

## 2015 PNUCC Load Forecasting Workshop – Lessons Learned



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On July 22, 2015, PNUCC held a day long workshop focused on load forecasting in the Northwest. The workshop was attended by experts from 15 different utilities and organizations who shared their insights.

During the workshop the main focus was on how and why load forecasts, and forecasting methods, are changing. The workshop was geared towards discussion, with forecasters leading off specific topics with short presentations. This document compiles the lessons learned from the workshop and possible next steps.

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### Key workshop findings

Below are the key findings from the workshop. The remainder of the document dives into each finding.

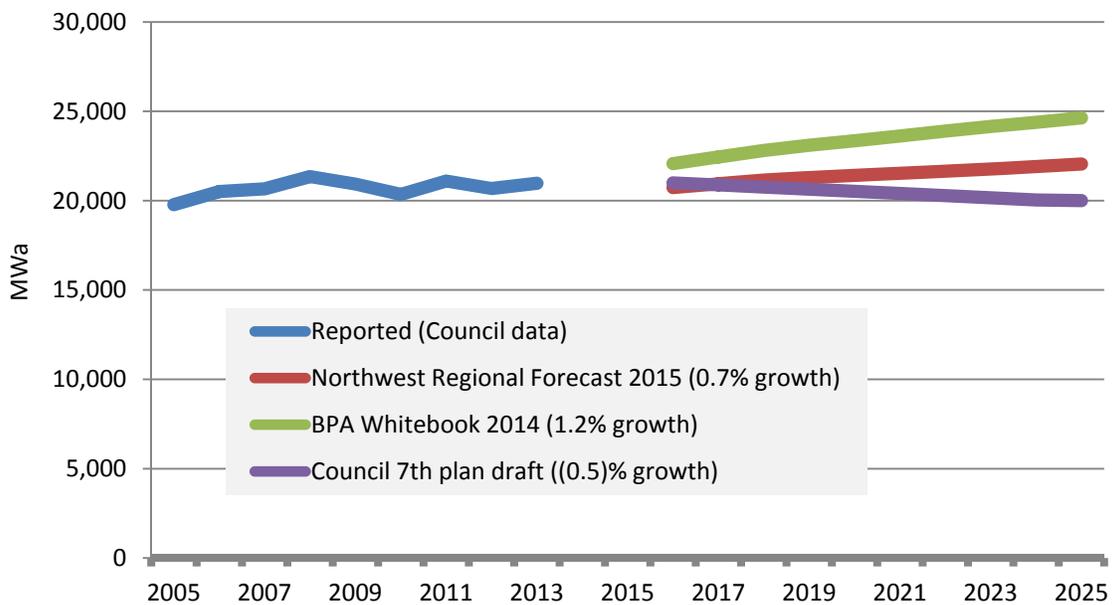
- Electric load growth has been slow/flat for most utilities since the 2008 recession
- Historical load growth indicators may be losing their accuracy
- Natural gas heat continues to dominate new residential builds
- Demographics can play a large role in electricity usage
- Higher summer peaks coming to the Northwest
- Potential new loads hard to predict

**Load growth has been slow/flat for most utilities since the recession**

Each year PNUCC compiles the *Northwest Regional Forecast*, an aggregation of Northwest utility loads and resources. As the economy came out of the 2008 recession many utilities had strong growth predictions. In 2009 the *Forecast* projected 1.6% annual energy load growth for five years. Today, the 2015 *Forecast* five year annual energy load forecast is half that – 0.8%. Looking back from 2008 to 2013, the region as a whole has seen relatively flat loads.

The chart below shows reported Northwest energy loads in blue, and three different forecasts going forward. Annual growth values for each forecast are shown in the legend. These forecasts show a relatively wide range of potential load growth futures for the Northwest. The general sentiment in the Workshop was that load growth has slowed since the 2008 recession and future growth expectations are low.

**Figure 1 – Reported and forecasted Northwest energy load**



These forecasts are for the Northwest as a whole. A few utilities, particularly those with incoming data centers and other industry, are seeing rapid load growth. On the other hand, some utilities are forecasting negative load growth. Potential new Northwest electric loads are discussed later in this document (page eight).

**Historical load growth indicators may be losing their accuracy**

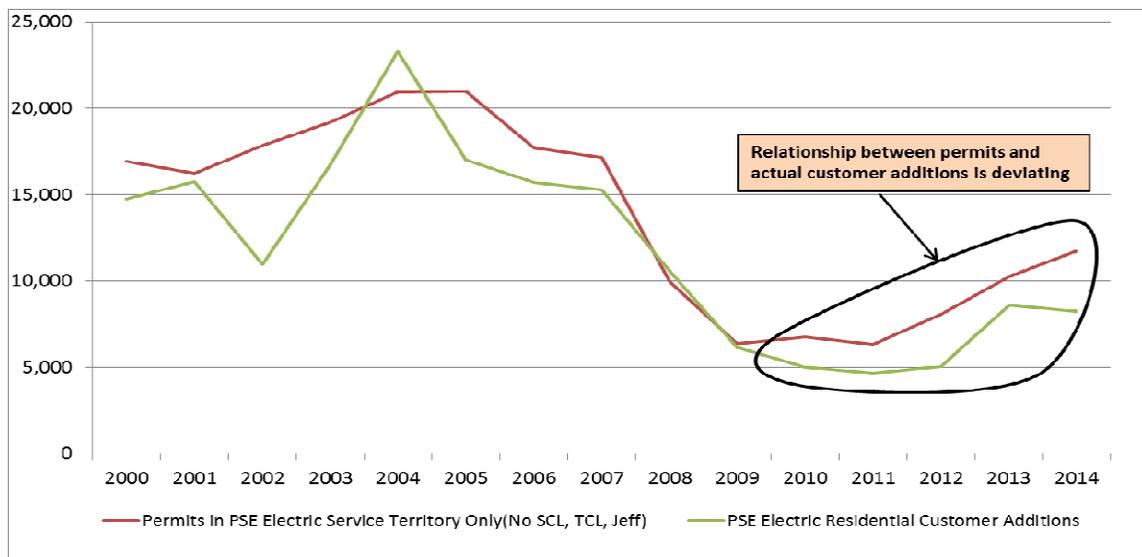
Villamor Gamponia and Phillip Popoff, Puget Sound Energy, gave a general overview of how they forecast loads, with a focus on future growth indicators. They noted that previous indicators of electric load growth, notably building permits, may not be as useful today.

One challenge with building permits is that they do not always translate into a complete building, and sometimes the new build replaces an existing structure. For example, a developer could acquire a building permit, demolish an existing building, and then build a new building on the site. The net effect on load would depend on the difference in electricity usage between the old and new building, and could potentially be zero or negative.

Workshop participants recommended looking into other permit data to augment or replace the building permit data. Other permit data include finished building permits and demolition data. This could help load forecasters better determine if the new building was complete, and if so, if it took the place of an existing building. These data are sometimes publically available and are also available via paid subscriptions.

The figure below shows how the relationship between building permits and customer additions can differ – in recent years permits issued have outpaced customer additions.

**Figure 2 – Building permits may no longer accurately predict load growth**



The issue of price elasticity of demand with residential customers was raised as well. Many participants noted that the elasticity is usually quite small – consumers are somewhat insensitive to changes in the price of electricity. A few participants mentioned that they do include price elasticities in their forecasting models and include a lag time. The lag represents consumers not reacting to higher rates until they have paid a higher bill.

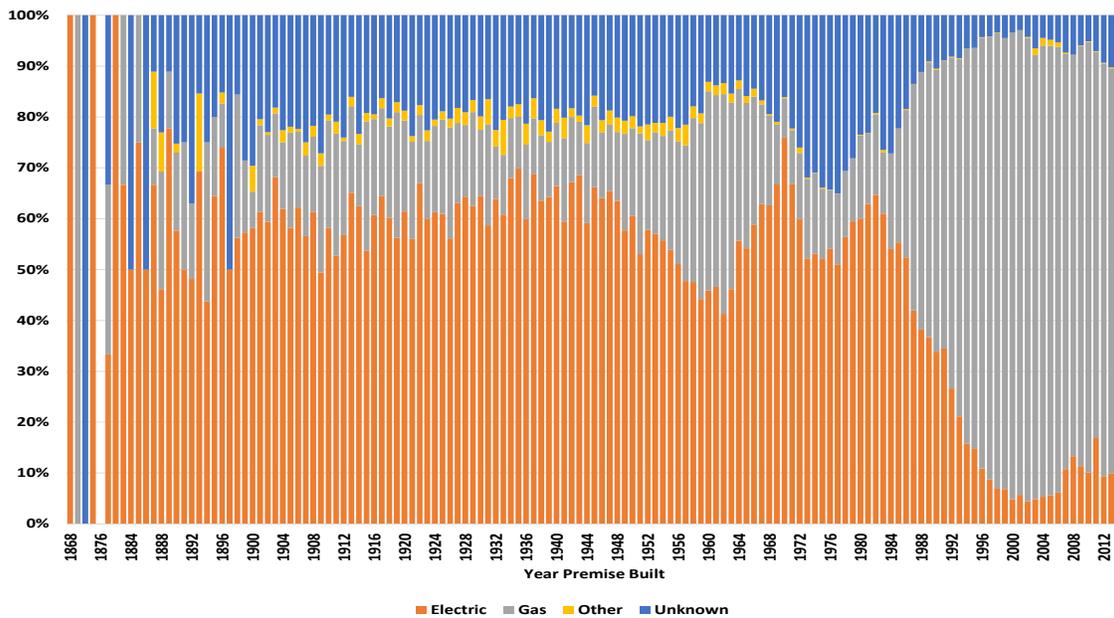
### Natural gas heat continues to dominate new residential builds

Joining the group from Snohomish PUD to discuss changes to building stock was Erin Boyd. She said that for Snohomish load growth has been flat since the recession. This is somewhat at odds with historical load growth predictors as they are also seeing a growing population and a recovering economy. She also noted that since the 2008 recession housing supply has not kept up with demand in Snohomish’s service territory.

Looking deeper into the housing stock, most homes built after the mid 1980s have natural gas heat, a trend that continues with new builds today. Many older homes have converted from electric to gas heat as well. Exceptions to that trend are apartments and manufactured homes which still predominantly use electric heat.

The chart below shows a snapshot of the existing single family home building stock, the year it was built, and the type of heat it has. Note that the chart shows existing heaters, not the heat source when built. For example a home that uses natural gas heat but was built in 1900 was likely a conversion.

**Figure 3 – Natural gas heating highly prevalent in new homes**



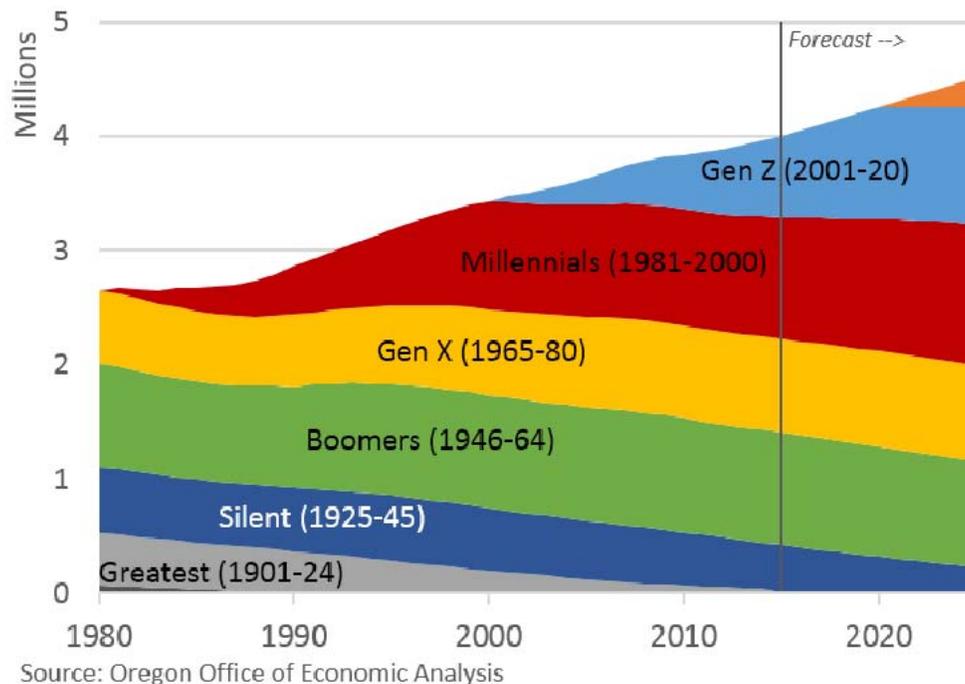
Beyond the switch to gas heating, all new homes, regardless of heating type, use energy more efficiently than older homes. Per square foot, the average residence built in the 1970’s consumes over twice the energy of a residence built in 2010. Total energy use is lower for new homes as well even though new homes are typically larger in square footage. Going forward, it will be important for load forecasters to continue to track home heating trends.

## Demographics can play a large role in electricity usage

Kirstin Munro, PacifiCorp, discussed the importance of considering demographics when forecasting loads. Around 30% of energy usage can be explained by the user, not the appliances/building stock, she noted. However, most research done by load forecasters has focused on what appliances are in the home, not how people use them. As our population changes it could behoove the region to learn more about how demographics impact energy use.

There are a number of ongoing changes to demographics in the Northwest. The population as a whole is aging, and there are new generations becoming heads of household. How a Baby Boomer and a Millennial interacts with a water heater or dishwasher may differ, which could affect peak and average energy use.

**Figure 4 – Oregon population and generations**



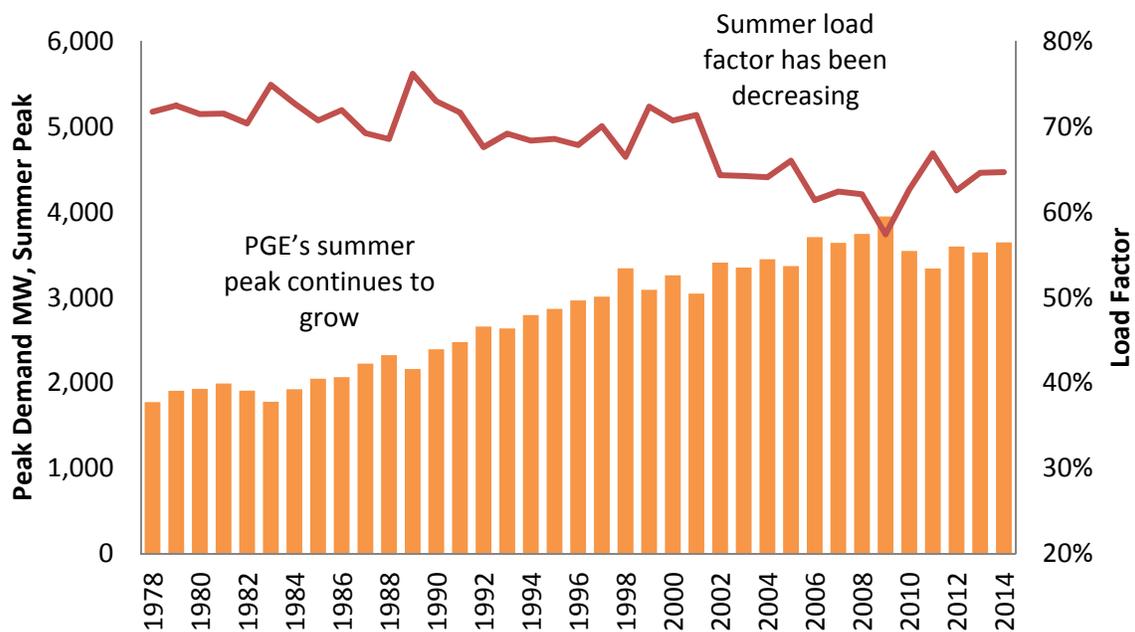
Beyond age, the Northwest, particularly the metro areas, are seeing population growth. New residents may interact with appliances differently, particularly heating and cooling appliances. For example, someone moving from Phoenix to Portland might be accustomed to always having an air conditioning unit, and may use AC more often (or purchase an AC unit) as compared to a native Northwest resident. The new resident may use heat in the winter differently as well.

Demographics could potentially impact both peak hour and annual average energy usage. It could be useful for utilities and regional planners to better understand how demographics impact loads.

### Higher summer peaks coming to the Northwest

Sarah Dameon from Portland General Electric shared some insights regarding how her utility’s peak season and load profile have changed since the late 1970s. Although PGE has traditionally been a winter peaking utility, they are starting to become a dual peaking utility, and may become summer peaking within the next couple decades. PGE is also seeing a declining summer load factor, indicating a “peakier” summer load profile. Their winter peaks, conversely, are seeing a relatively flat to slightly increasing load factor.

**Figure 5 – Summer peaks growing and becoming gaining prominence**



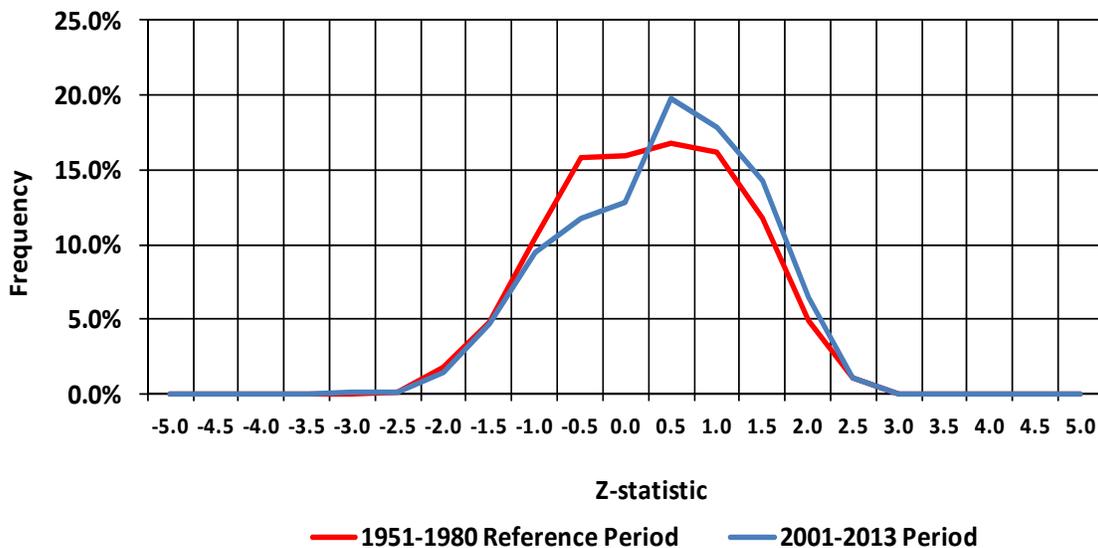
Other workshop participants noted that their summer peaks are also growing faster than their winter peaks. The PNUCC *Northwest Regional Forecast* shows faster summer than winter peak growth as well, although the region as a whole still is winter peaking.

Beyond the growth in summer peaks the time of day for PGE’s winter peak is changing. In the 1970’s the utility tended to peak in the morning. More recently the evening peak has been higher.

Grant Forsyth, Avista, shared insights into his load forecasting model and research on temperature patterns in the Spokane area. He started by discussing his model, which uses historical data from 2004 to present and is largely driven by GDP, among other variables.

Regarding temperatures, Grant noted that there has been a slight, yet statistically significant, shift toward warmer temperatures in Spokane. He also found that the extremes had not shifted as much as he would have anticipated. The figure below demonstrates this shift. Note that while average temperatures have gone up, as shown by the shift to the right in the 2001-2013 period in comparison to the reference period, the tails in the figure are relatively unchanged.

**Figure 6 – Spokane Summer Anomaly Histogram**



Summer peak loads tend to build, Grant said. For example, if a Tuesday, Wednesday, Thursday all have a similar temperature profile of 95 degrees Fahrenheit, the load on Thursday will likely be the highest. This is due to a number of factors, including buildings retaining heat.

Avista has seen declining and flattening peak forecasts for both winter and summer since the recession. Although temperatures are getting warmer, Avista is projected to remain a winter peaking utility for the foreseeable future.

### Potential new loads hard to predict

The day ended with a discussion of new loads in the Northwest, specifically server farms and indoor cannabis farms. Both consume a great deal of electricity, the server farms for climate control and powering the servers, and cannabis farms for lighting and climate control.

Cannabis farms were focused on first, with Erin Boyd teeing up the conversation. Snohomish PUD has seen a large number of permits for indoor cannabis farms in the past year, but the PUD is unsure how many permits will be issued, and how many of those will result in actual farms. Adding to the mystery is the fact that some cannabis operations will not be new, rather, they will simply now be legal. Additionally, cannabis is illegal on the federal level, so there is a chance that a new administration in 2016 could crack down on production, potentially limiting the number of farms that take root. All in all, there is considerable uncertainty about how much electric demand indoor cannabis farms will bring.

A few participants wondered if cannabis farms will move to areas with cheaper power prices, or if they will predominately become outdoor operations (which use less electricity). Massoud Jourabchi, Northwest Power and Conservation Council, noted that for these producers electricity costs are not a large issue, and the quality control of indoor growing is a big advantage.

Another type of farm has been popping up in eastern Oregon and Washington for a few years now, server farms. For server farms power prices are a big issue, and they are largely clustering in service territories that offer low rates. Greg Mendonca, PNGC Power, shared some insights about these high tech customers. He noted that it can be hard to forecast new loads as companies are often secretive about expansion plans. He also mentioned that server farms tend to have a flat load profile.

Overall, it is hard to accurately forecast the future electric demand impact of either cannabis or server farms. The region may have to quickly adapt to new loads coming online (and offline) as these industries continue to evolve.

### Follow up/next steps

During the workshop there was discussion on topics that PNUCC could follow up on. The follow up could occur at a PNUCC System Planning Committee meeting, at an additional load forecasting workshop, or in other forums. Follow up items include:

- Continue to collect data on peak energy use, and keep an eye on rising summer peaks
- Continue discussions on current home heating trends. As electric options become more appealing, such as heat pumps, will the trend toward natural gas heating change?
- Monitor development of new load sources, expressly data centers and cannabis farms
- If the region embarks on a large survey, such as a revision of the ELCAP survey, encourage the inclusion of questions pertaining to customer demographics

Lastly, depending on regional appetite, PNUCC may organize another load forecasting workshop.



PNUCC Load Forecasting Workshop – July 22, 2015  
Attendance List

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**In person:**

Natalie Baerlocher	The Energy Authority
Jeff Kugel	PNGC Power
Greg Mendonca	PNGC Power
Adam Rue	Eugene Water & Electric Board
Ryan Egerdahl	Bonneville Power Administration
Villamor Gamponia	Puget Sound Energy
Sarah Dammen	Portland General Electric
Amber Riter	Portland General Electric
Phillip Popoff	Puget Sound Energy
Shauna McReynolds	PNUCC
Allison Jacobs	Puget Sound Energy
Erin Boyd	Snohomish PUD
Tomás Morrissey	PNUCC
Dave Lenar	NW Natural
Steve Storm	NW Natural
Glen Booth	Bonneville Power Administration
Massoud Jourabchi	Northwest Power & Conservation Council
Ryan Baeken	NW Natural
Tamy Linver	NW Natural
Grant Forsyth	Avista
Kirstin Munro	PacifiCorp

**Via webinar:**

Tom Haymaker	Clark Public Utilities
Sibyl Geiselman	Eugene Water & Electric Board
Ian Bledsoe	Clatskanie PUD