Northwest Power and Conservation Council
Conservation Resources Advisory Committee
February 14, 2019

Massoud Jourabchi, NWPCC, began the meeting at 9:15 with introductions in the room and on the phone.

Discussion of the Council's planning process and brief over view of the Council's long-term Demand model

Jordan Prassinos, Idaho Power, asked if the forecasts to be discussed are pre or post energy efficiency programs [Slide 4.] Jourabchi answered that he produces three different load forecasts and more information is coming on the next slide.

Terry Morlan, Independent, asked what the market for the natural gas demand forecast is. Jourabchi called the natural gas demand forecast a great enhancement to the modeling work which allows for the exploration of different policies like deep decarbonization. Steve Simmons, NWPCC, added that natural gas information will not be fed into the RPM but it will affect the electricity load forecast.

Morlan asked if AURORA is still being used [Slide 5.] Jourabchi answered yes, but its output is fed into the RPM as wholesale prices.

Attendee on the phone asked when a carbon price forecast is developed. Jourabchi answered that the Sixth Plan had an explicit carbon tax range but Council staff don't develop a price but instead rely on a third-party consultant or advisory group. He added that any carbon price is layered into what consumers see in a retail price.

Prassinos referenced the vintage of load shapes used and noted that they would add some small biases and not accurately capture current customer behavior. Jourabchi agreed that some shapes are old but stated that calibration techniques will adjust the shapes. Morlan confirmed that the load shapes are adjusted by the same factor and wondered how missing something, like a policy change, will affect the forecast. Jourabchi said the calibration value varies month to month. He agrees that a calibration technique is not as ideal as updated load shapes. Morlan recalled historic encouragement of organizations to update their load shapes, acknowledging the difficulty of the task and barriers to sharing information. Prassinos voiced appreciation of the calibration effort.

Fred Heutte, NW Energy Coalition, asked if information from Global Insight drills down to state-level granularity [Slide 9.] Jourabchi answered that Global Insight starts with states and he brings in national trends. Heutte asked if Global Insight breaks down information beyond the state level. Jourabchi answered that there is a companion product that gives fairly good, shift share allocation factor county-level data. Heutte asked about Global Insight's data sectors.

Jourabchi explained Global Insight's two products and other products used. Heutte called the information very detailed.

Morlan recalled that past Plan work put the regional growth rate equal to the national rate. He called this bothersome and wondered how to get a differential growth rate in aggregate for the region. Jourabchi explained his present approach, emphasizing that he only uses the national trends to establish a delta between optimistic and pessimistic trends which he then applies to each class of business.

Morlan said he was trying to understand the rationale for using pessimistic and optimistic cases. Jourabchi said Global Insight doesn't give him enough detail to create a state-specific range. He said this is a case for relying on Advisory Committees as state economists are closer to the needed information.

Morlan asked if the region looks the same as the nation for population growth, employment and output. Jourabchi said we have our own path. Morlan asked if this method captures our higher regional growth. Jourabchi said there is a differential that may not capture it exactly.

Tom Potiowsky, PSU/NERC, referenced using a connection between square footage and employment as a determinant and cautioned that recent work with Metro finds that the relationship between employment and square footage is breaking down and may no longer be as reliable. Jourabchi agreed, noting that the key driver is employment, modified with a calibration.

Jim McMahon, Better Climate, called this approach good if the future matches history and asked how to capture other trends like increases in building retrofits or a Green New Deal. Jourabchi answered that his forecasting tool is end-use and he relies on the Advisory Committee for more accurate inputs about trends.

Tomás Morrissey, PNUCC, noted that OR and WA forecasts differ from what is shown during the action period on [Slide 10] and asked about the process. Jourabchi reported that this is IHS's base forecast and he will adjust the numbers based on Advisory Committee input. Morrissey suggested reaching out to experts about the Oregon numbers, particularly during the action plan period, and offered data. Amber Riter, PGE, agreed. Potiowsky stated that Oregon population numbers come from PSU's Research Population Center and Global Insight uses that data. Heutte noted that every state has an official Population Center.

Mike Paruszkiewicz, NW Natural, asked if components of population are being used. Jourabchi answered that he uses both, noting that new school additions are forecast to be very flat, which helps test individual cohorts. Paruszkiewicz offered a yellow flag, saying that migration numbers overwhelm natural increases and they are worthy of investigation.

Potiowsky called the expected negative natural increase in population amazing [Slide 11] and wondered if people who migrate have different energy needs than existing residents. Jourabchi answered yes and no as their formative habits are different.

Morrissey asked how much of the effects of [Slide 13] are due to a shrinking workforce versus relative life expectancy. Jourabchi called it a combination and workforce increases will have to be from migration.

Morrissey stated that he doesn't see a shrinking workforce on [Slide 12.] Jourabchi said there is a changing workforce and an increase in people 85 years and older.

Morlan asked if elder care facilities fall under Commercial versus multifamily [Slide 16.] Jourabchi answered yes, calling elder care facilities a new and problematic market segment as some can be in small homes. Heutte said he was surprised that elder care is Commercial as they are permanent residences. Jourabchi said they are big establishments that most utilities are treating as Commercial buildings. There are head nods of agreement in the room.

Heutte asked what portion of total residents are in elder care. Morlan guessed that it is small but growing. Jourabchi recalled a report that showed fast growth in large, elder care facilities.

Morrissey was surprised by the drop of multifamily homes as the region becomes denser [Slide 17.] Jourabchi agreed, saying these are preliminary numbers. Morlan added that it's hard to introduce business cycles into trend forecasts and this industry is very cyclical. Potiowsky said PSU's work shows the multi/single family split coming again. Jourabchi said affordability influences single family and numbers suggest that they may improve. Potiowsky joked that affordability looks to be moving from "can't" to "maybe."

Paruszkiewicz asked when these numbers will be locked down. Jourabchi called for all data as soon as it's available, noting that most of the numbers can be re-run until as late as early next year. Paruszkiewicz thought that single family numbers would come down and asked how they enter the model. Jourabchi said there are in levels; number of units and square footage. Paruszkiewicz thought that entering by levels would prevent a permanent, upward shift.

McMahon asked why Other Family growth rates on [Slide 16] are so much lower after 2017 as manufactured homes, 3-D printed homes and tiny homes will have some shares. Jourabchi called it a good point but referenced an increase in the 1980-90s that he tried to keep flat due to zoning rules that push this type of housing out of urban areas. He said the levels can be increased.

McMahon asked if climate and city plans will increase housing density. Jourabchi answered that his gut feeling is yes as any response to climate change is better achieved in a dense urban area than widespread rural areas.

Morlan guessed that smaller-sized homes would use less energy [Slide 21.] Jourabchi asked where new homes are being added. Paruszkiewicz stated that single-family is not a trend he sees in urban areas and smaller, infill homes are a transient trend that doesn't reflect the region as a whole. Heutte agreed that infill projects and ADUs are significant for densification but felt that there are a lot more four-five story apartment complexes replacing commercial structures.

Paruszkiewicz said OR state bill 20-01 proposes to get away from single family zoning for most of the entire state. Jordan Prassinos, Idaho Power, reported that Boise is seeing a trend toward less square footage to address affordability. Jourabchi suggested increasing market share for Multifamily and decreasing Single Family to reflect this input.

Morrissey asked for more granularity on [Slide 22.] Jourabchi said this comes from the RBSA which is a snapshot and not a time series. Aaron James, NEEA, said the sample size gets small when looking at individual years but the numbers can be seen. Morrissey asked about a post-recession dip in home size. Jourabchi said that can be seen and there will be a future dip by 5-10% because of affordability [Slide 23.] Potiowsky cautioned that meetings with developers say that building costs, SDCs and land prices make it hard to recoup investments in smaller homes.

Morrissey suggested looking at housing start data to find square footage data. Jourabchi asked the DFAC for help getting that data but said he he's hearing increasing consensus to increase the multifamily numbers and not reduce Single Family square footage that much. Paruszkiewicz agreed and said affordability issues are mostly driven by land constraints which is not related to square footage as he sees homes built to take up the entire lot.

McMahon moved back to [Slide 21] to comment on entertainment, noting that energy consumption from electronics is decreasing as more people are viewing video on smaller, handheld screens. He felt that IoT will play an important role in Demand Response and flexibility. Jourabchi agreed saying the next meeting will address use per appliance.

Morlan stated that [Slide 28] shows commercial square footage growing faster than employment. Jourabchi moved to [Slide 44] to show an eventual .2% decline is square footage per employee across all sectors. Morlan pointed to [Slide 26-27] saying employment is growing at .75% while square footage is growing at 1.1%.

Morrissey questioned the hard change in k-12 floor space requirements represented on [Slide 30.] Jourabchi said the employment figures come from IHS with pipeline data from NEEA and F.W. Dodge. Morrissey moved to [Slide 38] calling the drop significant. Jourabchi agreed, saying that 2015-17 that are still up for refinement. Potiowsky said this chart shows an assumption of structural change. Jourabchi agreed and called for actual data.

Morlan said he sees schools being abandoned or redeveloped which might have more to do with the age of the buildings. Jourabchi said that might be possible and cautioned the room not to rely too heavily on the numbers until we have the CBSA.

Prassinos noted that many new arrivals to Idaho are older which may influence hospital and other health numbers on [Slide 31.] Morlan asked about "Other Sector." Jourabchi answered that these represent mixed use, like a commercial building with restaurant. Morlan inquired about where energy use for construction falls. Jourabchi answered that these uses fall under industrial but the construction company office space is captured in the office side.

Jourabchi thought that climate change work could encompass the energy needs of massive infrastructure projects, as well as clearing mud slides and asked for more feedback.

McMahon wondered if Lodging included sharing economy options like Airbnb. Jourabchi answered that it depends on how the entity is registered and he uses the six-digit NAICS Code. He added that he has no information that shows a trend of lodging numbers going down and Airbnb numbers going up. McMahon offered anecdotal evidence of houses converting into investment properties and noted the 600,000 Airbnb units listed in the US.

Prassinos noted that this aggregation is at the NAICS level and wondered if the information is self-reported as the energy use for company operation may be very different that the head office. Jourabchi said he was not sure about all of the nuances but the CBSA makes site visits to identifies the correct categories. Paruszkiewicz confirmed that states often confirm self-reported NAICS codes and change them if they are incorrect.

Potiowsky inquired about the 2017 jump in new floorspace on [Slide 43.] Morrissey agreed that it looked suspect. Jourabchi this is pipeline data from Dodge and some may not come to fruition or may take several years. He assured the room that the CBSA is the benchmark tool. Paruszkiewicz asked about the geographic scope of Dodge. Jourabchi said they go down to county level. Paruszkiewicz wondered if the spike was caused by first-floor retail in a multifamily building. Jourabchi said he uses the CBSA to correctly categorize projects and Dodge's output is mainly used to generate bids and not establish floorspace requirements.

Morrissey suggested looking at car ownership and car sales per year trends as he wasn't sure there will be a reduced need for auto repair [Slide 45.] Jourabchi pointed to the rise of electric vehicles, which have fewer moving parts.

Morlan pointed to past work which used ranges to deal with uncertainties. He doubted that Global Insights used similar ranges. Jourabchi agreed and thought that the ranges would increase once climate change is incorporated.

Heutte questioned why Oregon manufacturing employment increases while Washington decreases [Slide 48.] Potiowsky deferred to the Oregon Office of Economic Analysis but pointed to the sector's recent comeback, naming Intel's new factory as example. Potiowsky wasn't sure if it was a trend and thought it would eventually decline. Jourabchi moved to [Slide 50] and said the region is moving away from resource-based industrial output. He then asked if anyone has reliable load numbers for the newly proposed Intel plant or other industries in the medium

term. Potiowsky cautioned that load demand is not the same as employment. Riter stated that she can't share Intel's needed MW size.

Heutte speculated that an uptick in 3D printing will decrease energy use [Slide 51.]

Morrissey asked if different scenarios could be run instead of embedding numbers in a forecast. Jourabchi answered yes, explaining that a range of forecasts go into RPM to generate a wider range. He stressed that usage peaks are driven more by weather which are captured outside this model.

Prassinos wondered about the Agriculture growth shown on [Slide 52.] Jourabchi attributed it to indoor ag, which encompasses cannabis and closer-in urban farms.

Morrissey wondered if the population adjustments on [Slide 54] trickle through the other drivers or if those numbers come from different sources. Jourabchi said yes, the numbers feed through.

Morlan confirmed that the growth shown on [Slide 56] are inputs and not actual loads. Jourabchi confirmed this.

Heutte questioned the pessimistic residential case on [Slide 57.] He wondered how much historical variance there has been from past forecasts. Jourabchi admitted that he hasn't done that work but called the load forecasts pretty close. Morlan said some factors, like population, tend to be solid but others, like natural gas prices, can be tricky. Heutte said a 12% difference in the 2040 population numbers seemed high. Jourabchi called this the best assessment for the moment and asked for better data. Morlan asked if Global Insight's ranges are applied at the sector level which would make them more stable. Jourabchi answered yes.

Morrissey said the range looks the same from early on to later. He called this counterintuitive as he expected more uncertainty farther into the future. Jourabchi agreed that uncertainty expands and agreed to investigate. McMahon suggested investigating the industrial numbers as well as the reference case is lower than pessimistic while optimistic is really high in 2040-50.

Paruszkiewicz asked if a carbon cost is baked into [Slide 60.] Jourabchi answered no. Morrissey asked about the pencils down date for the delivered price of electricity. Jourabchi answered Q2 2020.

Morrissey pointed to PGE and NW Natural's long-range studies about the future cost of renewable gas [Slide 61.] Jourabchi said that information would be valuable for this work and the NGAC.

Prassinos asked about the source material for [Slide 62.] Simmons answered that it's from the NGAC.

Morrissey asked if there would be a specific agenda item dedicated to Northwest air conditioning saturation rates [Slide 65.] Jourabchi answered yes. Morrissey suggested reaching out to people at Seattle City Light for information.

LUNCH

Gauging The Potential Impact of Behind-the-Meter Solar + Batteries to Modify Load in the Pacific Northwest.
Steve Simmons, NWPCC

Morlan asked what X-axis on [Slide 10] represents. Simmons answered they are the months. Jourabchi called for actual load data for solar generation.

Morrissey cautioned against comparing utility-scale plants with rooftop solar. Simmons agreed. Jourabchi said utility solar is modeled on the supply side. Kevin Smit, NWPCC, asked if MT's numbers are the whole state or just the western portion. Simmons answered that they are the western locations. Jourabchi added that the loads are netted out the load shape.

Prassinos asked if the NREL publication that yielded the numbers on [Slide 15] had geographic distinctions across costs as regional variations can be surprisingly large. Simmons was not sure.

Morlan asked about the optimization process for the Simulation Tool [Slide 16.] Simmons briefly explained that the objective is to get the greatest peak load reduction first, then optimize on reducing average load. Morlan thought the objective of a behind-the-grid technology would be to reduce electricity cost to the consumer. Simmons said he's thinking about using the system load profile as a proxy for a time of use rate. Morlan asked if there's significant operating costs to shift the equipment from battery and back. Simmons pointed to needing to overcome 14-15% roundtrip losses.

Morrissey added that a battery can charge off grid [Slide 20.] Simmons agreed and noted a case where the battery can only charge from the solar. Morlan stressed that May has a run off period where electricity prices are low which would make this less attractive. Simmons agreed that it might look similar to CA's Duck Curve.

Morrissey asked about the battery size used on [Slide 25.] Simmons said he used actual energy the battery can hold and not the power.

Prassinos confirmed that [Slide 30] is coincident to the Northwest system and asked if Feb-April are more morning peaking. Simmons said yes. Jourabchi added that some load reduction is from solar and battery. Simmons said this technology makes it easier to reduce sharp peaks.

Riter noted that September has no grid to battery bar and asked how that works in the modeling [Slide 24.] Simmons said he's just started exploring the data but found that it might not be worth it to charge from the grid. Morrissey asked if the model lets you charge the

battery off the grid while using solar direct to load reduction. Simmons said no, it will dispatch solar to battery first.

Morrissey asked if "just battery and no solar" was explored [Slide 31.] Simmons answered no. Heutte pointed to potential extra value given the Northwest's extreme capacity constraints in August-October.

Morlan asked how this resource and its cost effectiveness is integrated into the overall plan [Slide 40] of if this is more future looking. Simmons answered he is trying to gauge how much is installed and get an initial feeling if they could eventually be used to reduce load. He pointed to separate solar/battery systems on the Generation side. Morlan wondered if it might eventually be treated like conservation as a resource with recommendations to the region. Jourabchi noted applying this to PGE's TOU rates and not finding enough savings to justify investment but said people do it anyway.

Potiowsky speculated that there will eventually be a break even point. Morlan wondered about the storage capabilities of electric cars. Simmons called them another battery opportunity. Potiowsky told an anecdote about a Japanese EV case study. Jourabchi noted potential resiliency benefits of EV batteries.

Morrissey asked for a battery-only case and then wondered about testing against loads or net-loads as more solar means that net-loads might shift backwards. Simmons called dynamic load profiles complicating and worth thinking about.

Heutte stated that NREL has a good solar plus storage publication and Tucson Electric has done good system-level battery work.

Residential Building Stock Assessment #2
Aaron James, NEEA

[Single Family Homes]
Morlan asked when RBSA I was completed. James answered 2012-13, adding that NEEA tries to do stock assessments every five years.

[Heating]
Prassinos asked if a trend toward heating electrification in new construction was detected. James answered that he sees Ductless Heat Pumps trending but did not break down new construction vs replacement. He added that they are replacing wood stoves as primary heat and going in as supplemental heat but not replacing primary heat.

[Multi-Family Insulation]
Jourabchi asked if the homes are mostly low-rise. James answered yes, noting the difficulty in categorizing Multi-Family as many are mixed-used with retail on the ground floor or have common areas that behave more like commercial spaces.

[Lighting]
Heutte recalled that he replaced 20 incandescent bulbs with CFLs in 2005 and so far, has replaced only two.

[Location of Lighting]
Potiowsky suggested watching the kitchen lights closely as they are on the most.

[Gas Appliances]
Heutte stated that most appliances in new construction are gas. James agreed.

[Smart Devices]
Paruszkiewicz asked for a definition of a smart power strip. James said they have to be wi-fi enabled to qualify as a smart strip. There were anecdotes about various smart technologies and Jourabchi noted that manufacturers suggest changing passwords but people rarely do, calling it a security issue. Heutte joked that the S in Internet of Things stands for Security.

[Demographics]
Paruszkiewicz asked how Multi-Family is defined. James said Single Family is four units or less and Multi-Family is anything more. Jourabchi said it mirrors the census definition. Potiowsky asked if Oregon has more opportunities for programs than other states. James answered yes, theorizing that ETO might play a role. Jourabchi confirmed that the programs could be large or as small, like a lightbulb.

Industrial Loads and EE Research
Kevin Smit, NWPCC
Morlan asked if [Slide 5] shows technical efficiency potential or an estimate of realizable potential. Smit answered that this is achievable potential from the Seventh Plan.

James asked if there would be much variation of the EUI of buildings on [Slide 9.] Smit said some of these buildings vary by size and number of employees. Jourabchi added that the nature of product being frozen also plays a role.

Jourabchi called for data on refinery and chemical loads [Slide 12.] Morlan noted that the table is very detailed which might make it hard to react to and suggested asking for major regional trends might yield better responses.

Tentative Timeline of the 8th Plan Load Forecast
Morlan asked if Jourabchi is asking for a range for the Load Forecast and Scenarios [Slide 66.] Jourabchi answered that the Load Forecast will have a range, but the scenarios will include sensitivities like Deep Decarbonization.

Jourabchi spoke about climate change, wondering if it would be a scenario, like in the Seventh Plan or in the base case. He called it a major lift as it will include indirect effects on the

economy and spoke about his proposed methods that will use historic data. He called for volunteers to help with this work.

Morlan noted that progress made in data granularity and model details, calling it impressive. Jourabchi thanked him but admitted that more data points introduce more problems.

Jourabchi called attention to the upcoming Pacific Northwest Regional Economic Conference and suggested attending and/or presenting. He ended the meeting at 2:30.

Attendees

Massoud Jourabchi	NWPCC
Steve Simmons	NWPCC
Mike Paruszkiewicz	NW Natural
Tomás Morrissey	PNUCC
Aaron James	NEEA
Fred Heutte	NW Energy Coalition
Amber Riter	PGE
Jordan Prassinos	Idaho Power
Terry Morlan	Independent
Tom Potiowsky	PSU/NERC

Attendees via Webinar

Aaron Bush	PPC
Cam LeHouillier	Tacoma Power
Frank Brown	BPA
James Gall	Avista
Tom Pardee	Avista
Jim Litchfield	Litchfield Consulting
Matthew Barmack	CalPine
Will Price	EWEB
Garret LaBove	PSE
Phillip Popoff	PSE
Shirley Lindstrom	NWPCC
Tom Karier	NWPCC
Tom Martin	Tacoma Power
Villamor Gamponia	SCL
Jim McMahon	Better Climate
Brian Robertson	Cascade Natural Gas