Northwest **Power** and **Conservation** Council

Council Meeting
January 10 and 11, 2016
Portland, Oregon

Council Chair Henry Lorenzen called the meeting to order at 1:32 p.m. Members Tim Baker, Tom Karier, Bill Booth, Guy Norman and Henry Lorenzen were in attendance, and Jim Yost joined by phone. Jennifer Anders was delayed because of the weather.

Reports from Fish and Wildlife, Power and Public Affairs committee chairs

Fish and Wildlife Committee

Committee and Council Member Booth gave the committee report. He said the committee heard a presentation by BPA that the agency is under pressure to improve its financial situation. It is stable, but its debt ratio is higher than they want it to be. BPA also discussed the use of cost-savings funds. In fiscal year 2017, the cost-savings workgroup found $600,000 in savings. He said that $200,000 has been allocated to the O&M subcommittee on hatcheries and screens infrastructure, and that $300,000 is still available. There was a discussion that the funds should go to higher priorities. The first is a sturgeon proposal. The committee approved a request for information that will attract requests for proposals and projects to improve knowledge about white sturgeon. Also in the queue are some potential projects on cold-water refugia and lamprey. BPA notified the committee that it will be more difficult to achieve these savings going forward as funds are tightening. Its costs are impacted by the Federal Columbia River Power System's (FCRPS) National Environmental Policy Act (NEPA) BiOp requirements. BPA proposes that in the future, some of the savings may need to be apportioned to some of those NEPA costs. There will be more to come on this topic.

Then they discussed the committee staff's recommendations on the Integrated Status and Effectiveness Monitoring Program (ISEMP), Columbia River Habitat Monitoring Program (CHaMP) and Action Effectiveness Monitoring (AEM) program. Staff recommends developing a list of questions for scientific review. It would take a month to review and refine them before sharing the list with the Council next month or the following month. Also, staff proposes that BPA come to the Council with a synthesis report on its work in the tributaries.

There was an update on the project review on our 600 projects, Member Booth said. There are six umbrella projects in the region. Information has been requested and there will be a meeting February 16, after the Council meeting, when the umbrella project managers will come and present their projects. Council Members are encouraged to stay over and attend.

The committee is moving to a review of its 30 wildlife projects hoping to complete them this year. There will be a three-day symposium April 18-20, where managers will present these projects. The committee held a discussion on the recommendation that came from the O&M subcommittee on funding for hatchery projects. As stated, the Council approved $200,000 in savings for mission-critical hatchery projects. An engineering firm reviewed 12. A list of critical projects was identified for potential funding. Two additional facilities still need to be visited and that will take place this month.

The committee approved $165,000 for five projects, with $35,000 for contingencies and for work on projects on the hatcheries that haven't been visited. Fiscal Year 2017 ends in September, so the Council sought off-the-shelf projects that could be completed by then. Those were approved and are ready to go.

The committee will now work on Fiscal Year 2018. They discussed that they will need to take a more strategic look at 2018 and beyond now that they have a basic template. The goal is to develop an overall strategic plan to identify larger, more expensive projects. Member Booth said they had a good year on the O&M subcommittee on the screens. They completed the database and trued up the specifications for 1,000 fish screens. Idaho Fish & Game will be the guinea pig. It is creating a template that will be brought to the committee, and the rest of region can take a look at it.

Last, there was a discussion on the seven emerging priorities in the program, and Member Booth said they are making good progress on each. Plans to re-do the research plan will be discussed tomorrow.

Member Lorenzen said that the Fish and Wildlife Committee has allocated funds for hatchery maintenance. My determination is that no vote is needed, he said. Without a stated objection, we'll go along with that recommendation.

Power Committee

Power Committee Chair and Council Member Karier said the committee discussed four issues. They looked at a work plan for the Power Division. It reads a lot like the action plan in the Seventh Power Plan. These topics include: looking at expanding energy efficiency in hard-to-reach areas, (such as among renters, low-income and rural people), developing demand response, improving forecasting models, energy storage and electrification of transportation.

They did a detailed review of the Aurora Model — understanding how it works, and what it can and can't do. The model develops a price forecast for the entire West. From that, we learned which are the resources used for generation, and which ones are cost effective. Also used that model to determine how much carbon is emitted from the western grid. Those slides will be on the website.

Staff is looking at load forecasts outside of the Northwest. We need to look at the entire West Coast because it determines the market, overall prices and what happens in the Northwest, Member Karier said. We learned how staff does that, relying on the West Coast Energy Coordinating Committee for WECC, Lawrence Berkeley Labs and the California Energy Commission.

Last, the staff provided a primer on energy efficiency and how it is defined. They looked at how the Northwest Power Act defines energy efficiency, which is "Does the opportunity reduce electric power consumption?" And, "is the reduction in electric power consumption the result of an increase in efficiency of energy use, production, or distribution?"

It could be due to more-efficient appliances, and it could be more efficiency in industrial processes that saves energy and makes products more efficient to produce. There are other methods such as automatic thermostats.

Public Affairs

Public Affairs Committee Chair and Member Yost said there was no meeting last month and there wouldn't be one today.

Member Lorenzen welcomed new Council Member Tim Baker from Montana, remarking that the good news is that "we haven't reduced our number of lawyers on the Council." Member Baker has served as an attorney for Montana Public Service Commission and Department of Environmental Quality. Most recently, he served four years as Governor Bullock's natural resources advisor, dealing primarily with energy issues. He'll get up to speed quickly and make a positive contribution to our work. He also served as the executive director of the Montana Wilderness Association and as communications development director for Montana Trout Unlimited. Therefore, he has experience on both the power and wildlife sides.

1. Panel Discussion on renewable resource development in the Northwest

Rachel Shimshak, Renewable Northwest's executive director, introduced renewable resource development panel discussion. She said Renewable Northwest is a public interest organization, not a trade organization. They're clear about their biases, working to create markets for renewable energy. They deal with transmission and integration issues, and state citing protocols. The organization covers the same geographic area as BPA.

Reviewing renewable projects sited since 1998, Shimshak noted that the total renewable megawatts was in the two figures. Today, wind, solar and geothermal projects are hugging the region's transmission lines, and there is a tremendous amount of activity that has taken place over the past 20 years. We'd like to think we support these activities, Shimshak said. Today, the number of renewables total 8,000 MW.

There are renewable energy standards in three of the four states in Oregon, Washington and Montana. OR increased to 50 percent last year. There are tax incentives in all the states and a

vibrant retail market for purchasing renewables. Many utilities have programs for that to happen.

Added up, more than $21 billion has been invested in regional projects and manufacturing, which has created almost 12,000 jobs.

Looking forward, there are coal retirements — some a function of policy and others that were having trouble competing. It adds up to a lot of megawatts of opportunities. The replacement of Boardman is a conversation underway at PGE. The first of two Centralia units needs to be replaced in 2020. How we meet that opportunity is our next great challenge. Hopefully we'll be meeting that with renewables as opposed to fossil fuel generation.

Derek Reiber, Vestas Americas' sales director, provided some background on his company. Vestas is based in Denmark. They monitor 58 gigawatts (GW) of turbines globally, including 27 GW in the Americas. They have installed 56,000 turbines in 75 countries. The U.S. has been a key market and driver for wind power. In 2015, its revenues were over 8 billion euros. In 2016, it will probably be around 11 billion euros. They have announced 3.6 GW of orders, including safe harbor purchases. For 2016, Vestas will end up with 40 percent of the U.S. market, with General Electric nudging them. Vestas' North American presence is far and wide. Portland is the U.S. headquarters, employing 250 people. In the Pacific Northwest we have 800 turbines. Three years ago, Vestas moved its U.S. manufacturing base to Colorado, employing 3,600 people. At its Pueblo facility, they produce blades, cells and towers. In the U.S., they have a sizeable footprint: 18.4 GW from more than 20,000 turbines being monitored.

Regarding wind's cost competitiveness, Reiber said we've seen north of 80 GW of wind in the U.S. It will be 83-84 GW this year. The PPA prices have dropped steeply. The average is $20-25 dollars per MWh. Wind is highly cost competitive. The levelized cost of wind energy has dropped precipitously over the last eight years, more than 60 percent since 2009. Wind turbines are getting more cost-competitive.

Member Lorenzen asked, with a PPA of $20, how does that fit with PURPA avoided costs pricing? Reiber replied that we've seen $20 in the wind bill, and that doesn't correlate to the avoided costs of that specific utility, since PURPA is a function of their avoided costs. Member Lorenzen asked if the wind generators typically enter into a PURPA-related contract. Reiber said no, they are typically market PPAs that are generally 15-20 years. Shimshak added that Reiber is referring the wind prices that are popular in the Midwest. We'll have other information about Northwest prices, she said.

Reiber said there have been large drivers on the corporate/industrial side. By mid-2016, 1.6 GW of corporate offtake deals had been signed. At the end of 2016, it should total to more than 4 GW. It's driven by the fact that the cost of wind energy has been below wholesale. Corporations also have their own green targets, which help get them outside of the rec market. In regulated markets, there's an impetus to use different structures. For example, Amazon announced it wanted to source power from a community wind farm, and couldn't do so directly, so Dominion acquired the farm and allowed it to happen.

We're also seeing that for many utilities, the integration costs of wind are dropping down. Even with utilities with low penetrations of wind, the cost of integration is relatively low. Certain territories in Northern states have integration costs that are just north of a dollar. In the Pacific Northwest it's about $5-6 per MWh. The ancillary technology is improving. There is better day-ahead and real-time forecasting, and it allows utilities to plan for it.

Turbine advances are helping drive levelized costs of energy. Rotor sizes are getting larger and manufacturing is more efficient. Wind turbine capital expenditure costs related to installation are about 70 percent. If we can drive down the cost of the machine, we can pass that along to the consumer, Reiber said.

Reiber discussed the different types of turbines available, such as a 2 MW, Type 3 machine. It requires some compensation at the substation. The trend is toward the nameplate of the generators getting larger and the rotors getting larger. Type 4, 3 MW platforms are gaining a lot of ground as well.

Johnny Casana, EDP Renewables, formerly Horizon Wind Energy, opened up shop 16 years ago. EDP is now the third or fourth-largest wind developer with 10 GW of installed capacity globally. It is the largest customer of Vestas. Companies have thought of us as a trendsetter in wind, Casana said. We have a Northwest footprint, but it's been challenging to get projects over the finish line in the past few years.

Wind is extremely cheap, but it wasn't always, Casana said. That value has been difficult to capture in regulated markets. Bilateral transmission has something to do with that. "The Northwest is losing investment opportunities from companies like mine," he said. "My development team in the Northwest competes internally for capital against teams in the central region, eastern region, Canada and other parts of the world."

Casana said the costs decline as the size increases. What this has meant for procurement nationally is that if you're running an RFP as a utility, and you're anticipating prices that are six months or a year old, you're out of date in terms of what prices to expect on an energy basis. If you're thinking about data from your last procurement, and that was five or six years ago, it's archaic. You might as well be talking about a Model T and we have jet engines. When we plan for the future, the inputs that go into our models are from recent market tests.

Casana talked about advances in manufacturing turbines.

Regarding the value of wind for the Northwest, Casana said it is not as low as the wind belt. "I would say that $20 per MW is a little high," he said, which triggered some laughter. "No, seriously, that would not win a bid in some of the lowest-cost markets. Out here, we're more in the middle of the spectrum."

In the Northwest, sometimes you hear that the PTC has expired, he said. It has, but the vintage, 100-percent value turbines are available and will be through 2020. It's a bit of a clearance sale. There's a fixed and diminishing supply. There are projects with PTC vintage that can be applied to them. Our Northwest projects could get those, but we're competing with our teammates using those same turbines. The first utilities that get an RFP out to capture

that full PTC market will get it, while those late to the game will miss out. It's as cheap as it will be in our lifetimes.

Even without the federal subsidy, wind is competitive with conventional generation. It wasn't five years ago. It's something we should consider in long-term planning. Something we spent time working on in California, is when you have that cheap energy, it doesn't get captured as value in the system unless you go beyond merely plugging it in to the system. Wind and solar can be used to provide ancillary services.

Some of the challenges that we're facing in the Northwest have to do with WECC being mostly a bilateral and fiscal market where transmission is concerned, which means there isn't an opportunity to optimize dispatch across a wide footprint. All of the markets that have expanded their footprint of grid management have seen dramatic decreases in integration costs of variable resources, and they have enabled more cheap power to come online. Casana talked about bringing a project for Amazon online in Ohio. It was a liquid market where it could buy the recs and EDP could sell the energy into it. We don't have that ability here, so the integration costs for those customers can be 2 to 10 times greater. That means the Northwest is losing opportunities it might otherwise have. The commercial market is the fastest growing.

Jeff Bissonnette, executive director of OSEIA, said his organization is a trade association focused in Oregon. Its membership is large and small solar manufacturers. A utility executive was quoted that solar is where wind was 8-10 years ago, but it is growing. In Oregon, we're still 1 percent of the overall energy mix, Bissonnette said. While costs have been coming down and while the opportunities have increased, we're still an emerging industry in need of incentives. The extension of the tax credit at the end of 2015 came as an unexpected breath of life for a lot of companies. However, the industry has to plan for smaller or no incentives, but it won't be today or next year.

Solar technology is improving, prices are falling and installations are increasing. In Washington, incentives took a break — some of the incentives stalled and net metering limits were reached. That meant that some of the companies started doing more business in Oregon. If we want solar to grow and continue, he said, we need to continue our reputation as a stable and friendly marketplace. Oregon rates fourth most solar-friendly marketplace in the country.

Solar can be a stand-alone resource, but it is better if thought of as "solar plus." Examples include solar plus EV, solar plus storage, solar plus demand response.

Coming up, OSEIA is working with the Green Energy Institute to dig in where we are and what's possible over the next 10 years. We'll be releasing the Oregon Solar Plan in February. We hope this will guide regulatory, legislative and industry discussions. We'd be happy to come to another Council meeting to discuss.

Michael Cressner, Orion Renewable Energy Group on Montana wind development:

Orion focuses across the country and the UK. It has 4,700 MW of projects. Cressner oversees Orion's Northwest development assets. The company developed the Biglow wind farm, which

is owned and operated by PGE. They have assets in the Columbia Gorge as well. We're keen on opportunities in Montana, he said. Across Oregon and Montana, they have 1,300 MW of development assets.

Why Montana wind? Cressner discussed Puget Sound Energy and PGE's 2014 load data. The resource curve shows why Montana wind fits the need for Northwest power customers. We peak at the same points as Puget and PGE demand grows. Columbia River Gorge wind is a summer-peaking resource. Montana trends toward winter peaking. It presents huge capacity value that Montana wind is unique in providing.

In terms of high capacity factors, it's difficult to compete with Montana. Oregon and Washington project NCF's typically range between 30-38 percent, which is a standout resource. In Montana, it is mid 40-50 percent.

Pricewise, Northwest Energy's most recent QF project signed a PPA starting at $34 per MWh to the high $30s per MWh. That's unheard of in Montana.

They are RPS compliant: Montana projects can comply with the Washington RPS. That's less of an issue for Oregon and California.

The region is transitioning from a fossil fuel based grid to a carbon-free one, Cressner said. In Montana, Colstrip retirement will present a problem. The projects we're developing will present opportunities for those communities. Our project will provide as much tax revenue as the entire Colstrip power plant.

Cressner listed the hurdles to development, which are not unique to Montana:

Transmission – the largest obstacle to opening the market for export. The antiquated transmission charges (the intertie rate) and uncertainty around future costs and availability.

Colstrip Transmission System (CTS) – As Colstrip units come offline, what happens with existing rights? How will upgrades be paid for and how will new capacity be awarded?

I-5 bottleneck – I have no rabbits to pull out of my hat to solve this, Cressner said, but there is unused capacity and rights that could be allocated.

Regulatory and market uncertainty: "These are special times," Cressner said. Montana wind has not been treated equally historically in IRPs, compared to Oregon and Washington. Now that's changing. Portland General and Puget are going through the IRP process. We're noting that there's a lot of movement in how it's being treated, the cost of transmission, and that the capacity factors for Montana wind have been 45 and above. There's now greater recognition on how low the cost is to installing wind.

Portland General was aggressive in its goals for new resource procurements, citing the PTC as the main reason, Cressner said. How utilities will view that will affect the pace of development both in Montana, Oregon and Washington.

Regarding the PTC in general, we're hoping that with the new administration, the IRS won't do

a 180 in terms of its current guidance, Cressner said. In terms of tax appetite for tax credit investors, what the effects of changes in corporate tax structures from the federal government will play into the timing and demand from the PTC side of the appetite coming from the market.

The other exciting thing is seeing industrial customers separating themselves from that, such as Google, Amazon, etc.

The RPS: Oregon's increase in the RPS and California's will increase demand for projects in Oregon, Washington and Montana.

Member Bradbury asked, the RPS in Oregon has been moved up to 50 percent by when? By 2040, Shimshak said. There are incremental steps. Washington is 15 percent by 2020. And Montana also is at 15 percent. They are pursuing a post-2020 policy in Washington, whereas any utility would meet the growth they have with a combination of clean energy resources. We are building support for that in the legislature.

Member Karier expressed interest in the Midwest price of $20 per MWh. "That's showing up in bids for new wind generation?" he asked. Casana replied, "Yes, it's due to the 55-58 percent capacity factors."

Member Karier asked if Montana is in the ballpark for those capacity factors or still below.

Casana replied, "I think the delivered costs might be close to that, but by the time you deal with transmission … the Midwest wind belt has those liquid markets where you're not adding on those wheels."

Cressner discussed the transmission market differences. Liquid markets provide challenges in how you cost-out that risk, he said. "You see high capacity factors in Montana, but not the kind you see in Kansas. In terms of a good price point, coming in with a price point of $32 in Montana, others could come in less than that.

Member Norman asked if there is a target area for Montana wind development prospects. Cressner replied that it's traditionally in the western part of the state, but we're focused on the east side. Not that any region is better than another. Every company has its philosophy of solving the transmission issue. Montana is extremely underdeveloped to get high quality wind resources. It's not as finicky as it is in the Columbia Gorge.

Member Karier remarked, "I was reading about a pump storage project in Montana to take advantage of Colstrip. Is that kind of thing complementary to wind development?" Cressner replied that overall, yes, it's complementary. Especially when you have baseload resources retiring.

Shimshak added that they're intending to use wind power to pump the water up the hill to bring it back down to supply the storage capability.

Member Karier asked if that helps solve their resource problem. Cressner replied that it doesn't hurt. Upgrades on CTS would provide 600 MW of additional capacity on the line.

Shimshak said they made requests of NTTG to study what changes would need to be made for the Colstrip line to deliver wind versus coal. A preliminary look is that it wouldn't take that much. They are hopeful that between what PGE and Puget might need to replace its coal facilities, a combination of resources could be used. It's not just a renewable standard thing, she said. These are low-cost, low-risk resources that are good for customers and the system. They would do what the RPS were intended to do — to have renewables replace power because they're the right economic and reliable choice.

Member Lorenzen said, "On one hand, we show PPAs related to wind in the Midwest at $20 and $34 for Montana. These numbers seem low in terms of what we've been hearing this last year. Are they coming out with all-in costs? Are we at a point where we have relatively high PLATT factors at $20 a MWh or less?"

Reiber replied that $34 was referencing a specific RFP in Montana. From what we've seen in the Midwest, it is true. There's the PTC, which is part of the revenue stack of the developer. Member Lorenzen asked what is the levelized cost of generation in the Midwest? Casana said it varies project by project. Some of it is proprietary. The sub-$20 is real, including the PTC.

"Out here (the Northwest), you're talking about the $40s, hovering around the $50s, which is lower than three years ago," Casana said. "If you have the right project, right need, right time, you could drive it down even further."

He said that Colstrip comes off line in 2022, two years after the federal PTC is unavailable. It seems like a narrow window and you might make a "no regrets plan" to expedite moving forward.

Member Lorenzen asked what is the lifespan of a wind project? Casana said they do 25-year business models based on equipment warranties.

Bissonette said they're starting to see the same economics for solar on a smaller scale. As we looked at new RPS, in 2007, we looked at meeting load growth overall. As we looked at the new RPS, we're taking coal out of the system and how we going to replace it. For PGE and Pacific Power, we want to do all the efficiency we're doing. As you do your regional analysis, it's a wash. You want to look at how utilities are trying to meet their load.

Member Lorenzen asked how the electronics have changed over the years? Reiber answered that the turbines are much more capable. Collectively, they can integrate more smoothly with the grid. That means the developer doesn't have to provide a control room solution. It's also a function of the grid stability, looking at what it's capable of taking.

Member Lorenzen asked, with the new systems, could they provide frequency control? Reiber replied, yes. Casana said there were standards in California that passed in 2004 to provide those kinds of insulator supports in every turbine gearbox manufactured. So everything for the past 13 years is very different than what came before that — they're variable and not intermittent. It used to just come on and off, now it's a slow up and down. It can be used for more than it's being asked to right now. The same goes for solar with the right kinds of converters.

Member Bradbury wondered about transmission: “I realized that there’s a question mark in my mind about transmission —how it’s regulated, controlled, and who does it. It’s not all through the PUC. What needs to be done to make sure the transmission system is available for these renewable resources?”

Casana replied that one thing we don’t do is talk to each other. In WECC, there are 38 different BAs that handle their own transmission, he said. In MISO, there are 15 states with one BA. Their software is a single brain looking at different resources. Here, when they want to share reserves and resources, they have to call a human. Other places have technology trading in real time. Let’s upgrade the computer software, rather than relying on land lines.

Shimshak replied it’s a good question. Many utilities in the West are participating in the EIM. There’s a five-minute cartoon on their website. It breaks down the vulcanization of the system. Maybe someday we’ll graduate from the energy imbalance market and put together a regional system operator that rationalizes all of the resources together, she said. We’re not there yet, but at least there’s a conversation going on.

Shimshak concluded the presentation by saying that people used to think that renewables were high cost and energy only — not able to contribute to the grid. Costs are low and are falling even lower. Solar and wind can add services to the grid to help other resources be balanced. We’re anxious to work with Council staff to provide new information. Economic development felt by renewable projects is real. Sherman County in Oregon has more turbines than people. The county has planned over 20 years on what to do with the revenue from those projects. They have improved educational programs, improved roads, etc. Now they’re writing a $500 check to every resident of the county. There are tangible benefits to renewables. There are opportunities in replacing coal plants that help the communities being disadvantaged. The PTC is available now, so we’re urging utilities to buy early. It’s a buyer’s market with good deals to be had.

“Our organizational idea is to have a policy push and a market pull to increase renewables in the region,” she said. “Renewables and clean energy are what customers want. We hope this reduces the need to build new, fossil-fuel generation.”

2. Briefing on small modular reactor technology, opportunities and potential

Jim Gaston, Energy Northwest’s energy services department general manager, and Christopher Colbert, NuScale Power’s chief strategy officer, introduced small, modular reactor technology, discussed current opportunities and its development potential in the Pacific Northwest.

The Seventh Power Plan identified small modular reactors as an emerging technology and an alternative to conventional nuclear power plants.

Energy Northwest and NuScale are participants in the Carbon Free Power Project (CFPP), led by the Utah Association of Municipal Power Systems (UAMPS). The CFPP is currently

working to site, license and develop a small modular reactor on the Idaho National Laboratory (INL) grounds.

Gaston reviewed Energy Northwest's history, which started in 1957. The joint operating agency has 27 members, five municipalities and 22 PUDs. It has plenty of operating experience with Packwood Hydro, Columbia Nuclear Generating Station, Nine Canyon Wind Project, White Bluffs Solar Demonstration Project and Tieton Hydro. O&M is an expanding business line for Energy Northwest.

CFPP is a 12-module, NuScale, small modular reactor plant.

UAMPS is the project lead, owner and licensee with the NRA. It is doing both project development and is developing power purchase agreements (PPAs) with all or part of its 45 member cities involved in the project. NuScale is the design authority. It's their plant design and will provide the nuclear plant. Fluor is the EPC contractor for the facility at the Idaho National Laboratory. Energy NW is the consultant on the project and will have the first right to be the O&M service provider to UAMPS on the project.

UAMPS has finished the final site selection report and is in the process of obtaining water rights for the project. A study is being conducted on if using hybrid dry cooling at the plant would have advantages over wet cooling towers. That will influence the final economic modeling. UAMPS is making a decision to go to a combined license application at the end of the first quarter 2017.

Energy NW is doing preliminary work for the operator licensing and accreditation program

Gaston provided an overview of the Idaho National Laboratory site (INL) near Idaho Falls, its characteristics and reactor site selection criteria.

He outlined the CFFP milestone schedule:

- NuScale submits the design certification application (DCA) – Dec. 31, 2016
- NRC approves the DCA – 2020
- UAMPS starts combined operating license application (COLA) Development – 2nd quarter 2017
    - Submit COLA – mid 2019
    - They expect the NRC to issue the COLA in mid 2022
- Fuel load Module 1 – 3rd quarter 2025
- CFPP in full commercial operation – 2nd quarter 2027

Economics

The economic modeling of the project continues to be examined. The cost of power will be competitive with alternatives, with natural gas being the short-term exception, Gaston said. The capital cost is estimated at $2.5–$3 billion with a levelized cost of $78 per MWh over a 40-year life of the plant. The project has a 10-20 percent cost add.

Back in 2013, a study by URS for the Tri Cities Development Council that analyzed the Hanford site. Completed in 2014, It found that the previous Northwest Energy sites for Units 1 and 4 would have considerable advantages over a purely greenfield site for construction of a small modular reactor in Washington.

Christopher Colbert briefed the Council on the nuts and bolts of the project.

He reviewed the history of NuScale and its accomplishments. NuScale technology has been in development and design since 2000.

He announced that NuScale submitted a design certification application to the Nuclear Regulatory Commission on Dec. 31, 2016.

NuScale's total expense to date is $507 million in designing and developing the technology. NuScale also has been demonstrating a 1/3 scale test facility at Oregon State University since 2003.

A NuScale Power Module (NPM) is a reactor producing 160 MW of power, generating 50 MW of electricity. It is 76 feet tall by 15 feet diameter, and weighs 150 tons. It isn't small enough to fit into a car, but it's about 1/20 the size in terms of output, he said. The plant takes 12 of those, puts them in a building, set in a pool of water for cooling. They get 600 MW net out of it.

NPMs can be incrementally added to match load growth – up to 12 NPMs for 600 MWe gross (~570 net) total output.

Colbert described a normal operation. It's similar to a heat exchanger and simpler than a steam turbine. It's not using any pumps. That affords us the ability to have a higher ratio of water to MW thermal, he said. Nuclear power plant challenges are losing power and losing pumps for cooling. If you don't use pumps for cooling, you eliminate that danger. Refueling is performed by performed existing fleet operators.

Colbert described the building dimensions. The facility is 34.5 acres within a protected area. About 360 people work at the facility. A 600 MW coal plant might have up to 120 people.

Member Karier asked if the operators could you refuel each model simultaneously? No, replied Colbert, they're sequential. Refueling is staggered once every two months. Member Karier asked if they could you frame it around the spring runoff. Yes, we could, Colbert answered.

Colbert discussed the facility's containment design for safety. It can withstand 1,000 psi of pressure, he said. There's no external release. By going small, we made the containment small and it's stronger than a concrete building, he said. It's like a thermos bottle. There are a limited number of penetrations that are all leak-tested. Also, a vacuum keeps the heat from releasing into the environment.

Discussed steps to reduce plant risk. "Probability of core damage due to NuScale reactor equipment failures is 1 in 100,000,000 years," he said. If something were to happen, our

modules are 1/20th the size of a conventional reactor. There's much less radioactive material. Also, there are typical barriers found in a large plant. In our design, you're in a pool of water in a steel-reinforced concrete vessel. It's a "once in a universe" chance of an event. It also has a smaller Emergency Planning Zone, he said.

For $507 million, we've built a lot of hardware, he said. Colbert then provided an overview of NuScale testing programs.

Colbert read a slide on the facility's cost competitiveness:

- NuScale's power module enables utility companies to "right-size" their power plants for current needs, then add capacity as necessary.
- Design simplification enhances safety, reduces maintenance, and improves plant availability.
- Off-site fabrication and assembly reduces costs, and components are delivered to the site in "ready-to-install" form. As a result, construction occurs in a shorter, more-predictable period of time.
- The workforce needed to build NuScale power plants are measured in the hundreds, not the thousands.
- The short, three-year construction schedule provides greater assurance that the plant will achieve operation before unforeseen external events impact the schedule.
- The projected first plant levelized cost of energy (LCOE) is $98/MWhr, and improving.

Colbert talked about design simplification — because we got rid of reactor pumps and eliminated systems and components, this simplification results in a safer design.

Looking at the estimated average U.S. levelized cost of new generation resources, the technology falls below sequestration. Gas prices are at an all-time low now, but if there's a carbon tax then we could fall below that, he said. We eliminated 73 percent of reactor scrams (which are actuations of the safety system).

NuScale forecasted its prices and performance against other types of energy. Its cost falls below coal. Combined cycle turbines have natural gas, which is at an all-time low. But if you have a carbon capture or a carbon tax, we can be fairly competitive. Other intermittent resources, such as wind, don't include the effect of Production Tax Credits. NuScale also can be operated up and down fairly rapidly.

Member Lorenzen said one of the problems is what to do with waste and asked what's happening on that front.

Colbert mentioned the perennial dispute over the Yucca project. It's not really waste, he said. "We only use 5 percent of the energy in the fuel, then there is other stuff that — instead of reprocessing — we take it out and put new fuel in. In the next year or two, we'll have a solution for interim storage. It's not a technical problem; it's a political issue. There are a number of people looking at doing it on a private sector rather than having it forced on them by the federal government."

Member Booth asked Gaston about the Columbia Generating Station and asked the cost per

MWh. Gaston replied it's under $42 per MWh. That includes fuel, etc. They have a trajectory to decrease that cost as we work with BPA on the 2028 program.

Member Booth asked if that includes fixed costs. It's all costs under the debt service, Gaston replied.

Member Karier said, "You said it has a better ramping than a traditional nuclear plant." Colbert said that each turbine has capability of 100-percent bypass. Member Karier said, "So the power keeps generating, but steam is diverted." Colbert said the reactor can go to 50 percent in 10 minutes. It comes down to an optimization question.

Member Karier commented that they had a price of $98 per MWh. Another chart showed $78. Colbert said the EIA methodology assumes an IOU getting a return on its equity on its debt of $78. It's the cost of capital for a municipal power system.

Member Lorenzen announced that the Council would go into a brief exec session.

Adjourned at 4:05 p.m.

Because of inclement weather on January 11, 2017, the Council Meeting was not completed. Following is the remainder of the January 2017 Council Meeting, taking place prior to the beginning of the February 14-15, 2017 Council Meeting in Portland, Oregon.

Continuation of Council Business from January 2017

- **Approval of November 2016 and December 2016 minutes.**

Northwest Power and Conservation Council Motion to Approve the Minutes of the November 15-16, 2016, and the December 13-14, 2016, Council Meetings

Member Booth moved that the Council approve for the signature of the Vice-Chair the minutes of the November 15-16, 2016, Council Meeting held in Coeur d'Alene, Idaho.

And

That the Council approve for the signature of the Vice-Chair the minutes of the December 13-14, 2016, Council Meeting held in Portland, Oregon.
Member Anders second. Approved without objection.

- **Council decision to adopt Annual Report to Congress for Fiscal-Year 2016.**

Northwest Power and Conservation Council Motion to Approve the Annual Report to Congress for Fiscal-Year 2016

Member Booth moved that the Council approve the Annual Report to Congress for Fiscal Year 2016 as presented by staff. Member Bradbury second.

John Harrison, staff information officer, said the annual report should have been out a month ago. He said it's the only time where there has been more direct comments from Council members than from the public by a count of 2–1. There has only been one comment from the public in 90 days. Staff added text about Member Norman's appointment, information about invasive mussels in Montana, and Governor Bullock's executive order on that topic from last fall. Staff removed references to the "duck graph" as too complicated. Harrison said that staff is carefully tracking events in California and their potential impacts on the Northwest. He added that a letter from Elliot Mainzer was inserted into the report.

After a call for a vote, the motion was approved without objection.

- **Election of officers**

Member Karier nominated Member Lorenzen to continue his service as chair. Member Booth seconded. Member Bradbury moved to close the nominations. Member Booth seconded. Ayes carried.

"It's a real honor," Member Lorenzen said. "I have enjoyed the opportunity to chair this past year."

Next, there were nominations for Council Vice-Chair.

Member Bradbury nominated Member Booth to continue in his able job as Vice-Chair. Member Anders second. Member Bradbury moved to close the nominations and that there be a unanimous ballot for Member Booth. Member Karier second. Ayes carried.

Member Lorenzen adjourned the January meeting at 1:37 p.m. on February 14, 2017.

Approved March ___, 2017

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Vice-chair