PNUCC

Load forecasting workshop (2.0)

On September 14, 2016, over 20 load forecasting professionals gathered in Portland to discuss trends and issues in their craft. They had an enthusiastic discussion on changing load drivers, forecasting tools and future loads. In many ways, the discussion was similar to last year's workshop. For most Northwest utilities projected load growth is low or flat, save for a few areas potentially seeing the arrival of data centers and new industrial facilities. Many workshop attendees mused that although there is plenty of construction, and a growing economy, loads are not materializing as expected.

The key findings from the meeting are below. Following the key findings are additional details on the workshops six focus areas. The meeting began with introductions and an acknowledgement of the PNUCC Antitrust Compliance Statement. A list of meeting attendees is at the back of this document.

Key findings:

Load growth across the region is tepid

Throughout the meeting a common thread was the lack of load growth. A few causes of falling growth were discussed. Some utilities are seeing declining industrial loads, which if not offset by other sectors, will drag down growth. Many are seeing falling use per customers. For example, metropolitan areas are seeing increases in customer count and construction, yet load growth remains low. This trend of low to flat load growth is causing forecasters to reevaluate what factors drive growth.

**Codes and standards can significantly impact load growth**

Codes and standards have been rolled out at a high pace this past decade, and as they take root it will be important for forecasters to incorporate their impact on loads. Going forward, codes and standards will continue to displace utility energy efficiency programs. This will make incorporating codes and

standards into forecasts increasingly important. Additionally, there could be public perception challenges as more savings come from codes and standards and less from utility sponsored programs.

Summer loads growing faster than winter loads

Another trend across the Northwest is quicker growth in summer peak and energy load as compared to winter. This is largely due to increased levels of air conditioning penetration and more cooling degree days. As a result, utilities that have historically been winter peaking are becoming increasingly concerned with their summer peaks.

Figure 1 – Avista has seen an increase in cooling degree days (and a decrease in heating degree days)

Time Trend of Moving Averages of Different Periods, 1977-2015
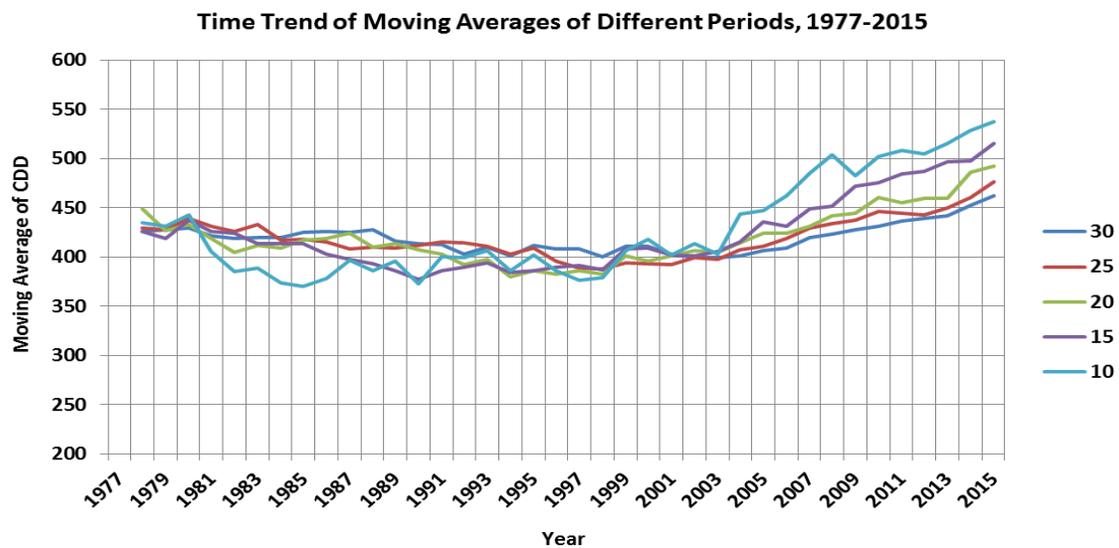
Indoor agriculture loads less than expected, electric vehicles still on the horizon

There has been much curiosity regarding how much load indoor cannabis cultivation could bring to the region following legalization. After a few years of legalization in Oregon and Washington, the answer appears to be, not much. This is in part due to many of the grow operations not being new loads – they have simply become legal.

Although the group envisioned more electric cars in the future, they also mused that the load impact could be minor. While electric cars keep improving, the low price of oil and large distance between Northwest population centers could dampen adoption rates. A few attendees noted that many electric vehicle projections from a few years ago were very robust but did not pan out.

Aligning models to reflect reality

Alison Jacobs led off by discussing Puget's service territory, their most recent load forecast, and their evolving forecasting model. One significant change in their model has been a reweighting of variables. Their new model gives more weight to household population growth and less to building permits. This is due to building permit data being less reliable – sometimes building permits are pulled but do not result in new construction, or replace existing buildings, and do not add new load.

In their most recent forecast loads are flat for 10 years and then trend upwards starting in 2026. This is partly due to Puget assuming they have a 10 year pipeline of energy efficiency that eventually dries up. However, Gurvinder Singh from Puget noted that each year new measures become cost effective. Due to these new measures the 10 year pipeline is constantly being refilled.

Figure 2 – Puget has a flat peak load forecast for the next decade
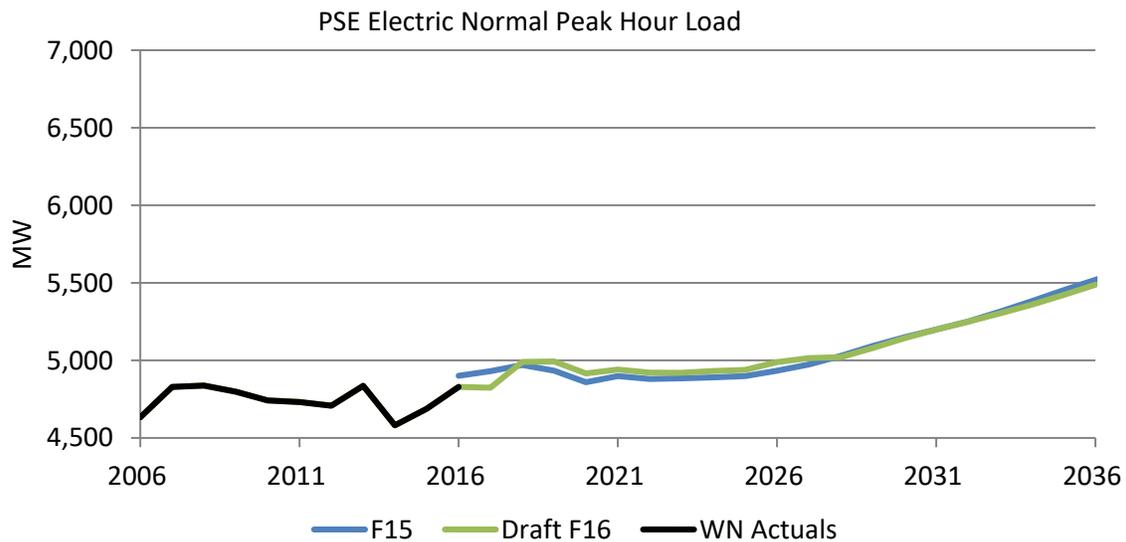
Digging deeper into the forecast most of the projected growth is in the commercial sector. Residential loads are forecasted to decline until 2026 and then start to recover. Industrial loads fall throughout the 20 year planning period.

Alison noted that the flat growth forecast is sometimes met by disbelief. Bellevue and other parts of Puget's service territory are seeing economic and population growth yet load growth is flat. John Rudolph from Seattle commented that they are seeing the same phenomena – there are construction cranes everywhere and new buildings being finished, but loads are not growing in line with forecasts. However, some of the areas that have undergone or are undergoing large commercial development may not be fully energized yet.

Peak load trends and forecasting methods

Amber Ritter from Portland General Electric teed up the discussion on peak load trends and forecasting methods. PGE has experienced an increase in summer peak loads over the past 20 years whereas winter peaks have trended flat-to-declining. Beyond growing in magnitude, summer peaks have a declining load factor, i.e. are becoming "peakier." Winter load factors are flat to slightly increasing. Today, PGE is effectively a dual peaking utility.

The growing summer peaks are mostly due to increased air-conditioning penetration. Amber said that eventually the air-conditioning market will fully saturate and growth may slow. PGE gets their air conditioning data from customer surveys.

Figure 3- Trends in Portland General Electric's peaks
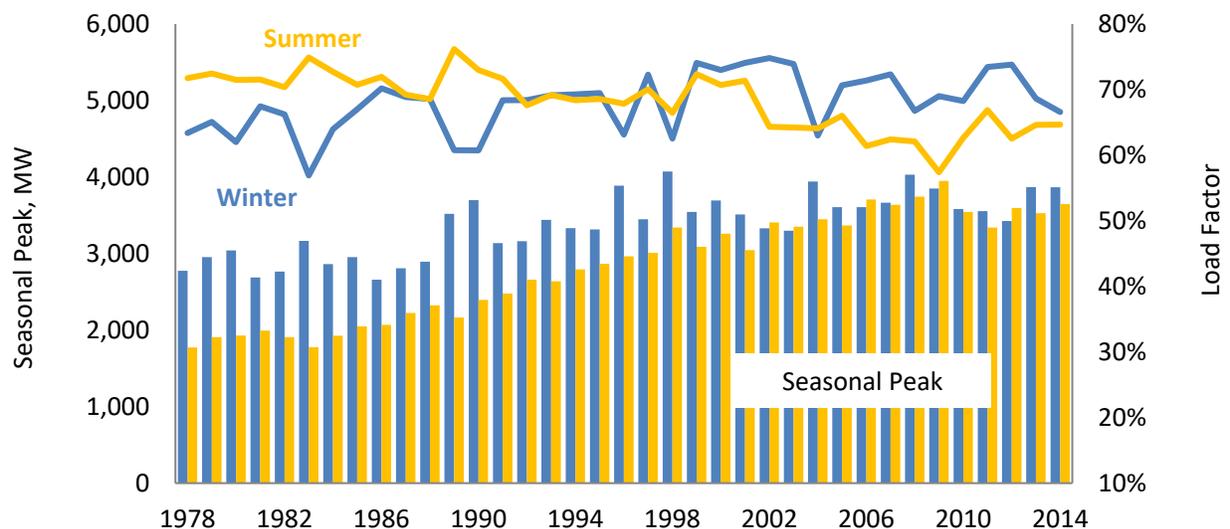
Regarding peak forecasting methodology, Amber referenced an Itron load modeling survey. Around 60% of survey participants used an econometric method. Due to these findings PGE is exploring using an econometric model rather than a load factor model. Regarding variables to use in the model, many workshop participants found that some historically significant predictors, like economic growth, were declining in significance.

Some workshop participants found that switching to an hourly forecast rather than a daily forecast for calculating peak loads improves accuracy. Kevin Harris, ColumbiaGrid, recommended accounting for sequential extreme weather days. Due to buildings and other structures absorbing heat, hot weather days at the end of a heat wave tend to produce higher electric loads than one-off hot weather days.

The impact of codes and standards on loads

Building codes and appliance standards play an increasingly large role in total energy efficiency savings, Massoud Jourabchi, Northwest Power & Conservation Council, told the group. One advantage of codes and standards is that unlike energy efficiency programs they have 100% participation rates. Additionally, the costs are not borne by utilities.

Over the past decade, largely due to federal rulemaking, many new codes and standards have been adopted. However, they can be difficult to capture in load forecasting since they are not utility programs. Shauna pointed out that codes and standards are a growing piece of the energy efficiency pie. Going forward, utility programs may be cannibalized by codes and standards giving the impression that the region is doing less energy efficiency. She stressed the need to discuss how energy efficiency is still a key priority for the Northwest even as the buckets the savings are counted in move around.

Figure 4 – Codes and standards play an important role in regional energy efficiency savings
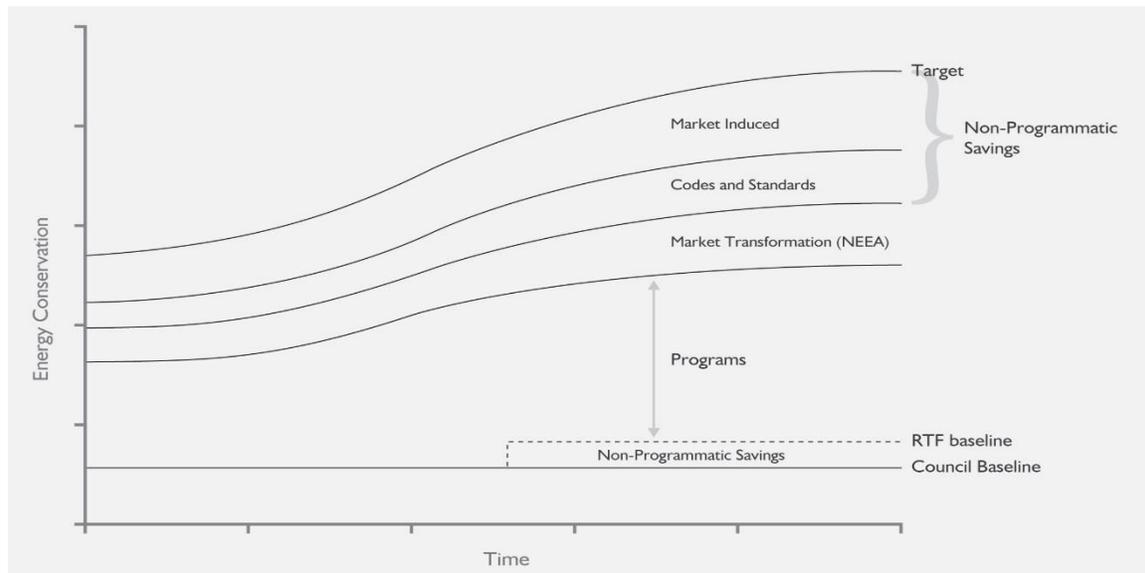
Massoud used refrigerators as an example of codes and standards impact on loads. In 1972 an average household refrigerator used around 2,000 kwh per year and was just under 20 cubic feet in size. Today, the use is under 500 kwh per year even though modern fridges are slightly larger and pack more features.

Regarding data, Massoud offered utilities to use the Council as a resource for estimating the impact of codes and standards in load forecasts. Cam from Tacoma noted that incorporating codes and standards has made their forecasts more accurate, and thanked Massoud and the Council for their work.

Load forecasting research

Phillip Popoff, Puget Sound Energy, kicked off the conversation by highlighting the need for better data to understand how energy efficiency affects load magnitude and shape. Utilities invest millions of dollars a year in energy efficiency programs, but the exact impact of these programs on peak loads and load shapes is foggy.

The Northwest Energy Efficiency Alliance (NEEA) is starting to scope an end use study to help dig into this question. Phillip asked the other participants if they were plugged into this effort. Many members of the group were unaware of the project, and a few were unfamiliar with NEEA. This helped underscore the need for communications between utility energy efficiency and load forecasting departments.

Figure 5 – Communication is important

End use research is expensive. In order to conduct the research homes and commercial spaces have to be specially metered to read electric use from different appliances (HVAC, water heater, etc). The price tag for a study starts at over 10 million dollars. There are new technologies, including non-intrusive load meters, could potentially reduce future study costs.

Many questions were raised about how much data are needed from the study. Data from more appliances and in shorter time intervals could be useful, but more expensive. Puget is creating a scoping document to better outline and understand their needs.

Puget Sound Energy is hoping to collect data specific to their service territory. This could be done within the NEEA process by oversampling, or if needed Puget could conduct an in-house study. With or without NEEA they see a need to have better data to understand how energy efficiency is dampening loads and changing load shapes.

Changing temperatures and data quality

Leading the discussion on changing temperature trends and data quality was Brian Booth, Snohomish PUD. He began with an overview of the Snohomish service territory. Population growth has slowed in recent years, and with the exception of electric heated apartments, most new builds are being heated with natural gas. These factors are depressing load growth projections.

Brian asked the group for input about verify temperature data quality. In the dataset he is working with the coldest and warmest temperatures are clustered, leading Brian to suspect that instrument/reader error could be an issue. Grant Forsyth from Avista noted that he has to adjust his historical data as the thermometer at the weather station he uses was moved in the 1940's causing a change in the readings. Other participants suggested cross-checking the data with other nearby stations, such as SEA-TAC.

Figure 6 – Are the data high quality?
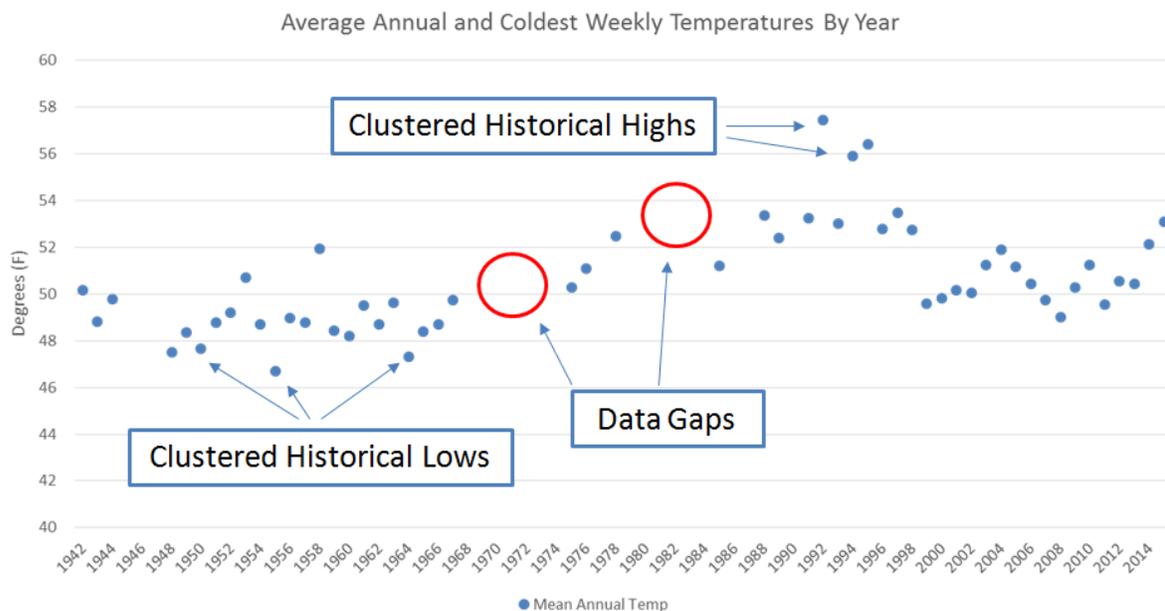
Brian asked the group about using historical data – are 70 year old temperature data still usable for forecasting? Grant said that when conducting reliability assessments he goes back to the turn of the 20th century to ensure all possible weather events are included.

The group discussed how to best check model fit. It was suggested that modeling a year whose data were not used in creating the model was a good approach. For example, if the model is created using data from 1993 to 2014, then running temperatures from 2015 would be a good way to check the fit.

Load growth trends and potential new sources

Priming the pump for conversation on load growth trends and potential new sources of growth were James Dykes, Benton PUD, and Grant Forsyth, Avista. James started by discussing load growth trends at Benton. Looking forward, they see relatively mild growth of roughly 0.5% per year.

Figure 7 – Mild load growth ahead for Benton PUD
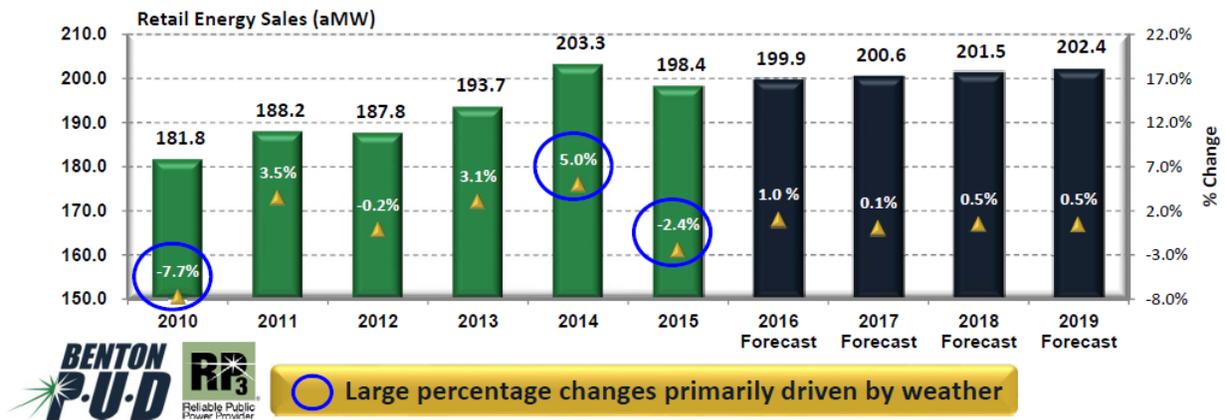
Benton is eyeing a few projects that could boost future growth including data centers and food processors. However, James said that they compete with other utilities for these loads, leading to uncertainty in what loads may arrive.

Indoor agriculture load was brought up. To date, Benton PUD has not seen a sizable impact from this sector. A few meeting participants mentioned that many of the grow operations are not new, simply, they are now legal. As such, they have not brought extra load to the Northwest.

James discussed potential load growth from electric vehicles. The Tri-Cities were recently identified as an underserved electric vehicle corridor. Benton PUD is seeking grant money for charging stations to encourage higher rates of adoption. Cam raised the question of range being a barrier to adoption. It is over 200 miles to SEATAC, which is out-of-range for all but the most expensive electric vehicles today. This could make it difficult for a Benton customer to have an electric vehicle as their only car.

Grant closed out the meeting with a presentation on trends and load growth prospects for Avista. Trends included slowing population growth, an increase in annual cooling degree days and a decrease in annual heating degree days. Avista is currently using a 20 year moving average for incorporating CDD and HDD in their forecasting model – this captures current trends without being overly volatile. Like many utilities in the Northwest, Avista is seeing declining projections for load growth. Part of this is due to declining use per customer, Grant said.

Rooftop solar came up in the conversation. Penetration rates have been low in Avista's service territory, Grant reported. One factor stifling solar growth is shade from trees in higher income neighborhoods. Additionally, Avista's rates have been fairly low and constant since the recession, providing little economic incentive to install solar.

The discussion shifted back to electric vehicles. While there is potential for load growth, and Avista is currently expanding changing stations, Grant cautioned against becoming too optimistic. A few years ago, there were lots of reports projecting high electric vehicle penetration rates, but adoption has been slower than forecasted. Additionally, while more electric vehicles will be taking root around the region, they likely will not have a huge impact on utility loads.

Figure 8 – Population grown slowing in Avista's service territory

MSA Population Growth, 1971-2015
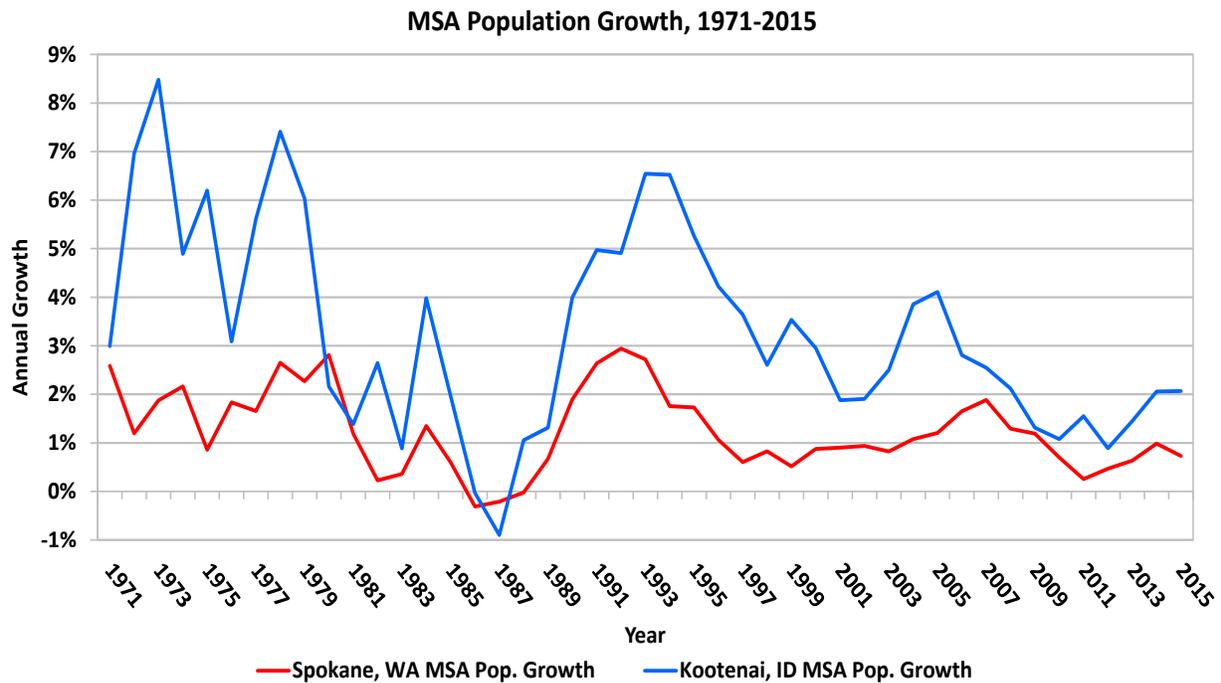
Meeting participants

Last	First	Representing
Babbitts	Matt	Clark Public Utilities
Baerlocher	Natalie	The Energy Authority
Baise	Raymond	PacifiCorp
Bellcoff	Steve	BPA
Booth	Glen	BPA
Booth	Brian	Snohomish PUD
Dockery	Paul	Clatskanie PUD
Eelkema	Pete	BPA
Forsyth	Grant	Avista
Harris	Kevin	Columbia Grid
Haymaker	Tom	Clark Public Utilities
Jacobs	Allison	Puget Sound Energy
Jourabchi	Massoud	NW Power Council
Koss	Valarie	PNUCC
Kugel	Jeff	PNGC Power
Lehouillier	Cam	Tacoma Power
McReynolds	Shauna	PNUCC
Molander	Lorin	Puget Sound Energy
Morrissey	Tomás	PNUCC
Popoff	Phillip	Puget Sound Energy
Price	Stephanie	Puget Sound Energy
Riter	Amber	Portland General Electric
Rudolph	John	Seattle City Light
Rue	Adam	Eugene Water & Electric Board
Singh	Gurvinder	Puget Sound Energy
VanHoose	Zeecha	Clark Public Utilities
Campbell	Greg	Tacoma Power
Dykes	James	Benton PUD
Haener	Rick	Idaho Power
Keating	Becky	Chelan PUD
Ng	Felicienne	Snohomish PUD