Council Meeting
November 13 and 14, 2016
Portland, Oregon

Tuesday, November 13

Council Chair Jim Yost called the meeting to order at 1:31 p.m. All Members were in attendance.

Reports from Fish and Wildlife, Power and Public Affairs Committees

Fish and Wildlife Committee

Council Member Guy Norman, chair of the Fish and Wildlife Committee, reported on eight items:

1. Patty O'Toole, program implementation manager, provided a review of the Fish and Wildlife Program Amendment process and schedule. Recommendations are due by December 13. Staff will review those recommendations and will start on workplan. This will lead to a draft in July 2019 and a final in December 2019.

2. Lynn Palensky, program development manager, talked about the Research Plan Review process for 2019. There are 25 programs totaling $11.6 million. Staff put together a template to review projects and to provide recommendations for moving forward with those projects. This will move to the full Council next month.

3. Palensky announced the start of Mainstem/Program Support Category Review. It will be followed by resident fish and sturgeon in Fall 2019, then anadromous habitat and hatcheries in Fall 2020.

4. The committee heard a project review on Pacific Lamprey Conservation Initiative from program participants. The Council supported the project last year. It was funded out of cost savings and will be funded in 2019 for $238,682. The recommendation is to continue funding that project through cost savings at a level not to exceed $300,000 per year.

5. Nancy Leonard, fish, wildlife and ecosystem M&E report manager, gave an update on the draft mapping online tool, which was developed to display existing goals and objectives for seven resident and two anadromous fish species. It will go out for review for co-managers to look at next week, with a final product in 2019.

6. There was an update from staff on the tributary monitoring and evaluation project. Led by Council staff, Bonneville and NOAA, it's important undertaking to streamline habitat effectiveness monitoring.

7. Bonneville has a draft agreement with the Kootenai Tribe of Idaho. The draft will be out for public review tomorrow. It's for four years for $48 million.

8. Tony Grover, Fish and Wildlife Division director, provided an update on policy issues emerging from Bonneville's budget adjustments. There will be a detailed update next month.

Power Committee

Council Member Tom Karier chaired the Power Committee earlier that day and reported on three items:

1. The committee looked at emerging technologies in energy efficiency. NEEA's Mark Rahley talked to the committee about the work the organization is doing tracking 100 products that are not yet commercially available. The products cover a variety of applications from space conditioning, water heating, commercial HVAC and gas heat pump water heaters. Another is a three-layered insulated window. It markedly increases the efficiency of windows and they can be manufactured at low cost. High-definition televisions are bring made that use three times as much energy as the flat screens used today. With TVs, we're always one step behind, Member Karier said. Virtual reality devices using headsets is another emerging product. The computing behind those headsets could require a lot of energy usage.

2. Franco Albi, with PGE, discussed his company's integrated resource plan. Most IRPs look at loads in next 5-10 years, as well as generating resources, energy efficiency and sometimes storage. PGE is including distributed energy resource planning (such as household solar collectors), transmission and distributed planning, microgrid development, and the electrification of transportation. Portland is one of the first utilities to approach it this way, Member Karier said.

3. John Shurts, general counsel, and Ben Kujala, Power Division director, talked about the Power Plan provisions of the Northwest Power Act. They spent 90 minutes providing background on what's in the Power Act and what's implied. Shurts will be doing a presentation for the Fish and Wildlife Committee as well.

Public Affairs Committee

Council Member Bill Booth, chair of the Public Affairs Committee, reported that John Harrison is finishing a website article on sea lions that looks at the entire river, not just Bonneville Dam. He is working with Dr. Michelle Wargo-Rub on the draft. Public Affairs is working with the Power Division to develop some branding materials for the next Power Plan. They're also working together on a new brochure highlighting the benefits of hydropower, including the benefits of newly developed capacity markets on the West Coast. Website improvements are being made to support the Fish and Wildlife Amendment process and the new Power Plan.

1. Briefing on PNGC Power Marketing Insights

Ben Kujala introduced Greg Mendonca, PNGC Power's vice president of power supply.

Mendonca has worked for PNGC for 13 years, starting in hourly trading and working his way through a BPA slice contract. PNGC is a load-following customer with BPA and is its fourth largest. It is a Portland-based electric generation and transmission cooperative, owned by 15 electric distribution co-ops. It provides power supply and transmission services, and aggregates geographically diverse loads. It operates primarily in the four Northwestern states, but is in a total of seven states. They've seen about six percent load growth on their system over the past four years. Last year, they saw 10 percent load growth. Over the next four years, they anticipate 10 percent load growth. They are growing, while other entities' loads are flat or declining.

As a load-following BPA customer, they live and die by their BPA contract, Mendonca said. BPA power makes up the largest chunk of PNGC's resources. To meet the load growth, the board directed PNGC to use the wholesale power market to fill those positions, he said. They have to meet load that is above their highwater mark and new, large, single load, which is ineligible for priority firm service (PF rates). He said their strategy is to look at the market, and look at different suppliers and contract lengths to reduce volatility, such as spikes due to a pipeline explosion or delayed maintenance in Southern California. They don't fixate on getting the absolute lowest prices. They're trying to help reduce volatility and help members plan for their power supply.

Mendonca said they do see more frequency in market volatility than what they've seen the last three years. He pointed to the retirement of baseload units that provide dispatchable power, and said there's been some erosion in the flexibility of the hydrosystem. When there's snap events, or a delay in gas maintenance and the inability to meet load, markets react irrationally and spike up to areas where we don't like paying $200–$300 per MW power, he said. Rather than be exposed to those prices, they layer in different terms, supplies and types of products. Mentioning the price spikes in late July and early August, he said the loads weren't reacting to the weather, so they didn't have to participate in that market. They have a rate structure where BPA acts as a balancer for its resource load needs.

Member Yost asked Mendonca to look into his crystal ball and forecast what he sees for the energy imbalance market (EIM) in California next spring or summer, in terms of accepting different products from other states. Mendonca replied that by being a for-requirements

customer of BPA, they don't participate in the California market, but what happens there affects the rest of the West. He doesn't see the EIM markets impacting the day-ahead, monthly or term prices to spike. It provides intra-hour flexibility. They're interested in seeing where different utilities go with it and are looking at if it makes business sense for BPA to join.

Member Richard Devlin asked what percent of PNGC's load might be on an average month outside of power from BPA? Mendonca said 700 MW is the total retail load and 500 MW is from BPA. They're getting close to looking at being a 50/50 split between BPA and nonfederal resources toward the end of its Bonneville contract. Peak load has been 1150 MW. They're still a winter-peaking entity.

Member Booth said it looks as though PNGC is seeing increasing peaks in July and August — kind of an annual increase. What's the reason and do you expect that to continue? From 2013 to 2014 it's about 300 MW, Mendonca replied. Those are probably actuals. We haven't seen consist load growth that has a heavy air conditioning component. That's where we'll see our largest growth. Some of our members are doing ductless heat pumps, and doing measures with more efficient heating and that offer air conditioning. That air conditioning is raising our summer peaks.

Member Booth asked how much of their gap is coming from carbon facilities that will disappear in a few years. Mendonca answered that because they have members in Oregon and will presumably be looking at a cap and trade in Oregon, they're very keen on where the energy is coming from. They don't buy from any thermal asset. They buy from hydro-based utilities and some non-specified resources at the Mid-Columbia (which could come from some thermal assets). It's an area we focus on, he said.

Member Jennifer Anders asked Mendonca to elaborate on his statement about the unreliability and volatility of hydro. No, hydro is the opposite of that, he said. There's some volatility of hydro year-to-year.

2. Presentation on the U.S. Army Corps of Engineers' predation management in the Columbia River System

Laura Robinson, program implementation and liaison specialist, introduced Tim Dykstra, fish program manager, Northwestern Division, and Mike Langeslay, senior project manager, both with the U.S. Army Corps of Engineers. Robinson said this is one in a series of presentations on predation, which began in September. In the 2014 program, the Council has an emerging priority to expand the management of predators.

Dykstra said the last time he was before the Council was 13 years ago as fish and wildlife director for the Shoshone PaiuteTribes. He started this job last January. Predation is a larger problem than any one program or agency. He said the Corps' role looks at a narrow subset of the overall problem. This presentation is about birds and pinnipeds.

There are three avian predation management plans: estuary terns, estuary cormorants and inland (Caspian) terns. He'll also talk about what's being done at different dams and sea

lions at Bonneville Dam. The Corps will continue to implement these management plans. The Columbia River System EIS process will offer an opportunity to reevaluate.

To understand Corps' role, you need to understand Rice and East Sand islands, he said. Rice Island had world's largest Caspian tern colony. The consensus was that this was a problem. A majority of their diet (83 percent) is salmonids. The Corps moved the breeding colony to East Sand Island. The idea was to get further to the ocean, hoping the terns would eat less salmonids and diversify their diet. The effort was successful. Their diet of salmonids fell to 33 percent.

Still, they have the world's largest colony of terns and they're still eating lots of salmonids. There was an interest in doing more. They worked to pull the terns to other places. The Corps constructed a perfectly round island. They began to manage East Sand Island to reduce available habitat. Unless we're managing it, it gets overtaken by vegetation, he said.

The Corps' efforts to pull the terns were discussed — targeting about 3,000 nesting pairs at East Sand Island. Dykstra showed a graph where the percentage of salmonids consumed by terns has declined. In 2006, terns were eating 1 out of 4 Snake River steelhead were eaten by Caspian terns. Today, the ratio is 1 out of 20.

Member Baker asked what changes the percentage of the birds' diet? Dykstra said it's a reduction in the number of birds, so the impact on ESA-listed fish is less.

Member Devlin referred to a recent presentation that indicated while things were going well, previous targets were not being met in the number of terns on the island — and that it was doubtful that further efforts would be made to reduce the population. Dykstra replied their target is acreage. We're managing to leave one acre for Caspian terns. We don't have a hard and fast target on the number of birds in the acre, he said. It's how much habitat we'll maintain for breeding.

Langeslay said there was a number of breeding pairs estimated, 3,125, based on the habitat reduction. There was no timeline on when that would happen. We had to do an EIS to do this action, he said. It covered an acre. To do anything else, we'd have to do a supplement to the EIS.

Member Karier had a comment about estimating the number of breeding pairs per acre, and asked if the number of pairs should have targeted instead of acres. We could take a look at that, but they're managing consistent with the management plan for terns and the EIS, Dykstra said.

Member Yost asked if this was considered in the FCRPS EIS? Yes, replied Dykstra.

Member Booth asked if there is a target population for terns somewhere in federal fish and wildlife regulations. Dykstra said this is being looked at through the EIS. Until that occurs, they are managing consistent with those plans. We don't have authority to do additional research outside of EIS, he said. From my perspective, the tern issue is under the umbrella of the U.S. Fish and Wildlife Service. So I'd assume our action is consistent, he said.

Member Ted Ferrioli said that agencies are saying their hands are tied — circling around the issue while timber acres burn and protected species prey on each another. At some point, agencies are going to have to find a strategy that reduces the acreage but also reduces the density. If you can't accomplish a reduction in avian predation, there's no management.

Dykstra said it's premature to say that an acre isn't the right number. We've reduced it to an acre and the birds have responded. We have created offsite habitat that we hope will be a draw for birds. To say it needs to be reduced further, is premature. That's why we have the plan in the first place to set the guidelines, see the biological response and then reassess.

Ferrioli said it seems that if an acre was a strategy arrived at through negotiation, the terns are more adaptable than the agency, because they increase their density. We're supposed to reduce predation.

There has been a reduction in overall terns on the island, Dykstra replied. Looking at 2017, we were close to the target. We didn't expect an instantaneous response. From my perspective, it's premature to say we need to do more. Our hope is we'll continue to see a biological response. If not, we'll reevaluate it through the EIS.

Member Norman said makes intuitive sense to have a period of discovery. He noted in the impact table that there is a substantial reduction — from 1 in 4 steelhead to 1 in 20. The question is does the Corps keep planning to monitor tern density and PIT tags? Yes to both, Dykstra said.

Dykstra discussed the cormorant management plan. Phase one was a four-year lethal strategy to achieve a colony size of 5,380–5,939 breeding pairs. It was successfully completed and they're moving on to phase two, which is terrain modification to reduce the amount of area for nesting. He discussed reduction results on a graph.

The third plan is to reduce inland avian predation. There are two colonies, on Goose and Crescent islands. A high percentage of the birds' diet is salmonids. There was a 15.7 percent predation rate before the plan. Dykstra discussed management actions. The same pull/push approach was taken. In 2007–2014: the predation of steelhead and salmon has been significantly decreased to 0.1 percent of Upper Columbia steelhead. The effort to reduce tern colony has largely been successful.

The Corps will pull together a synthesis report of all the projects in 2019.

The measures being undertaken at the dams include wires, water cannons, active hazing and monitoring.

Langeslay talked about efforts to deal with pinnipeds. There are California and stellar sea lions. They're staying at Bonneville Dam. There's an estimated 15,000 sea lions. In 2006 there were 300,000 along the West Coast. Now stellar sea lions are the more populous species. They were listed until recently.

The Corps' role is monitoring. It supports the removal efforts of the states. The Corps also funds USDA to come and haze sea lions away from fish ladders. They also support the

states in their removal efforts under NOAA, including looking at data to see if it's working or not.

Langeslay said they don't have the authority to remove the stellar population at Bonneville.

Member Karier said he didn't see a reduction in Cormorant impacts from the slides. Langeslay replied that 2015 is when they started the management plan and in 2016, you do see a reduction.

Member Norman said it's a true partnership with the states on the sea lion program. The key piece is identifying problem sea lions. If legislation passes, there will be a more increased role for the Corps in working with states.

Member Booth thanked Dykstra for his participation over the years, and thanked Langeslay.

3. Council decision to request a science and economic review of predation by the Independent Scientific Advisory Board and contract economist(s)

Laura Robinson talked about why we need an Independent Scientific Advisory Board (ISAB) review of predation in the basin. She outlined the history of the effort, the 2016 predation metrics report and the proposed 2019 ISAB draft work plan.

The proposed scope of review considered Council member interest, the past work of Council members, current program investment, threat of northern pike, and any unknown impacts of other non-native predatory fish.

Member Booth said that a lot of work was done in the last month to revise the questions. It's time to move on. This is focused principally on northern pike, where time is of the essence.

Member Anders supports the letter. She said the Fish and Wildlife Committee is trying to get at all levels — where are the gaps and how to best fill them. We support or fund a lot of efforts that we never get an economic analysis of, so this is a unique step. It's important to go the extra mile to look at northern pike and others.

Member Norman supports the letter and also wants an assessment of the overall predatory problem in the basin. Can we accomplish it in this six-month timeframe? Erik Merrill, ISAB manager, replied that it's an ambitious set of questions. We'll do what we can and lay out a path forward to answer more questions.

Member Karier said it's important to do a study. We know what the costs of suppression can be. If it's successful, there are not a lot of other impacts. If it's not successful, then costs get much larger. We need to know if we're putting money in the right areas. He referred to getting into a rut of funding hatchery studies. We might be in danger of doing the same with predation. There is not a lot of change in the reporting system. We need to consider what outcomes we're aiming for.

Northwest Power and Conservation Council Motion to Approve a Letter Requesting the Independent Scientific Advisory Board and Council-Selected Economists to Conduct a Science and Economic Review of Predation and Predation Management

Member Anders moved that the Council approve a letter requesting the Independent Scientific Advisory Board and Council-selected economists to conduct a science and economic review of predation and predation management, a review to be completed by the May 2019 Council Meeting, as presented by staff and recommended by the Fish and Wildlife Committee.

Member Norman second.
The motion was approved unanimously.

Chair Yost said an executive session will be held at 8 a.m. tomorrow

He recessed the meeting at 3:16 p.m.

Wednesday, November 14

Chair Yost called the meeting to order at 9:12 a.m.

4. Presentation on Streamflow and Temperature Projections of the Latest Climate-Change Datasets for the Columbia River Basin

Dan Hua, power system analyst, introduced Erik Pytlak, Bonneville Power Administration's weather and streamflow forecast group manager. Pytlak shared the phase-one results of an ongoing global warming study that was commissioned in 2013 by the River Management Joint Operating Committee (RMJOC). The second phase of the study will look at hydropower. The group is made up of BPA, U.S. Bureau of Reclamation and U.S. Army Corps of Engineers. They commissioned the study with the University of Washington and Oregon State University. They have published several peer review journals about the effort.

Forecasts for the Columbia and Willamette River Basins call for continued warming, increased rainfall in some areas and reduced winter snowpack. Carbon dioxide levels in the atmosphere are rapidly increasing and are at the highest levels in hundreds of thousands of years, Pytlak said. Methane emissions are another factor. It's the rate of this change that is significant with regard to climate change. Global temperatures have risen 1.7°F since the 1970s. Also, 2016 was the warmest year ever recorded (going back to the 1880s), and possibly the warmest in over 2,000 years.

Pytlak discussed human versus natural causes. He said that In the past 60 years, absent greenhouse gas increases, we should have had no change, or slight global cooling. He discussed the range of carbon emissions scenarios — the amount of CO2 projected to go into the atmosphere. We concentrate on the more aggressive scenario, he said.

He discussed the project objectives and hydroclimate modeling steps. A lot of hydropower research is being done. Even past observed temperature, precipitation, snowpack and

streamflows have some uncertainty. He showed a map of streamflow locations and a table of hydrometeorological simulations. It resulted in 172 scenarios.

Pytlak said that all the scenarios studied for the Columbia Basin show continued warming. Warming in the Pacific Northwest is more pronounced in the summer, but the study shows warming in all seasons. One scenario shows winter warming of between 6°F. Another scenario shows warming of 2°F. Warming will be greater in the interior than on the coast — possibly about 5.5°F between now and 2030. He said that already-dry areas could become dryer, and greater precipitation could occur in the wetter months. Precipitation trends are not identical across the region, but shows precipitation increasing in Canada. Some models show the Snake Basin getting wetter in the summertime than previous studies showed.

He said the largest impact is a reduction in snowpack. The average winter snowpacks are very likely to decline over time as more winter precipitation falls as rain instead of snow. In the Snake River Basin, it doesn't have to warm up very much to change the basin from a snow-dominated basin to more precipitation, he said.

Looking at streamflows, the study shows increases in spring flows across all climate models. By the 2030s, Pytlak said we start to lose glacier melt as the glaciers are depleting in Canada. Canada is doing similar studies and he wants to compare his studies with theirs.

When we get to Grand Coulee, the snowmelt shifts by two weeks, Pytlak said. In the Upper Columbia, streamflows increase significantly in spring and are lower in the summer and fall.

In the Snake River Basin, spring snowmelt starts earlier. We start seeing multiple peaks, he said. It usually peaks in May, but sometime in the 2030s, we start seeing them in February or April. It's harder to differentiate when peak is in the Snake River Basin.

At The Dalles, most models show an increase in flows. It depends which climate model you pick. We'll use a range of them, he said.

The Willamette already is rain-dominated. With an increase in precipitation and temperatures, there are higher peaks in the wintertime. Flows are already low by May, June and July. Another issue is the peaks, combined with higher flows on the Columbia River, is concerning to the Corps because of flood risk.

Pytlak ran through several charts showing the projected changes in annual streamflow volume in the region.

These inputs are going to be used in the Columbia River Systems Operations (CRSO) process that is underway. He said he would like to be further along with the hydropower studies, but the same researchers are conducting CRSO and treaty studies, as well as doing their day jobs.

Member Anders asked if this data is informing the Columbia River treaty process. It will be, he said, because it's part of the regional recommendation. We chat regularly with BC Hydro. Part of the negotiations will be quiet, but the climate results are as open as possible.

Member Devlin asked about slides 5 and 11, dealing with streamflows and temperatures. Your scenario RCP 2.5 would seem to be totally unrealistic, he said. Some would say RCP 4.5 is the most realistic. At those levels, if you go to 11, we already have significant temperature issues for salmon in portions of the Columbia and Snake during the summer months. It's foreboding for the future of salmon runs. If it's at the upper level, we may need to develop a temperature-resistant species.

Pytlak replied that scientific opinion agrees that RCP 2.5 is not realistic. There's uncertainty if we can get to a 4.5. That will help us in the 2020–2030 timeframe. You see warming in all scenarios. Fish is outside my expertise. It's tough to model water temperatures given all the variables.

Member Karier complimented Pytlak on an excellent presentation. He asked if this confirms the results of the study done seven years ago or is it substantially different? Both, replied Pytlak. It confirms the higher winter flows, lower summer flows, the earlier peak runoff, snowpack losses and temperatures. This has a bigger range of outcomes because we were more honest about the modeling we did. The climate models break a little wetter this time.

Member Tim Baker asked Ben Kujala about the power supply implications with warmer summers and water flows shifting. Thinking about loss of load probability and Council's Power Plan, where does this come in for us?

Kujala said they're waiting to see what comes out of the regulation. We have a bunch of hydropower and want to adapt the system around it. Some look at more water and say it's more energy. It could be more flood control. It's not obvious what you'd get from these streamflows in this regulated system. I don't know how far out you can project. I can't give a simple answer. It has to go through the regulator.

5. Update on Natural Gas Pipeline rupture in British Columbia

Steve Simmons, senior economic analyst, provided context for the region's natural gas system. He is working to set up a panel discussion with utilities and pipelines on how the incident and power generation was handled. This might take place in February or so.

Fortunately, no injuries were involved. The rupture occurred October 9. Simmons read facts about the explosion and the resulting measures taken.

> **October 9** – There was a major rupture and explosion on an Enbridge gas transmission pipeline in a rural area near Prince George, B.C. (450 miles north of the B.C./Washington border). The rupture was on a 36-inch mainline. An adjacent 30-inch line was depressurized and taken offline as a precaution. No gas was flowing at the interconnect with the Northwest Pipeline at the Sumas Washington/B.C. border — resulting in a Force Majeure notice. The largest gas storage facility in the Northwest (Jackson Prairie Storage, which is located on the Northwest Pipeline) was offline for scheduled maintenance at the time of the rupture.

October 10 – Shippers on the BC and Northwest Pipelines (including FortisBC and Puget Sound Energy) asked customers to conserve natural gas, and gas-fired power generation in the region was dialed back.

October 11 – Enbridge brought the 30-inch adjacent line back into service and started gas flows at a reduced capacity. Williams completed maintenance on the Jackson Prairie Storage facility and brought it back on line.

October 14 – Preliminary soil sampling at the rupture site detected no traces of hydrocarbons in the soil. A temporary road was built to access the site to repair the 36-inch mainline.

October 31 – Enbridge completed repairs on the 36-inch mainline and expect it to be flowing gas again by November 3, but at a reduced capacity. This will continue through the winter.

Pre-rupture gas flows in the winter were around 1,700 mmcf/day. It provides around 75 percent of Fortis BC gas. The remaining flow to the U.S. Northwest at Sumas is around 1,150 mmcf/day.

Post-rupture flows dropped to zero for a few days. Since October 18, flows have averaged 460 mmcf/day at Sumas (EIA). Flows on the pipeline are expected to be around 900–1,300 mmcf/day this winter.

Simmons showed a map of the Northwest's natural gas system. The Williams pipeline is bringing supply down from B.C. and Alberta to the I-5 corridor. The largest shipper is Puget Sound Energy. Simmons pointed to storage facilities, including Mist underground storage in Oregon. GTN brings gas down to Oregon, but most of it is for Northern California. PG&E is the largest shipper. Portland General ships gas for its Carty power plant.

Natural gas-fired generation was dialed back, but there were no outages due to the incident.

Price impacts: At the end of October, there was a spike. Prices peaked at $17, the highest in five years or so. At other regional hubs, prices have not gone up. Market prices at the Mid C have risen from $34 to around $60. Just one hub has been impacted. Our gas plants have been pulling gas from other regions, Simmons said.

Member Ferrioli asked about the cause. Simmons said it's still under investigation.

Member Karier asked, so the fact that the other markets didn't respond, does it mean they're not competitive with each other? Is it because contracts are firm and they can't change that quickly? Simmons replied, yes, they are. Alberta prices actually dropped after the rupture. Some gas from Northern B.C. came through Alberta on GTN.

Member Ferrioli asked did the fact that part of the facilities were offline for maintenance mean that users contracted for alternate supplies? Simmons said for storage, October is more of a maintenance and ejection season. Typically, you would not expect to withdraw gas from storage in October. We expect it during December and January.

Member Yost asked how much gas was sold at higher prices. There just wasn't as much gas? Correct, replied Simmons. There was reduced volume. We don't have data. Higher prices could last through the winter.

6. Briefing on the effect of compound climate events on adequacy in the Pacific Northwest

John Fazio, senior systems analyst, introduced Nathalie Voisin, regional water-energy dynamics research lead, and Sean Turner, water resources management modeler, both with Pacific Northwest National Labs.

Fazio said that the Council has taken RMJOC data and has used it in its Sixth and Seventh Northwest Power Plans.

Two scientists from the Pacific Northwest National Labs talked about the effect of compound climate events on power supply adequacy in the Pacific Northwest. This work is in cooperation with BPA. It's an Action Plan item to participate in efforts to update and model climate change data.

Voisin provided background on how the work came about. The project started in 2017, with PNNL teaming with BPA and the Council. They're looking to determine the sensitivity of resource adequacy studies to future water availability and load flexibility of build outs.

The two objectives are to: 1. Quantify the contribution of regional water availability to electric capacity expansion planning; and 2. Quantify the sensitivity of the expansion plans to extra-regional markets (Southwest).

Turner provided a briefing on the effect of compound climate events on system adequacy in the Pacific Northwest. He discussed possible impacts, such as how increased demand could register shortfalls.

A system could be impacted by multiple climate impacts simultaneously, Turner explained. One impact to the power system could be increased power demand due to increased summer temperatures, but the system might have enough redundancy to handle that impact without shortfalls. Another impact could be reduced water availability for hydro during the summer, but the system might be able to handle that impact as well. But combined, you might be registering shortfalls, he said.

Hydro is affected by snowmelt timing. With climate change, there is a robust shift backwards in time (e.g. earlier in the year) in the hydrograph.

The researchers are using GENESYS to model impacts on hydro and load potential. He explained the process of modeling future climate change river flows by using different combinations of historical flows. In comparing modest climate change scenarios with more extreme scenarios, they discovered that there aren't enough historical years available to

represent the extreme cases and so were limited to presenting only the most conservative climate change scenarios, with modest impacts on demand and hydro.

Member Yost asked, what's modest? How many degrees? In terms of average degrees difference, I'm not sure there's an average over the region, Turner replied.

Infrastructure (e.g. resource build out) in the 2035 scenarios are considered, he said, with current policy as one scenario and carbon risk policy as the other. Fazio said these buildouts are from the Council's Seventh Power Plan for the 2035 operating year. Turner said they're looking at a no climate change scenario as well for comparison. When looking at shortfall risk, the metrics include a loss of load probability, average event duration and average maximum shortfall.

Simulation results show a dramatic reduction in winter shortfall risk and an increase in summer shortfall risk. Summer risk is compounded by combined climate impacts on hydropower and loads. If you want to consider climate impacts, both need to be considered at the same time.

Member Anders asked, looking at summer shortfall slide, does it factor in current operations for fish? Fazio said, yes, as simulated for the BPA rate case, but it doesn't include court-ordered spill.

Member Karier said the results are summarized well. We felt there would be a difference, but here it looks profound.

Fazio said the work that the RJOC is doing is extremely complex. They have taken the IPCC 5 data, downscaled it for the Northwest and created climate-adjusted natural streamflow projections. Unfortunately, to do adequacy assessments, the Council needs modified streamflows (which take irrigation into account) and the operating rule curves to go with them. That data is not quite ready yet. However, because the year-to-year variation in streamflows is quite wide relative to the expected average change, some more conservative climate change scenarios can be simulated by resampling from the historical water year record. In other words, it is likely that for those conservative cases, we might see a repeat of some historical years in future years. Thus, resampling historical water conditions with different probabilities of occurrence is a good approximation for two of the most conservative IPCC 5 climate scenarios. When the RJOC data is ready, we'll take their modified flows (and associated rule curves) to rerun the study.

Member Yost said the conclusion is the conservative climate models you looked at fell within the normal 80-year water record we have for the Northwest. Yes, Fazio replied. Yost added, but that's not under normal water operations or conditions. Fazio said for the conservative climate scenarios, the resampling method is a good approximation because it meets the three criteria required for the analysis; 1) average streamflows using the resampling method must be close to the average expected from the RMJOC data, 2) the number of resampled years cannot be small (e.g. should be as large as possible) and 3) the extreme conditions (e.g. high but especially low water years) must be reasonably represented. Fazio went on to say, however, that using this method will not capture potentially new streamflows that we have not observed in history. That's why we need to wait for the RJOC results. But I think this is a strong conclusion and that there's no doubt

that if these climate scenarios occur this shift in shortfall seasons will happen. The shift in streamflows — there's going to be more water in the river in the fall, along with higher temperatures. That's going to be good for the power system. In the summer, there will be higher temperatures with higher demand for air conditioning, and less water in the river, which means less hydropower. So, the general trend makes intuitive sense.
Then all we have to do is to balance the power generation with the biology for the fish, Member Yost said.

7. Council decision to release final Energy Efficiency Savings Development and Use White Paper

Jennifer Light, Regional Technical Forum manager, said they have received a lot of questions on how the RTF develops savings estimates. This paper, developed through the RTF and its advisory committee put context into that. The Energy Trust of Oregon was supportive of the paper, but asked for more explanation on non-electric fuels. We don't allow fuel switching, Light explained. BPA asked for more clarity around inconsistencies between program savings and the target. That section was hardest to follow and they provided good comments. Light provided examples on how baselines can be different between plan assumptions and programs. The RTF does rely on total market studies where possible. The RTF included comments and the response to comments in the Council Members' packets.

Northwest Power and Conservation Council Motion to Release the Final Methodology for Estimating Energy Efficiency Savings in the Northwest White Paper

Member Anders moved that the Council approve the release of the Council's final Methodology for Estimating Energy Efficiency Savings in the Northwest white paper, as presented by staff.

Member Baker second
Motion carries without objection.

8. Presentation by Snohomish County PUD on solar/EV/and demand response:

Kendall Farley, policy analyst, introduced John Haarlow, CEO; and Jessica Matlock, government relations manager, with Snohomish County PUD (SnoPUD).

SnoPUD covers 2,200 square mile area in Snohomish County/Camano Island. It serves nearly 360,000 electric customers and 20,000 water customers in one of the fastest-growing counties in the Pacific Northwest. Its power is 98 percent carbon free.

Haarlow talked about the SnoPUD's actual retail load and population growth. Its load is going down due to codes and standards, energy efficiency and climate change.

Haarlow said it's his fourth week in his new role at the company. He talked about how SnoPUD is changing the way it does things to become the utility of the future. It starts with

safety, breaking down silos, improving processes and increasing the value proposition for customers. It also means expanding customer input and choice, and increasing engagement with stakeholders.

Haarlow talked about launching a holistic distribution system planning and optimization effort to coordinate effective utilization of all resources — including customer-sited distributed energy generation and demand response. Reading from a slide, he said this effort will include:

- advanced meters;
- additional distributed generation options;
- an evaluation of the value of distributed resources based on location, time, and grid services provided;
- pilot demand response programs (waste-water and water heaters);
- leveraging existing battery storage projects and examining other capabilities of storage;
- developing a system heat map to understand capacity constrained areas to better plan efficiency and impact of electric vehicles; and
- examining the power market value of capacity.

There are two battery projects underway: a lithium-ion and vanadium flow. The projects are designed to improve reliability and the integration of renewable resources. The lithium-ion is used to hedge against peak load. The vanadium flow is more experimental and has not been as successful. Haarlow said SnoPUD is in a do-over mode on that model.

In Arlington, Wash., they are looking at a solar microgrid — a 500-kW solar array. If there's no power, the backup center can go off grid and operate off the solar and battery. It's a great test bed for us, he said. With a community solar array, customers and the community can buy portions of the solar,and can charge vehicles. It all will be controlled at the microgrid center or at the main control center,

Haarlow discussed the renewable choices energy program. He said that customers don't really know if electrons really came from a particular site. What if we could verify that? I don't know if the electrons actually look any different, but to track it would be very interesting.

SnoPUD is looking at electric vehicles from an economic standpoint. If customers could charge them during the day and discharge that power when demand is highest, and then recharge overnight, it's basically electron trafficking.

Member Karier said he's interested in the idea that customers can be a resource. There's a bill in the State of Washington that water heaters have to be demand response-ready.

Member Norman said he's interested in SnoPUD's forward-thinking approach. He asked about promoting its residential incentive program with customers. Will they try to message that in installing AMI? We want to do that in the right way, Haarlow replied. There's still some negativity with AMI. They want to sell their message on how it is good for the customer. I think AMI has gotten a bad rap, He said.

Member Yost asked how the utility provides security for customers when they use that device. Matlock replied that everything with an internet connection has been hacked, including NEST thermostats and EVs. You can't stop innovation, but you can connect the backfeed that goes to the utility. We need to make sure our firewalls are secure, she said. The biggest cyber threat remains phishing (using emails to induce individuals to reveal confidential information).

Member Yost said you may think we've heard about all of that — we haven't. We'd like a discussion at some point on security for the customer and to protect the utility.

Member Yost then asked about the community solar program. How many megawatts and how many slices or shares have you sold?

Haarlow said it's 500 kW. Matlock said the team is still looking at the price and how many slices — and it probably will be around $120 per share. They're still deciding whether to rent to sell the shares. Washington State's tax incentive isn't as generous anymore.

9. Briefing on California's 100% Clean Energy Standard

Gillian Charles, energy policy analyst, and John Ollis, power system analyst, briefed the Council on California's updated renewable portfolio standards (RPS).

California's Governor Jerry Brown signed legislation on Sept. 10, 2018, to achieve a 100-percent clean energy mix by 2045. The 100 Percent Clean Energy Act of 2018 also sets a target of 60 percent clean energy by 2030, using zero-carbon resources. Eligible zero-carbon resources beyond RPS-eligible resources include large hydro located within the state, natural gas with carbon capture and nuclear. Storage and emerging technologies also are expected to play a role.

Gillian Charles, staff energy policy analyst, explained that California has revised its renewable portfolio standard (RPS) several times, so this isn't a surprise. It is important to consider the potential impacts of this legislation as the Council prepares to draft its Eighth Power Plan.

Council Member Richard Devlin wondered if this means there will be no market for BPA in California after 2045. Discussions on that have not kicked off on that yet, Charles said. Ollis said it's a good observation. They haven't said it has to be renewables in-state, so there might be market mechanisms and work-arounds.

Member Ferrioli said that natural gas provides about a third of California's energy. Is carbon capture off-the-shelf technology? Charles said she understands that it's "almost commercially available." In the Seventh Power Plan, it's considered an emerging technology, and it will be evaluated again. "I hope we're not painting ourselves in a corner should the technology not be ready," Ferrioli said.

Oregon increased its RPS to be 50 percent renewable by 2040. Looking at renewable portfolio standards in WECC, how aggressive a state's RPS is isn't necessarily dependent upon the percent or year. Each state's RPS is unique and follows different rules. California

has the highest target. Oregon is next. Hawaii is 100 percent by 2045, and Vermont, New York, New Jersey and Washington, D.C., have higher than 50 percent targets.

Looking at California's resource mix, Northwest imports accounted for about 14 percent in 2017. Most notable were wind and large hydro imports and market purchases (presumably hydro).

In 2017, compared to prior years, hydro increased to its highest amount since 2006. Nuclear plants are disappearing: SONGS closed in 2013, and Diablo will to close in 2024-25.

Member Baker noted that solar development in California has resulted in more hydro staying in the Northwest, and he's not seeing that in the charts. Charles replied they've seen suppressed charges and time of day. Once we parse it out, we might find out more. Ollis added that it's an annual look. We'll probably see the biggest effect seasonally.

Charles and Ollis talked about flow volumes from the Northwest to California. There are times when it flows from south to north. Looking at flow shapes, the shape has changed and so has the magnitude. They hope to explain more after some analysis. Member Karier observed that February looks like a duck curve, but in July, it doesn't.

California's broader goals call to reduce greenhouse gas levels back to 1990 levels by 2020. California is the fifth-largest economy in the world, Charles said. When it passes legislation like this, others take note.

Ollis said at the next Council meeting, staff will present analysis modeled in AURORA, comparing how this policy effects the WECC-wide buildout of resources, wholesale prices, regional import and exports, and carbon emissions and production costs.

Member Anders asked if this analysis will include the effects of the executive order in terms of possible incentives. Ollis said that would be great. In the bill, there's not much of a ramp for the 100-percent clean economy, and no emissions in the transportation sector. The 100-percent clean energy is a pretty big deal. Mass electrification in California would require some shifting of load and demand response.

Member Karier said it looked like six percent of California's carbon is embedded in imported electricity. So they're importing carbon and restricting imports of carbon. The idea is to push the development in-state, Charles said. Not all the legislation lines up. It was a rhetorical question, Member Karier said.

Kujala said they might be calling in-state hydro different than imports. Let's not assume California will snip the wires and become an island onto itself.

Mike Starrett, energy analyst, remarked that on a seasonal basis, you can see where we would have sent power south in the spring. Overall flows are up and that's driven by economics.

Starrett said, for Member Karier, the reason why you don't see the duck shape in July is because gas ends up being below their operating costs during those midday hours. Load is relatively low.

10. Council business

Northwest Power and Conservation Council Motion to Approve the Minutes of the October 9-10, 2018, Council Meeting

Member Anders moved that the Council approve for the signature of the Vice-Chair the minutes of the October 9-10, 2018, Council Meeting held in Wenatchee, Washington.

Member Booth second
Motion approved without objection.

Member Karier said he wanted to note that his term ends January 2019. He told the governor that he wants to go back to the university. He has enjoyed his work at the Council. It's been a dream for an academic to be involved in the topics such as those we've seen this morning, he said, and noted that he's worked with 27 Members over the years.

Member Booth said he wanted to thank everyone again. As we part, I want to give something in tune with our mission of energy conservation and saving the planet, he said. He announced the donation of LED light bulbs to replace the incandescent bulbs in the desk lamp in the Idaho office.

There was no public comment

Chair Yost adjourned the meeting at 12:11 p.m.

Approved December ____, 2018

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Vice-Chair