the changes in metering technology, he said. Is that statement correct? Jourabchi asked. It's a reasonable statement, but we have no empirical study to show that it is true, Nguyen responded.

Slides 19 to 20: Jourabchi went on to present data on the penetration of advanced metering nationally and in the four Northwest states. Idaho has the highest percentage and Washington

has the lowest, he noted. There are opportunities for improving retail sales through more efficient metering, Jourabchi said.

Subsequent to the webinar, Mr. Ham Nguyen added the following comment.
[Slide 15 and 16: ….Your point about conservation reducing losses is not incorrect, but THE REDUCTION also applies to all **LOAD** losses, Ham Nguyen commented. **ALSO** depending on the sector, the line loss goes up and down, he said.]

Slide 21: Another possible explanation for the reduced gap is temporal factors, he continued. A comparison of trends in the peak and off-peak period loads shows the loads are growing at a faster rate in the off-peak period, Jourabchi said. Nguyen said the off-peak will reflect the 24/7 operations of industrial customers. Their share of load is higher off-peak, he said. This suggests the off-peak losses would be less, Jourabchi said.

Slide 22: Since 1995, Pacific Northwest utilities have acquired over 2,700 MWA of conservation, which also helps reduce the losses, Jourabchi said. He went over an example of how conservation reduces line losses. Although the magnitude of reduction in losses is not certain, one can argue that conservation lowers loads more than it does sales, he stated.

Nguyen said the example suggests the same reduction would occur in each year. The safest assumption is that there was a certain percentage of reduction in 1995, when the 18-year period began, but not so much now, he said. You can't make the extrapolation between the two points in time, Nguyen said.

Conservation is happening on the customer side so there are no line losses, Jourabchi said. Is the basic statement true that conservation is helpful? he asked. With the qualification that it is like any other loss, Nguyen said.

Slide 23: Jourabchi went on to explain the possible effect of distributed generation. He used a graph showing the share of various sources of generation between 2002 and 2012. Can the shift from central to distributed generation also lower losses? he asked. In 2002, 9 percent of total generation was conservation, but in 2012, it is more than 16 percent; there is a larger share of resource that has no associated losses, Jourabchi explained. In 2002, there was zero wind generation and in 2012, it was 6 percent, he continued. The hypothesis is that wind resources are more distributed and closer to load centers than hydro or coal, Jourabchi stated.

Much of the wind development is transmitted to the I-5 corridor so it is closer to load than Montana coal, Morlan commented. But wind generation is not necessarily closer than natural gas plants, he added.

Slide 24: The way we use energy has implications, too, Jourabchi continued. He explained how technology changes, i.e., heat pump water heaters (HPWH), can lead to lower usage. The new water heaters put less pressure on peak, which has implications for transmission and distribution losses, Jourabchi said. He explained the lines on the presentation graph: the red and green lines are electric resistance water heaters and the blue line is the HPWH. The point is that there have been changes in consumer behavior and technology, Jourabchi added.

Nguyen pointed out that the switch to natural gas water heating has really helped with losses. Grant Forsyth agreed the switch has had a big effect. We can expect much less contribution to load from water heaters in the future, Jourabchi concurred.

Subsequent to the webinar, Mr. Ham Nguyen added the following comment.
[Slide 24: …the switch to natural gas SPACE AND water heating has helped REDUCING losses.]

Slide 25: The bottom-line is we are doing more with more efficiency, Jourabchi said. In looking at the energy productivity index, which measures 2005$ GSP/MMBTU of total energy consumption, we are doing 60 percent more in 2011 compared to 1997, he said.

You are comparing a physical measurement to something theoretical, Nguyen said. He said the energy productivity index varies depending on changes in the economy. I see what you mean about efficiency, but this is not a good reflection, Nguyen said. If the point is to say we have become more efficient, maybe or maybe not; but this graph doesn't tell me that story, he stated.

A more accurate statement about the graph is that it reflects the energy intensity of the economy, Morlan said. Nguyen agreed.

In our service area, what you are seeing post the big recession is that most economic activity is in the metropolitan areas, Forsyth said. The rate of economic growth is greatest in the urban not the rural areas, he said.

Subsequent to the webinar, Mr. Ham Nguyen added the following comment.
[Slide 25: … You are comparing a physical measurement (ENERGY) to A MONETARY (or VIRTUAL) UNIT OF MEASUREMENT, Nguyen said. He said the energy productivity index varies depending on changes in the economy. I see what you mean about efficiency, but this is not a good MEASUREMENT, Nguyen said. If the point is to say we have become more efficient, maybe or maybe not; but this graph doesn't tell me that story, he stated. A NUMBER OF FACTORS HAVE OCCURRED OVER THE PERIOD THAT WOULD HAVE BROUGHT THE GDP TO ENERGY RATIO DOWN THAT HAD NOTHING TO DO WITH ENERGY EFFICIENCY INCLUDING INCREASING SERVICES SHARE OF THE ECONOMY, OFF-SHORING OF MANUFACTURING ACTIVITIES…]

Slide 26: Jourabchi recapped the list of factors impacting transmission and distribution losses, divided into two categories: factors increasing losses and factors reducing losses. Factors increasing losses include: increase in sales far from generation; increase in transmission line loading; and increase in extreme temperatures. Factors that reduce loss include: conservation; investments in transmission and distribution efficiency; more accurate meter reading; reduced theft; larger industrial sales; distributed generation; greater reliance on the market; peak-load reduction programs; reduced VAR requirements due to reduced industrial motor load.

With regard to the larger industrial sales, Nguyen pointed out that a data center may not take voltage at transmission levels. It is not like the pulp and paper load, he said. Jourabchi said he was thinking of the large data centers, and Nguyen said even they do not take power at transmission level voltage. We do, however, have changes in the industrial mix, Jourabchi said.

More firms are switching to more efficient equipment, Forsyth stated. Companies are also going after "parasitic load" and trying to reduce it, he added. I agree with that, Nguyen said. If a customer is running all compressors, you have low VAR compared to a customer who has load with variable VAR, he said.

Mendonca reported on a PNGC Power customer survey. We talked to our co-op members who have installed automated metering infrastructure (AMI) on their systems, he said. Because of the available funding, the installations were typically a full build-out of the system, Mendonca said. They reported a 1.5 to 2 percent instant decrease in losses, he stated. That has been a measurable experience from four of our members, Mendonca said. The co-ops have widely distributed systems with a low number of customers per line mile, he said. Automated meter installation caused an instant savings on losses, Mendonca reported.

That shows there are still lots of opportunities for demonstrating that sales can go up without loads going up, Jourabchi commented.

Slide 27: Jourabchi moved on to a summary slide: reported information indicates sales are growing faster than loads; we do not have a quantitative assessment of why this may be happening; qualitative assessment suggests losses have not been constant and there are reasons for the decline in losses; mix of sales and loads have changed over time; we have moved from great reliance on distant central plants to distributed generation, and losses seem to have gone down; and sales and loads are growing slower mainly due to regional investments in efficiency.

I think what we are seeing could be due to a shift or loss in load, Jourabchi said. We don't have a good assessment of why but the overall direction seems to be reasonable: sales are growing at a faster rate than loads in part due to investment in efficiency, he stated.

Nguyen said PGE uses the term "energy at meter" for what the presentation refers to as loads. WECC calls it net energy for load, he said. You are seeing changes in energy at the meter versus energy at the bus bar, Nguyen said. He suggested there are a lot of factors involved, including an improvement in line losses, and he suggested using a more neutral statement than attributing the change to one particular factor, i.e., conservation.

As a region, we have more effect from efficiency, Jourabchi said. Yes, but let's say we got a more efficient large industrial customer, it could have the same effect, Nguyen responded.

Forsyth said the effect of the meter switch-outs and its impact on losses is interesting. Could we do a study and find out more about the primary drivers? he suggested. This is due to more than one thing, but some factors will have more impact than others, Forsyth said.

Charlie Black explained that the genesis of the Webinar topic was a presentation to the Council's Power Committee on what is happening with load. Massoud has helped explain the discrepancy between load and sales and the contributing factors, he said. To get quantification, perhaps the PNUCC System Planning Committee could dig into it, Black suggested. You folks are closer to the customer and the physical system than we are and you would have more access to what is going on, he said. Maybe we could get a group going at PNUCC; it would be useful to get industry folks together to talk about which factors they are seeing on the system and the magnitude of them, Black said.

Tomás Morrissey said he would discuss the idea with Dick Adams. This is an issue a lot of people have questions about, he added.

It's difficult to make policy recommendations before you have an assessment of what factor is having the biggest impact, Forsyth said.

Next Steps

Jourabchi said the updated slides from the presentation are on the Demand Forecast Advisory Committee website. The next step is to see if we can get help from the System Planning Committee at PNUCC, he said. We have done a qualitative assessment and now we would like a quantitative assessment, Jourabchi said.

Nguyen reiterated his request that the wording regarding the reason for the losses be more impartial.

Jourabchi said the minutes of the meeting would be circulated and he would invite additional comments. At our next meeting, we will talk about the forecast for the Seventh Power Plan, he added.

The Webinar adjourned at 3:10 p.m.

Demand Forecast Advisory Committee
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Webinar, January 29, 2014

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