June 20, 2013

Meeting Time: 9:00 A.M. to 3:30 P.M.

Meeting Location: Northwest Power and Conservation Council
851 SW 6th Ave.
Suite 1100
Portland, OR 97204

Facilitator(s): Steve Simmons, Northwest Power and Conservation Council; Generating Resources Advisory Committee, Chair

Gillian Charles, Northwest Power and Conservation Council; Generating Resources Advisory Committee, Vice Chair

Note Taker: Kyle Gustafson

Attendees: *On-Site*
Gillian Charles, Northwest Power and Conservation Council
Phil DeVol, Idaho Power
Rick Sterling, Idaho Public Utilities Commission
Keith Knitter, Grant County PUD
Ray Grinberg, Peninsula Light Company
Villamor Gamponia, Puget Sound Energy
James Gall, Avista
Cameron Yourkowski, Renewable Northwest Project
Jimmy Lindsay, Renewable Northwest Project
Dana Peck, EDF Renewable Energy
Chris Johnson, Benton PUD
Greg Mendonca, PNGC Power
Kevin O'Meara, Public Power Council
Erin Erben, Eugene Water and Electric Board
Fred Heutte, Northwest Energy Coalition
Dave LeVee, PwrCast, Inc.
Massoud Jourabchi, Northwest Power and Conservation Council
Thad Roth, Energy Trust of Oregon
Stefan Brown, Portland General Electric
Silvie Melchiorri, Portland General Electric
Charles Black, Northwest Power and Conservation Council
Jeff King, J.C. King & Associates
Steve Simmons, Northwest Power and Conservation Council
Dave Vidaver, California Energy Commission
Eddie Abadi, Bonneville Power Administration
Cathy Carruthers, Tacoma Power
Dan Davis, U.S. Army Corps of Engineers

Charlie Grist, Northwest Power and Conservation Council
Michael Schilmoeller, Northwest Power and Conservation Council

Attendees: *Via GoToMeeting*

Patrick McGary, Clark Public Utilities
Mark Johnson, Flathead Electric
Bob Essex, Cowlitz PUD
Tom Kaiserski, Montana Department of Commerce
Dan Bedbury, Lewis County PUD
Howard Schwartz, Northwest Power and Conservation Council
Phil Obenchain, PacifiCorp
Greg Nothstein, Washington State Department of Commerce
Anna Miles, Snohomish County PUD
Dave Fine, NorthWestern Energy
David Nightingale, Washington Utilities and Transportation Commission
Bo Downen, Public Power Council
Ivin Rhyne, California Energy Commission
Brian Dekiep, Northwest Power and Conservation Council
Chris Roden, Lewis County PUD
David Clement, City of Seattle
Angela Tanghetti, California Energy Commission
Ted Drennan, Portland General Electric
Kelley Dagley

Steve Simmons, Chair for the Generating Resources Advisory Committee (GRAC), called the meeting order at 9:00 A.M. He reviewed the committee meeting's agenda before the meeting participants introduced themselves.

Overview of the Generating Resources Advisory Committee

Presenter: Gillian Charles, Northwest Power and Conservation Council

Gillian Charles explained what the GRAC is and the purpose of the advisory committee, referring to the slide "GRAC Charter." She noted that GRAC members serve under a two-year charter in an advisory capacity to the Council. The GRAC does not take votes, but does look for consensus.

Charles reviewed the objectives and scope of the GRAC, referring to the respective slide. She shared how the committee assists the Council with:

- Identifying and assessing resources and technology alternatives.
- Gathering and validating information.

- Reviewing and interpreting analyses about generating resources and technology alternatives considered in the Seventh Power Plan.

Charles shared the "Purpose and Expectations" slide, which outlines the role of a GRAC member. She stated that responsibilities include active participation in meetings, the sharing of information and ideas, and vetting and reviewing assumptions.

Charles then reviewed the expected timeline of future GRAC meetings, stating that all the meetings will take place at the Northwest Power and Conservation Council office in Portland, Oregon, in which advisory committee members can also participate via Web conference. There is expected to be an estimated six to eight meetings, with one meeting every two or three months. Charles shared that the next meeting will (tentatively) be in September 2013.

Review the Main Issues Identified for the Seventh Power Plan

Presenter: Charlie Black, Northwest Power and Conservation Council

Black shared that one of the GRAC's goals is to continue to be a source of information for various entities in the region. He talked about the Midterm Assessments and their use in the Council's Power Plans, referring to the slide "Seventh Power Plan – Discussion of Topics."

Black explained that the initial items prioritized for the Seventh Power Plan include:

- Regional needs for energy, peaking capacity and system flexibility.
- Customer demand response.
- The development and integration of renewable resources, particularly hydro.
- The incorporation of intra-regional transmission constraints in regional power planning.

Referring to the slide "Initial Topics for Seventh Power Plan – Other Topics (8)," Black noted that additional items that the Midterm Assessment prioritized were the topics of greenhouse gas, the role of energy efficiency and how conservation can help meet energy flexibility and capacity needs. He also stated that the Council is looking at how the paradigm for energy efficiency functions in an industry where future demand growth is not aggressive because it has "flattened out."

Black shared that the tentative schedule for the Seventh Power Plan includes advisory committee meetings and symposiums, the development and preparation of models and a new version of the Regional Portfolio Model using newer technologies through mid-2015. He stated that he expects the publishing of the Seventh Power Plan's final draft in late 2015 or early 2016, with a preliminary draft released in mid-2015.

Black discussed the symposiums that took place in February and June 2013. The next symposium, Pacific Northwest Power Markets, is on July 8, 2013 in Seattle. He explained that the purposes of the symposiums are consistent with the approach for the development of the Power Plan because they allow for the gathering of information and promote conversations about topics among regional interests and stakeholders. Black stated that a symposium about the "California Market" will take place on September 5, 2013, followed by a symposium about the Canadian energy market in Seattle in November 2013.

Keith Knitter wondered that since the "treaty is scheduled to possibly terminate," how the Council plans to incorporate this event and its uncertainties into the Plan. Black answered that it depends on the events that occur through the end of 2013, sharing that the "U.S. entity" will have its proposal complete by the end of November 2013. He stated that the Council hopes that the proposal will shed some light about the renegotiation. However, if the issue isn't resolved within the next year and half, the Council may run scenarios regarding possible treaty outcomes beginning in 2024.

Supply-Side Resources & Planning Assumptions

Presenter: Jeff King, J.C. King & Associates

Jeff King referred to the slide "What is This About?" to provide an overview of supply-side resources and planning assumptions. He shared that the topic covers power generating resources, which includes all electricity production resources (for example, "customer-side resources" like rooftop solar systems). King acknowledged that there other forms of electricity production resources that he did not list on his slide and stated that the advisory committee is free to suggest additional resources.

Dave LeVee asked King if a customer's ability to store energy is considered as part of the "supply side" or the "demand-side adjusting loads." Simmons answered that he believes that this will be captured as demand response. Black stated that this will be addressed as a "fairly discreet topic" that will inevitably be brought up for discussion.

Fred Heutte asked Black about how the Council identifies items on the supply side and generation side: Is it determined as an "in front of the meter/behind the meter thing" or considered by the type of technology? Black replied that the Council and various committees look at all resources on an "equivalent basis rather than artificially dividing them."

Resource Assessment Data Needs and Applications

King stated that the Council is after "numbers" – such as those that relate to cost, performance and availability– and that it inputs them into various models. He explained that the Council uses five principle models used for the data: MicroFin, ProCost, AURORA^{xmp}, GENESYS and the Regional Portfolio Model.

Information Flow

King presented the "Information Flow" slide, which diagrams how the Council inputs data from the resource planning assumptions and fossil fuel price forecasts into the MicroFin or AURORA^{xmp} models. The results are then input into the remaining models and the Energy2020 model, which relates to natural gas.

LeVee asked if the ProCost model represents efficiency and is an in-house model. Black replied that it is a levelized cost calculator and a cost/benefit ratio calculator used to analyze conservation measures, thus making it a "measure-specific" model that examines different costs, savings and economic parameters. He added that it's a stand-alone model that the Council uses to build a supply curve of efficiency costs, noting that the Sixth Power Plan contains examples of the ProCost model (on the Council's webpage).

Resource Data & Planning Assumptions

Referring to the "Resource Data & Planning Assumptions" slide, King shared the types of data that the Council evaluates. He stated that the Council typically begins with a reference plant for the new technologies available in a "commercial sense." The Council, for example, evaluates if the technology is new (emerging), in a conceptual stage or mature. King noted that if a technology isn't mature, the Council looks at the development timeline in regards to deployment.

King stated that the Council also reviews the following:

- Current costs in order to predict future costs.
- Fuel costs.
- Development and construction schedules, including cash flow and the implications of each stage in a project.
- Financing and incentives.
- Operating characteristics.
- Project inventory, including existing and "confirmed" projects.
- The development potential of new resources.

After Dan Davis asked about the anticipation of utility-scale storage, King said that the Council is thinking about evaluating this type of storage, but hasn't narrowed it down to a particular group of technologies. He shared that the Sixth Power Plan took a preliminary look at certain technologies – such as pumped storage, battery and compressed air storage – and added that it might be useful to expand on these for the Seventh Power Plan.

King explained that the Central-Station Solar PV (photovoltaic) plant is an example of a reference plant, which the Council used in the Sixth Power Plan. He provided details about the plant's net output, scope in regards to physical and technical attributes, and reference locations in the Pacific Northwest.

Cost Components

King discussed the "cost components" that the Council reviews, referring to the respective slide, and provided a natural gas combined-cycle plant and a wind plant as examples. He pointed out that a 2012 combined-cycle unit is a "low capital cost/high fuel cost-type of resource" and that a wind plant is a "high capital cost/zero fuel cost" resource that also has an integration cost. King then noted the different types of costs evaluated on the slide's graph, noting that the term "emissions" is limited to carbon dioxide.

Eddie Abadi asked King if the calculation of emissions falls under a specific category or committee. Black responded by stating that it "doesn't have an obvious home," but that the GRAC data will reflect the Council's decisions about greenhouse gas emission assumptions and their values.

King then referred back to the slide, stating that transmission costs include Bonneville's point-to-point tariff as a regional example of the cost of bringing power from remote locations.

Stefan Brown asked about how the Council evaluates transmission costs for resources outside of the region: "Will the Council include existing transmission rates or incremental costs of building transmission?" King answered that in the Sixth Plan, the Council examined the incremental costs of building transmission "almost exclusively." He added that if there was a reason to believe that there may be sufficient transmission available, one could rely on an existing system and use existing rates. Black added that Council will work more with transmission planning organizations so it can be more aligned in regards to information and assumptions.

Fred Heutte mentioned that the Western Electricity Coordinating Council's (WECC) 2013 plan has a new aspect to it: a 20-year, scenario-based, "top-down" plan and a 10-year "bottom-up" plan. He stated that what he found interesting is that the WECC developed a new long-term planning tool that has two components so one could review the incremental costs versus new-build costs.

King commented that the Council used a costing model developed by the Northwest Transmission Assessment Committee (NTAC) in about 2007 that depended on interconnection and voltage, adding that the model may benefit from an update.

Jimmy Lindsay asked where the Council received the data for the Sixth Power Plan's wind integration costs. King explained that the Council derived its data from the Wind Integration Forum and different utility organizations that measured the penetration levels of wind. He stated that, in hindsight, he thinks that the wind penetration estimates were too high. King said that the solar and wind integration costs were the same in the Sixth Plan and that he thinks that it may be valuable to get separate costs for each for the Seventh Plan. The wind and solar costs were also variable costs, but some organizations (like Bonneville), associate them as fixed costs, which King said that he thought was better.

Construction Schedule & Cash Flow

Silvie Melchiorri asked about the inclusion of production tax credits in the Plan. King stated that the Council did include these credits, but they were "almost irrelevant because they were expiring (at the time the plan was adopted)… so they didn't affect the longer-term." Black added that in the Sixth Plan, the Council included a "plug" of sufficient renewable resources to meet the RPS standards in place.

LeVee commented that the Power Plan assumes that Congress' tax codes and subsidies (tax credits) add to the societal costs of providing different technologies, which are "basically ignored" because the subsidies aren't counted. He stated that this issue needs to be addressed "somewhere" so policy makers can have a better understanding of such societal costs and options. In response, King stated that federal-level incentives have generally been included, and that state- and local-level incentives and tax credits have generally been excluded because of the idea that they are transfer costs within the region.

King addressed construction schedules and cash flow in regards to risk analysis. He explained that the risk model (RPM) is complex because it examines three construction phases:

- Development: The "shovel-ready" phase.
- Early construction: When not a lot of money has been committed.
- Committed construction: When large amounts of money have been committed and the likelihood of project termination is slim.

King noted that the table on the slide represents a combined-cycle example. The information listed for each of the construction phases include milestones, periods, expenditures, uncertainty, suspensions, termination and a life value.

Heutte asked where the data for the cost variability came from. King explained that the Council derived comprehensive data from a variety of sources, like studies, to provide a detailed assessment.

David Nightingale commented on the "uncertainties" data in the table, stating that cost variability normally has a trend across the different phases. Therefore, as a project gets closer to the construction phase, the level of uncertainty should logically decrease. Michael Schilmoeller explained how the Council obtains the data for uncertainties, stating that the figures generally don't change a lot when modeling a future. Heutte noted that the Council derived the data in 2008, during the "economic crisis," so there wasn't a lot of clarity about how much project costs would decrease. Schilmoeller stated that since the Council doesn't know what future it's going to find itself in, it uses a decision-making process during every simulation and reflects the uncertainty in construction costs during this process. [See Chapter 9 of the Sixth Power Plan, figures 9-6 and 9-7 for more information.] Simmons noted that lead times vary by resource, which adds to the uncertainty in a Regional Portfolio Model.

Financing Assumptions & Incentives

King stated that capital/construction costs are also called "overnight costs," noting that models need to include financing assumptions. He shared that the Council needs to review its financial assumptions and stated that he proposed considering who is likely to be building projects, the differentiation between the types of projects and adding relevant updates. King said that the Council will also look at the assumptions that underlie the incentives and make determinations about the incentives to apply to projects.

LeVee commented that he makes a distinction between economic costs and finance costs because of the risks and the risk-sharing assumed during a project. He encouraged the GRAC members to consider the costs from an economic perspective.

Operating Characteristics

King stated that the Council considers seasonal factors when considering operating characteristics. Seasonal factors include elevation, Variable Energy Resource capacities, forced outage rates, technologies, the outputs of different resources and response rates.

Project Inventory & Development Potential

King shared that the Council keeps a detailed inventory of projects, including committed projects and planned retirements. He noted that the detailed information about Northwest projects is going to become increasingly important because there are questions about the continued availability of energy and capacity resources, particularly from California because of the number of plant retirements.

King said that the Council makes an attempt to understand RPS obligations and keeps an updated database. Knitter asked about the type of RPS resources included in the database. Charles replied that the database includes all of the resources available under the RPS for the different states, adding that hydro upgrades are more difficult to track. Simmons stated that the Council has to make an assumption about the new types of RPS that would come online in the future. King added that the future assumptions will include hydro.

Lindsay asked about the Council's ability to capture future QF projects. King replied that the Council's database includes QF projects, but going forward, it hasn't attempted to distinguish between development-by-resource type and developer type. Black added that the US Army Corps of Engineers and the Bureau of Reclamation plan on investing in refurbishment and in work in the Federal Columbia River Power System (FCRPS). He asked the meeting participants if they had any information about the efficiencies and outputs from the FCRPS; no one had.

Black stated that Bill Drummond, the new Administrator at the Bonneville Power Administration, visited a Council meeting in early 2013 and talked about the capital requirements for reinvestments in FCRPS facilities to modernize them, and provided examples about local projects. Black said that he wondered if there will be enough capacity or energy output enhancements associated with the investments.

Heutte commented that Drummond stated that Bonneville is looking into new technologies that would increase outputs, like small generators alongside some of the big dams and turbine blades. Knitter noted that BPA's incremental hydro doesn't count as "renewable" in Washington state, but it does count in Oregon.

Resources Classes

King stated that the Council is trying to determine the level of treatment that each resource should receive. The Council wants to know if it has the right resources listed and if it missed anything in regards to treatment. He shared that "significant resources" are those that look as if they may have a major role in future systems. King noted that with the low growth of demand, there may not be a big need for future resources. However, if demand increases, the Council proposes conducting an assessment that is an "in-depth, quantitative characterization of the significant resources to support system integration and risk analysis modeling." The group of resources listed on the slide "Significant Components of Future

Systems" (for example, natural gas combined-cycle, wind plants and solar photovoltaic plants) is characterized by commercial availability, constructability, cost-effectiveness, and the large quantity of a developable resource.

King explained that the resources listed on the slide "Commercial with Limited PNW Availability" are "good resources" that are fully commercial, but don't have a lot of potential (for example, landfill gas recovery, woody residues and new hydropower). Therefore, the Council may not do a full risk analysis of these resources, but it would still perform a quantitative and cost-effective characterization.

Referring to the slide "Longer-Term PNW Potential," King stated that the Council is interested in looking at resources that have longer-term potential but may not be commercially available yet (in the next 20 years or more) because they look like they can be "developed to meet future needs and can provide the kinds of services that the system will require in the future." Examples of such resources include offshore wind, modular nuclear units, wave energy conversion, coal technologies with CO^2 separation and CO^2 sequestration. King shared that the Council's proposed assessment includes a qualitative discussion of each resource's status and potential.

Heutte asked about where the Council draws the line in its inclusion of resources within the different classes that King mentioned, particularly geothermal. King explained that the Council deemed that conventional hydrothermal geothermal has limited PNW availability, but engineered geothermal has longer-term potential. Heutte said that he thinks that it may be a good idea to consider conventional hydrothermal to be a resource with longer-term potential.

Thad Roth asked how the Council determines what resources have longer-term potential. King explained that it depends on the resource and the design concepts in relation to the products offered and future demand.

King stated that resources that have potential in the rest of WECC (for example, solar-thermal, large-scale advanced nuclear plants and coal steam-electric) aren't necessarily "major players" in the Pacific Northwest. He said that the Council's proposed treatment includes a qualitative discussion and sufficient quantitative assessments to represent the resources in AURORAxmp.

LeVee commented about the consideration of demand response as a supply or a change in load. He stated that he believes that a change in customer behavior patterns is necessary.

Since there are many technologies that have distribution benefits, Villamor Gamponia wanted to know what distribution benefits are included in the RPM or elsewhere. Black replied that the models and the system analysis advisory committee would reflect these benefits.

Topics of Special Interest

Proposed Topics: Resource Characterization

King shared that there is a handful of topics that the Council is interested in exploring, such as PV capital costs, which have declined considerably since the assessment in the Sixth Power Plan. He stated that additional topics include 8760 hourly solar output estimates, rapid response versus bulk energy production, storage technologies, natural gas, development and construction schedules, the potential for wind development, distributed generation potential and hydropower upgrade potential.

Proposed Topics: Resource & System Planning Issues

King noted that the proposed resource and system planning topics are more system-specific and less resource-specific, and reviewed the items on the respective slide. In regards to the topic of accounting for speculative project development, King shared that Council assumed in the past that the development phase of construction was undertaken at risk to the rate-payer. He noted, however, that this isn't the reality for many resources because of the inventory for wind projects, proposed combined-cycle projects and the growing inventory of solar projects — most of these are situations in which a third-party developer has taken on the initial risk.

King stated that additional proposed topics include the integration costs for current and forecasted wind and solar energy, as well as current and forecasted CO^2 costs. In regards to "Total Fuel Cycle" and greenhouse gas production, King stated that the Council looked at production at the point of generation, not through the fuel cycle of greenhouse gas production, transportation of fossil fuels, or fracking.

King explained that the Natural Gas Advisory Committee will deal with the natural gas price forecast and the Council will complete an annual wholesale electricity price forecast. He stated that the Council will also examine who develops, builds, owns and operates resources, and the financial differentiation of resources. It will also discuss the consideration of incentives and WECC plant retirements and replacements.

Ray Grinberg asked about how the Council will incorporate WECC emerging markets. Black answered that the approach of GRAC has been to characterize the generating resources themselves.

Heutte suggested adding the changing regulatory requirements, particularly environmental requirements, to the proposed topic list. He provided the example of the new EPA regulations on air emissions, CO^2 emissions, the Clean Water Act and the new development of renewable energy on federal and non-federal land. Heutte noted that while this is a "complicated topic," it will impact future models.

King commented that the Sixth Power Plan focused more on risk analysis and creating ranges of futures, while the Seventh Power Plan should perhaps include a supplement with a more explicit look at different scenarios, like carbon regulation.

Grinberg noted that the Sixth Power Plan discussed the capacity value of wind resources. He stated that he thinks that the same type of information should be added into the Seventh Power Plan, as well as a review of photovoltaic prices and wind technologies because they've changed and improved since the release of the Sixth Power Plan.

At the conclusion of King's presentation, Simmons excused the GRAC meeting participants for a short break.

Solar Utility Solar PV Cost

Presenter: Steve Simmons, Northwest Power and Conservation Council

Headlines

Upon reconvening the meeting after the break, Simmons shared the "Solar Power System has Bright Future" slide and "Sunny Headlines" slides with media headlines that recently appeared about solar power. Many of the headlines allude to advancing solar technologies, peak electricity demand and cost incentives.

Simmons highlighted the Outback solar project in Christmas Valley, OR, which took four years to complete, from conception to commercial service. The system uses polycrystalline ground-mount, single-axis tracker solar PV panels, which correspond well with the Council's proposed solar PV reference plant. He noted that the Outback project is 5 megawatts, but the Council plans to use a plant that's 20 megawatts as its reference plant.

Recent Report Summaries

Simmons shared a slide with "Not so Sunny Headlines" that alluded to bankruptcy cases, the decline of imports and plant layoffs. He then reviewed the "Recent Report Summaries" slide, which included solar rankings, cost and performance reviews, cost estimates and history, and an update of centralized solar projects.

Simmons reviewed a slide with the SEPA Utility Solar Ranking in the U.S. from June 2013. He stated that he found it interesting that in 2012, the installations are mostly done by IOUs and the reference plant in the Council's model assumes an IOU financing structure. He noted that the growth of solar coming online between the years 2010 and 2012 increased rapidly, with the majority of growth occurring in customer solar (net meter projects). Rick Sterling asked if the graph on the respective slide showed "name plate" capacity, and Simmons said that he believes it does.

E3 Cost and Performance Review of Generation Technologies

Simmons shared the E3 cost and performance review slide, noting that the costs are in 2010 dollars. The E3 reviewed single axis tracking systems and fixed tilt systems with 1- to 20-megawatt plants and 100-megawatt plants.

Simmons noted that E3 expects costs to decline following a learning curve; the more products manufactured, the higher the efficiency gains. He explained that as manufacturing increases, emerging technologies will decrease and cost declines will plateau. Therefore, one needs historic data to model cost declines and a forecast for future volume to make a projection. Simmons shared that E3 proposed the use of two learning curve rates into a weighted learning curve: one for the modules and one for the balance of system. He then noted the decline in costs that E3 forecasts.

Heutte commented that the information on Simmons' slide was part of the WECC's planning process and that he was part of a study group that reviewed this information in 2012. He stated that solar use on a utility scale included PV and CSP (concentrated solar power)/thermal solar. In regards to PV solar on a utility scale, Heutte said that his committee thought that E3's figures were outdated, so he'll offer the Council a collection of industry data that's more up to date. In regards to experience curves, Heutte shared that he thought that the E3 data is "not where it should be" because he believes that the costs will be lower than what E3 forecasted, particularly in 2032.

Simmons asked Heutte what he attributes E3's over-estimates to. Heutte replied that he thought that E3 was being conservative. He also noted that there is a "lag time" when collecting information, "especially with solar moving so quickly down the cost curve." Simmons and Heutte then had a short discussion about lag time and declining price trends. Heutte noted that it's important to not focus on the current price trends because there are ongoing developments in the solar market structure, making trends more difficult to predict.

King asked Heutte for his perspective on the "durability of cost reduction" in the solar market, giving examples of recent market trends that occurred with wind power. Heutte responded that it's important to look at output numbers, not just capacity. In solar power, he explained, it's important to examine energy versus capacity, but not overly focus on capacity because of the improvements in performance. Heutte compared the growth of solar power to the rapid growth that the auto industry experienced 100 years ago, noting that solar is now a global market in regards to demand and supply. Melchiorri commented that she would like to have the study that Heutte referred to available to the GRAC members. She told the group about a study that her organization, Portland General Electric, commissioned to Black & Veatch earlier in the year to analyze long-term solar patterns, and the company discouraged her organization from predicting any type of cost reductions. Melchiorri said that she thinks that it would be good to have a more thorough assessment of this topic. [All reports referenced have been posted to the GRAC meeting page on the website - http://www.nwcouncil.org/energy/grac/meetings/2013_06/]

Heutte stated that the Black & Veatch report recommended "against taking an experience curve approach by itself" and suggested taking a hybrid approach that combines analyst perspective with an experience curve/mechanical approach. He said that he thinks that the recommendations do have some value, particularly over shorter time periods.

Black commented about the declining trends in the cost of energy contracts that he's observed and asked if others have noticed the same kind of market information. Vidaver shared that the California Public Utilities Commission does not release this type of information and that aggregate information may not be released for a couple of years. Black explained that it may be hard to obtain information from investor-owned utility organizations. However, publically owned utility transactions are more transparent.

LeVee commented to Vidaver about the technologies that should be subsidized, the true costs of those subsidies and the sustainability of solar power without subsidies. LeVee then asked Heutte if there are markets without subsidies sustaining themselves. Heutte replied that there are a lot of markets sustaining themselves and provided examples, like the use of panels on cell phone towers in India. He said that he thinks that Arizona will become a self-sustaining market and explained some of the data that he found about other regions, such as Palo Alto, CA.

Cost Review

EIA Estimates

Simmons shared the "EIA Updated Cost Estimates" slide, which outlined the capital and O&M costs for two reference plants. He noted that the EIA's estimates were higher than E3's.

LBL

The LBL "Tracking the Sun V" study examined utility scale solar PV projects and rooftop projects through 2011, which were ground-mounted and greater than 2 megawatts. Simmons noted that the utility scale projects ranged in price, from $2.40 to $6.30 per watt. The LBL report also established capacity weighted project costs, and Simmons said that the organization did not find a discernible price difference between thin film and crystalline projects.

SEPA

Simmons stated that SEPA's Solar Projects Bulletin from the first quarter (Q1) in 2013 contained updated information about utility scale PV projects. He noted that nine projects were completed and 15 began construction during the first quarter. With module manufacturers dropping out and declining prices, Simmons mentioned that he thinks there may be some stabilization in prices.

Proposed Capital Cost Forecast

Proposed Reference Plant for Central-Station PV Plant

Simmons shared that the description for the proposed reference plant will be the same as the description in the Sixth Power Plan. He reviewed some of the key assumptions that the Council will include, such as total plant cost, fixed O&M, development phases over the course of three years, financing with a 25-year lifecycle, incentives, economic life and base dollars.

In regards to incentives, Charles commented that the Investment Tax Credit will decrease from 30 percent to 10 percent at the end of 2016.

Methodology

Simmons explained the Council's costing methodology, noting that it collected data from individual projects (normalized to overnight costs) and a variety of sources like the E3, EIA, SEPA and LBL. He stated that the calculated base cost for the Plan is in 2012 dollars. The methodology also includes a mix of the Council's Sixth Power Plan and a learning curve cost de-escalation through time.

Simmons reviewed the individual projects that the Council studies and showed slides with graphs depicting trends in Solar PV Utility Scale Capital Costs and proposed Overnight Capital Costs. He pointed out that reports indicate that the Picture Rocks project in Arizona indicates a price that's much lower than the other individual projects reviewed at $2,972 per kilowatt (AC overnight). In the slide with the Solar PV Utility Scale Capital Costs, SEPA's costs are lower than the E3 and Proposed costs.

James Gall asked if the Solar PV Utility Scale Capital Costs included connection costs. Simmons replied that they do.

Lindsay asked where the Council obtained the SEPA data in the Solar PV Utility Scale Capital Costs graph. Simmons explained that the Council used data from SEPA's Q1 bulletin. He noted that the Council used historic data in the graph up through 2012. The data for the later dates come from projections.

Simmons shared a proposed strawman forecast in the "Overnight Capital Costs Proposed" slide. The graph ranges from 2012 to 2035 and shows an initial decline in price, followed by a plateau.

Simmons stated that the forecast takes into consideration the base starting point for 2012 and the information projected from the base point.

Levelized Costs

Simmons shared slides that show the preliminary levelized costs from MicroFin.

King asked what established the "inflection point" in the forecast curve in the years 2023 and 2024. Simmons accredited it to a learning curve.

Heutte commented that he has a problem with the experience curve because these curves are robust. He said that such an inflection in an experience curve indicates that there is no further expansion in the market and no further saturation after 2025. Heutte asserted that he does not agree with the forecast because he does not think that the experience curve will change. He concluded that the "real question" is about how much the market will expand.

Gamponia stated that he thinks there needs to a better distinction between experience curves and the impacts of technological change. Heutte responded that an experience curve combines several factors like learning, technological innovation and market structures. He shared that the Santa Fe Institute studied experience curves and observed that "learning is less than innovation." Since learning curves use observations to gather data, there are no theories about how to construct them.

LeVee commented that significant drivers behind technological expansion are subsidies and tax credits. He noted that when incentives get removed, there are impacts on an experience curve. Simmons stated that there are crossover technologies to consider as well, such as semiconductor chip manufacturing

Heutte explained that subsides or incentives don't have a "single-sided effect." He used Germany's tariffs as an example and noted that solar prices increased globally from 2004 to 2007. Heutte pointed out that after 2007, an increase in expansion and market acceleration followed, which caused prices to quickly decline. He maintained that one can't just look at two- or three-year trends; one has to look at the long-term trends. Heutte stated that the U.S. has benefited from Germany's experiences with solar because they allowed the industry to expand up to the point that it could go global and drive the prices down.

Simmons shared the slide "Levelized Costs by Year," which show 2012 dollars for the proposed reference plant. One graph shows costs from 2012/2013 through 2024/2025 and the other reviews locations in Medford, OR; Boise, ID and Daggett, CA for the 2014 to 2015 year. The slides show estimates for transmission and integration, O&M incl. tax and insurance, and capital. Simmons noted that both graphs show a decline in levelized capital costs.

Gall asked if the ITC cost is a discount in the capacity cost or a cost that's amortized over a period of time. Simmons replied that the cost is amortized because IOU financing is assumed.

LeVee asked about the explanations of the debts on the graphs and said that a 25-year debt term seems abnormal. Simmons stated that he thinks the Council assumed a 25-year book-life asset, but he'll double check [this has since been verified].

Next Steps

Simmons reviewed the Council's next steps: it will finalize the base capital costs for the reference plant and finalize the forecast for capital and O&M costs. He stated that there will be an update about the costs at a later GRAC meeting.

Melchiorri asked if the Council assumed an increase in capacity. Simmons responded that the Sixth Power Plan indicated a degradation of about 1 percent per year.

Gall pointed out that the assumptions were for current panel technologies and asked if the assumptions would remain the same for panels installed a decade from now. Simmons stated that this is a point that needs further examination. King added that Sixth Power Plan had a fixed efficiency rate, but the Seventh Power Plan could show an increase in efficiency.

Simmons concluded his presentation and excused the GRAC meeting participants for an hour-long lunch break.

Solar Photovoltaic – Capacity Factors, Performance and Policy

Presenter: Gillian Charles

After the lunch break, Charles began her presentation with a slide that contained a graphic from NREL depicting "Photovoltaic Solar Resources of the United States," which shows where there is the most and least potential for solar power. The Southwest has the most potential and the Northwest has "decent potential" compared to the rest of the country.

Capacity Factors

Modeling Assumptions

In regards to capacity factors, Charles referred to the slide "Modeling Assumptions" and shared that the Council uses the NREL System Advisor Model (SAM), version 2013.1.15. She reviewed the assumptions, which include the technology used (solar PV), location, nameplate capacity, DC to AC derate factor, configuration, cell type, performance adjustment, plant life and weather data, explaining that the weather year is comprised of "the most typical historical months" instead of 12 cumulative historical months. Charles noted that the Council may change the details in the modeling assumptions based on input from the GRAC and that much of the current information reflects the default data.

In regards to the performance adjustments, Greg Mendonca asked what "no shading" meant for the annual input. Charles explained that shading meant items that can create shade, like trees or buildings. Therefore, in the model, "no shading" assumes that nothing shades the PV units except for the cloud cover reported in weather data.

Melchiorri asked which years are included in the long-term averages in the weather data. Charles replied that the data is for the years 1998 to 2005.

Charles showed the GRAC meeting participants a map of the 16 cities that the Council selected to model the capacity factors, which it based on the AURORAxmp Load Resource Areas. She explained that since the SAM model is only for the United States, the Council used representative cities in the US instead of B.C. and Alberta.

Heutte requested that Council add one or two more sites west of the Cascade Range for comparative purposes and because, over the long run, there will be an increase in rooftop solar.

Knitter asked why the Council included so many sites in the Southwest. Charles explained that the Council will input the information from the Southwest sites into the AURORAxmp model.

Performance

Annual Average Capacity Factors

Charles reviewed the annual average capacity factors for the 16 locations that the Council is reviewing. She noted that the table on the respective slide includes an AC and DC rating basis. The data is based on the first year of output. Charles shared that the Sixth Power Plan included a fixed technology year for all resources and that the Council could considering reflecting efficiency improvements in technologies for resources in the Seventh Power Plan.

Brown asked why the DC capacity factor in the table is lower than the AC capacity factor. King answered that "the capacity factor is the percentage that's multiplied by the DC or the AC rating." He explained that if the DC rating of one plant is over 25 megawatts and the AC rating is over 20 megawatts, for example, one gets a lower capacity factor when obtaining an AC output from the DC rating because one "multiplies a higher number by a lower capacity factor." After Brown stated that he was still confused about the calculation of AC and DC ratings, King, LeVee and Simmons explained it more at length as Brown gave examples of capacity factors that he's seen in other data. Charles encouraged the GRAC members to share any data they are able to regarding capacity factors that they are using or have seen.

Gall asked what the difference is between a tracking system and non-tracking system in regards to capacity factors. Charles replied that PVWatts system model only uses single tracking. Gall shared that he's seen different data for capacity factor AC ratings. King stated that the AC to DC derates lead to the different capacity factors. Jourabchi added that capacity factors also take into account geographic location and radiation.

Monthly Annual Energy (MWh)

Charles shared a slide with a chart that shows the first-year outputs for the 16 sites that the Council is reviewing. She pointed out that Spokane, WA; Medford, OR and Cut Banks, MT all have a "clear peak" in July and August. Locations with higher capacity factors and a better solar resource potential have a "flat shape" in their individual graphs and more consistent year-round outputs.

Heutte commented that the graphs in the slide show the weather inputs well. He stated that the graph for Daggett, CA is interesting because it looks like it has cloudy summers. Heutte then compared the Boise, ID; Billings, MT and Spokane, WA graphs, stating that they each show different local weather patterns.

Solar PV vs. Regional Load

Charles showed a slide with a graph that demonstrates how the curve or "shape" of solar PV in the Pacific Northwest is not congruent to the average regional load.. However, Charles noted that the peak in July in the Northwest slightly matches the peak in the regional load.

Heutte added that "reliability factor" is important, so it's necessary to look at seasonal information as well as daily and hourly data.

Improved Modeling of Solar

Charles stated that in the Sixth Power Plan, the Council only analyzed six locations and modeled two in AURORA, noting that it used the second week of each month as representative for the full month. She shared that the Council will use the full 8760 hourly time series in the Seventh Power Plan, which is consistent with how it currently models wind, and will model all 16 locations in AURORA.

Policy

Charles shared a slide with a map from the DSIRE database that shows the Renewable Portfolio Standard policies and information regarding solar and distributed generation provisions across the U.S. She highlighted that in the Pacific Northwest, Oregon is the only state that has a specific requirement for solar PV (20 megawatts by 2020), and that Washington has a provision that encourages distributed generation by allowing double credit of RECs for DG.

Solar Investment Tax Credit

Charles stated that the Council includes a 30 percent investment tax credit through 2016 in its MicroFin model. She noted that the tax credit will decrease to 10 percent after 2016, but she isn't aware of an end date for this credit.

Solar PV in the PNW (Utility Side)

Charles shared that the Council maintains a database of all of the projects in the Northwest. The current database includes 9.2 megawatts of solar PV installed capacity. The respective slide that Charles shared included a list of these projects, along with projects with 177 megawatts of proposed solar PV. She noted that proposed projects don't always get developed and that some on the list already have experienced setbacks. Charles stated that the database to which she referred is on the Council's website and that she welcomes any input and updates to data.

Brown asked how certain types of PV, like rooftop solar, would qualify under the "utility side." Charles stated that for the most part thinks the Council labels this type of PV as "customer side." If there are specific projects up for debate, Charles stated that she encourages GRAC members to send information on them so the Council can improve the classification and quality of their database.

Distributed Solar Power in the Northwest

Presenter: Massoud Jourabchi

Energy Consumption in 2011

Jourabchi stated that in the Sixth Power Plan, distributed solar PV was part of the conservation supply curve. It wasn't selected in the portfolio of new resources in the Sixth Power Plan because it wasn't cost-effective when up against other resources such as natural gas, wind, etc. Jourabchi shared that he thinks that distributed solar should be on the demand side or load forecasting side instead of the conservation-side.

Jourabchi explained that when he looked into the topic of distributed solar, he started at the national level. He showed a slide with a list of renewable energy. The charts on the slide, which used information from the EIA's Annual Energy Review, showed that renewables represented 9 percent of the national energy consumption in 2011. The renewable energies included hydro, waste, bio-fuels, wind, geothermal and solar PV. Jourabchi pointed out that solar consumption was only 2 percent.

National PV Shipments and the PV Market

Jourabchi stated that he looked at national shipments of PV cells and that in the 2000s, shipments grew exponentially, experienced a dip in 2007 and then increased again after 2007.

After showing a slide about the global PV market, Jourabchi highlighted that residential PV experienced a 37 percent increase between 2000 and 2010. During the same years, commercial PV increased by 44 percent, industrial PV grew by 5 percent and electric utilities increased by about 44 percent.

Regional Growth in Solar Energy Consumption

Jourabchi reiterated Heutte's comment about solar energy being a global market and added that the U.S. needs to be a major player in this market as a supplier and consumer. He shared that in 2012, the U.S. had an 11 percent market share of the global solar market.

Jourabchi stated that when he examined the regional solar market, he looked at information from the EIA's SEDS (State Energy Data System), which combined solar thermal (for example, residential systems for pools or water heaters) and solar PV.

Jourabchi shared that there has been a 13 percent increase in solar PV since the year 2000 and an increase of 9 percent in solar thermal. He stated that majority of solar installations have occurred in Oregon, followed by Washington; there isn't much growth in Idaho or Montana in terms of rooftop solar. Jourabchi then shared the slide "Northwest Solar Energy Resource Consumption (TBTU)" to put the figures that he shared into context.

Jourabchi showed the slide "Solar as Percent of Total Energy Consumption in the Northwest" and noted that there is a lot of room for growth.

Solar Energy Use in Oregon

Jourabchi stated that he obtained solar-related data from Energy Trust of Oregon about solar customers. He said that he used this information to look at the economic side of solar and the dynamics behind consumer decision-making. Jourabchi shared that he found that there is over 42 megawatts-DC of peak PV capacity in Oregon in 2012 and showed the respective slide, noting that residential and commercial sectors consume solar the most.

Jourabchi shared that, in regards to energy, Oregon's solar consumption is "roughly equal to 31 megawatts of generation," and showed the respective slide. He noted that the graph's figures have an added 10 percent to make up for T&D losses.

Estimated Solar Energy Consumption MWa 2013

Jourabchi showed the "Estimated Solar Energy Consumption MWa 2013" slide and stated that he was surprised to see that Idaho didn't have an increase in solar until the 2000s even though they have more sun than Oregon. He stated that he attributes this to economic reasons (lack of incentives). He asked Sterling about this, who replied that the growth was due to the incentives offered, but currently the only incentive is a small tax credit.

Heutte commented that, 30 years ago, multiple solar incentives were available in Oregon, while Idaho had little, if any. Therefore, market penetration was greater in Oregon.

Sterling stated that in the 1990s, there were only a handful of net metering installations. He shared that Idaho Power recently requested a doubling on the cap on installations and more people from the public are showing up at hearings in support of solar.

Lindsay, Grinberg, Gall and Mendonca commented about the incentives and packages offered in Oregon compared to those offered in other states, like Washington. Gall reiterated that "solar would not exist without incentives." Knitter stated that "residential economics" and income levels on the east and west sides of the state are another factor to consider.

Simmons referred to the slide and asked Jourabchi why solar decreased in Washington from 1989 to 2010. Jourabchi replied that he did not know.

Howard Schwartz asked if the graph showed utility-owned or homeowner-owned solar energy consumption and wondered if “off-grid” solar was included. Jourabchi answered that the graph only represents rooftop solar systems that are both thermal and PV; it doesn’t include the utility side.

Schwartz stated that he thinks that there is more of a decline in solar thermal than in PV. Heutte commented that it would surprise him if solar thermal has decreased in Oregon and gave examples of installations that were removed and decreases in incentives.

Net Metered Installations as of 2011

Jourabchi stated that the EIA 861 shared data about solar rooftop installations in the region. The slide that Jourabchi showed contained data for 2011. He observed that Oregon has more net metered customers in the residential and commercial sectors and that Washington has half as many net metered installations. Jourabchi noted that net metering policies in each state have the potential to affect the growth of solar.

Installed Cost Ranges in Oregon

Jourabchi showed a graph depicting the range in installed rooftop PV costs – total costs and net costs after incentives. He stated that as costs declined, incentives also declined. Jourabchi noted that incentive levels changed for solar thermal and rooftop PV. He highlighted that about 75 percent of installed solar costs were covered by incentives in 2005. By 2007, incentives only covered about 39 percent of installed costs. In 2012, incentives covered about 38 percent of the installed costs.

Jourabchi shared a slide that showed the distribution of installed costs in solar PV systems across multiple projects. He stated that he found the range in costs interesting as they spanned between $2.00 and $8.00 in 2011, before factoring in incentives. Jourabchi shared that he is thinking of assessing scenarios with the high and low ranges of rooftop solar costs so the data is diverse.

Jourabchi noted that about 50 percent of the costs in the residential sector are “hardware” costs and the remaining 50 percent are “soft” costs. Soft costs, for example, include those related to permitting, land acquisitions and site preparation. He shared that soft costs in the U.S. are higher than those in other countries because of a “wait-and-see” attitude. Other countries systematically implement a solar program and offer assurances to the public.

Heutte commented that he has a different interpretation of the soft costs. He stated that he doesn’t think the higher U.S. costs are due to the industry structure because the installers and supply chains are from small, local businesses. Heutte said that he attributes the price differences to learning effects because the industry is larger in other parts of the world, like Germany. He stated that Germany streamlined the process for residents to obtain a solar system, like with a simpler application process. Heutte mentioned that there aren’t any uniform processes within the U.S. for the public to access solar resources, nor is there industry maturation.

Jourabchi stated that the poor U.S. economic situation that began in 2007 may have attributed to lower labor costs. He gave the example of homeowners completing installations to save money in lieu of hiring an electrician, which could have possibly led to less demand and the lowering of labor costs.

Schwartz commented that he agrees with Heutte and Jourabchi, and shared the effects that a proposed bill had on the solar industry in Washington. He concluded that it would be helpful to have an assessment of how economic and industry trends could have an effect on solar costs.

Heutte stated that he agreed with Schwartz and gave an example of what happened in the cable industry. He noted that solar leasing is a factor to also consider when examining trends. Heutte said that he thinks that the cost of labor will go down with other costs as the solar industry matures, but there will be fluctuations.

Roth commented about solar leasing and the difficulty to obtain related data.

Support for Solar

Jourabchi stated that his investigations revealed that many people support solar power. He then posed a rhetorical question: If solar is so popular, why don't more people use more solar rooftop units in the Northwest? Jourabchi attributed the low electric rates in the region (benefits), incentives, space requirements, an abundance of trees and output variables.

Heutte shared that neighbors who don't have homes that qualify for rooftop solar may setup a community solar system where panels get installed in an ideal location and the group shares the output benefits.

Climate as a Factor

Jourabchi showed the slide "NW Climate Should Not Be Detrimental to PV," which has a map of the U.S. next to a map of Germany with the different solar regions color-coded. He stated that climate in Germany is similar to the climate in Oregon and the Pacific Northwest, so climate is not a detrimental factor to the installation of solar rooftop systems.

Cost as a Factor

Jourabchi stated that cost is a major factor in the rate of solar rooftop installations. He noted that the pie chart on the respective slide maintains a flat incentive rate.

DeVol commented on how "avoided costs" could impede rapid growth in solar installations, using wind power as an example. He said that he thinks that it's worth comparing the rate in declining solar costs and the rate of declining avoided costs. Jourabchi replied that he didn't take the avoided costs into account because the data that he is presenting is from the consumer's perspective.

Demand Forecast for Solar PV

Jourabchi stated that the Council has a long-term end-use model that examines all forms of fuel. He explained that the model looks at PV by "comparing electric rates with the cost of an installment and paying for a PV system" so it can calculate the potential of solar using engineering estimates and actual market experience (actual installs). Jourabchi shared that the model examines the costs, the economics from a consumer's point of view and the roadblocks or constraints to solar installations so it can create a forecast.

In response to Knitter's comment about some consumers choosing solar because "it's the right thing to do" instead of the attractive economic costs, Jourabchi stated that the model does not show non-economic data and explained how the model assesses the input historical data.

Erin Erben asked if the model considers residential discount rates. Jourabchi replied that it does not explicitly.

Heutte commented that solar has taken a long time to mature and it's important to consider situations and dynamics – such as people installing solar because they want to go green or renters who cannot install solar systems (but want to) – to get a better picture of the residential and commercial classes.

LeVee stated that the Council, when forecasting demand, should use the same economic framework used on the supply-side so it can compare "apples to apples." Jourabchi stated that he doesn't know if investment in rooftop solar should be the same as utility solar investment, so the comparison doesn't necessarily have to be apples-to-apples.

King stated that Council needs to look a solar power from two perspectives: from the demand forecaster's point of view to determine how the public will respond to various scenarios and from the view of an organization that recommends cost-effective means to serve future electrical needs.

Calculating Contribution to System Peak

Jourabchi explained that the Council analyzes the potential of solar rooftop and its effect on system loads. To do this, he said that he started with the Northwest system load from 1995 to 2011 and then estimated the average hourly PV generation at 25 sites in the region. Using the data, Jourabchi stated that he then found when peak load occurred during a given month to determine "how much, at the time of system peak, solar rooftop units are contributing and lowering the system load," and created a three-point load duration curve. He established a ratio that compared the generation at the time of system peak to the average annual generation for a given month, and then averaged the ratios calculated. The result was the contribution, or reduction, in system peak.

Jourabchi showed slides with a graph of monthly averages to annual generation ratios and a graph with PV generation at the time of system peak to average annual generation. He noted that there wasn't much contribution to peak in January, November and December, but there was a lot of contribution to peak in the summer months. Residential rooftop solar contributed to the system depending on the season and time of day.

Heutte, referring to the slide "Ratio of PV Generation at the Time of System Peak to Average Annual Generation," asked about the lack of generation in the month of September because it doesn't look right to him. He suggested that Jourabchi review the data to learn more about the "fall-out."

Vidaver commented that his organization, the California Energy Commission, calculates summer and winter peaks and assigns a contribution for the resource, and wondered if the Council was going to do something similar.

Forecast Drafts

Jourabchi reviewed the forecast drafts and their respective slides, reminding the group that all forecasts are wrong. He shared that the forecast calls for an 8 percent annual growth rate between 2015 and 2035 and noted that he didn't include a degradation of efficiency.

Heutte commented that he thinks that actual growth will be faster than the growth depicted in the respective slide, giving examples of why solar thrives in New Jersey and Germany. Vidaver then reviewed the net-zero policies in California for new home and commercial projects and said that the state will over-generate electricity in March.

Next Steps

Jourabchi stated that the next steps are to update the future trajectory of PV costs and to test different scenarios with incentives and carbon tax in the model. He noted that he would keep rooftop PV trajectories consistent with utility PV costs. Jourabchi said that he also plans to include a comparison of hardware costs and soft costs in the model.

Schwartz commented that Washington may have incentives that are more generous than those offered in Oregon and provided examples.

Knitter encouraged Jourabchi to include income and rate disparities into the model. Jourabchi then stated that he may be able to have the Energy Trust help him create a survey to collect such data. Knitter, Vidaver and Gall provided ideas about what to include in the survey. Heutte stated that he will look for relevant data because he thinks that this issue was studied in the past.

LeVee reiterates that that the model needs a "common economic framework" because, for example, utilities make decisions for their customers for conservation efforts, economic incentives and incremental avoided costs.

Wrap-Up: Hydropower Potential Scoping Study – Gauging Interest

Presenter: Gillian Charles

Simmons provided the GRAC members with a list of proposed resources to assess and asked them to provide him with their input. He stated that the next meeting is in September 2013 and that the Council will follow up with the committee about the rooftop and utility scale cost estimates.

Sixth Power Plan – Action Plan

Charles stated that in the Sixth Power Plan, the Council had two action-plan items to assess the potential of new hydropower and upgrades to existing hydropower. One result of this would be an update of the regional hydro supply curve. She shared that the Council has not updated the hydro supply curve since the Fourth Power Plan and gave the purpose of the hydro supply curve. She asked the GRAC members if there was interest in joint funding and steering such a project.

Potential Scoping Study

Charles recapped the information-gathering session that occurred on March 27, 2012, where regional stakeholders discussed the potential of hydropower in the Pacific Northwest and reviewed relevant studies. She stated that the proposed study may be a two-part study with an initial scoping study and literature review to determine the need for a second study, which could include the update to the regional hydro supply curve. Charles explained that the Council would manage the scoping study and use the GRAC as a steering committee.

Charles let the committee members know that she's not seeking a commitment for the scoping study; she just wants to see if there is any interest and volunteers for a sub-committee to further discuss and develop a draft statement of work.

Gall stated that he has an interest in this endeavor and gave ideas about gathering data and learning about potential. Abdai also expressed interest.

Erben stated that it would helpful to have some cost estimates. Charles replied that the literature review could cost between $15,000 and $30,000, but she doesn't have an exact figure.

Charles told the group that she will send an email to the GRAC members. She stated that the volunteers would draft a proposal and present it to the GRAC.

The GRAC meeting adjourned at 3:30 P.M.