Oregon
Tina Kotek, Governor

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Oregon State Energy Strategy Feedback

The following is a compilation of written feedback received during engagement to inform the modeling and technical analysis for the Oregon Energy Strategy. It reflects all comments received between July 31 and September 4, 2024 through the Oregon Energy Strategy comment portal and email. The Oregon Department of Energy solicited feedback throughout this time period to inform the key data and assumptions applied in the reference scenario and to provide ideas for alternative scenarios. September 4 was the deadline for input on the reference scenario.

House Bill 3630 directs the Oregon Department of Energy to develop an Oregon Energy Strategy that identifies pathways to achieving the state's energy policy objectives, develops policy recommendations to help achieve these objectives, and that is informed by robust stakeholder engagement. The Energy Strategy is meant to serve as a resource over time through continued analysis and engagement to help Oregon achieve emissions reductions in line with state energy and climate policy goals.

The process to develop the Oregon Energy Strategy is divided into three phases: Phase 1 focuses on the modeling and technical analysis to explore different pathways to meeting the state's energy policy objectives. Phase 2 applies learnings from this analysis to inform policy discussion and develop policy recommendations. Phase 3 involves the development of the final report, which must include: a summary of pathways to achieve Oregon's energy policy objectives, policy recommendations, and a description of the engagement process and how stakeholder perspectives informed the Energy Strategy.

The Oregon Department of Energy continues to invite written feedback on the Energy Strategy comment portal throughout the development of the Energy Strategy. The comment portal can be found here: https://odoe.powerappsportals.us/en-US/energy-strategy/

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Dear ODOE, BPA does not have access to your comment portal, therefore please accept the following comments. I know these are slim and I do apologize, but the transmission planning group is extremely resource constrained right now and cannot contribute more at this time. I did have them review the document and there were no red flags or gaps of information that were clearly evident to us.

Thank you for engaging BPA in this process.

These statements are taken from pages 10-11 on transmission and distribution of the document:

- The model is assuming no new transmission (totally new) until 2035—
    - *BPA has no new greenfield development coming online before 2035, correct.*
- *Reconductoring/Rebuilding Existing Lines* – Model assumes BPA's Big Eddy to Chemawa project and PGE's Round Butte to Bethel project, both expanding East to West transfer capacity from 230 kV to 500 kV and both online in 2035 (conservative assumption) or 2030 (liberal assumption)
    - Are there other "in-flight" projects (new lines/reconductoring/rebuilding) that should be considered to be complete before 2035?
        - *BPA is in the planning stages for a few substations that would come online before 2035 that may impact capacity, but, we do not have publicly available timelines or data at this time due to NEPA scoping not having occurred yet and the very early stages of planning occurring.*

- **Cost Assumption--**Proxy value based on historic costs from Energy Information Administration (EIA)
    - *BPA has found that costs have increased but we not have a model to share.*
    - *Consider talking to: Sam Kem - Senior Economic Research Analyst National Rural Utilities Cooperative Finance Corporation (CFC). She's been speaking lately about increased costs and may have a good reference.*
- Electricity transfer capacity between East and West Oregon: Using publicly available BPA data on historical path flows. Account for East to West transmission expansion projects noted above (B2H, Big Eddy to Chemawa, and Round Butte to Bethel) **How/when do we account for BPA and PGE's planned rebuild projects across the Cascades? Such as: Big Eddy to Chemawa and Round Butte to Bethel**

- BPA is in the early stages of scoping and assessing plans of service for the projects, and our NEPA process has not begun, therefore we don't have additional timelines on the project.

Hannah Dondy-Kaplan (she/her)
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Oregon Department of Energy (ODOE):

Cascade Natural Gas Corporation appreciates the opportunity to provide comments regarding the ODOE's Oregon Energy Strategy, and the opportunity to participate in its associated Working Group Meetings. However, we remain concerned by Cascade's exclusion from the formal Advisory Group.

As a local distribution company serving approximately 75,000 customers across Central and Eastern Oregon, we believe it's important that the distinct perspective of those serving rural and lower income gas users be recognized and included. We therefore formally request to be included as members of the Oregon Energy Strategy Advisory Group as the next phase of modeling commences. Participation by rural gas providers like Cascade will help ensure modeling performed by ODOE is not limited to the realities of its more urban and affluent areas.

In the meantime, Cascade offers the following feedback and observations:

Draft Reference Scenarios and Development of Draft Assumptions

Draft assumptions should be realistic, rather than aspirational. While Cascade appreciates that ODOE is modeling its assumptions from the state's energy objectives and greenhouse gas reduction goals, differentiation should be made between goals and outcomes. For instance, while a goal may be to achieve a target such as 95% of overall space/water heating sales for electric heat pump sales by 2040, this outcome will be dependent upon myriad factors including equipment affordability, market adaptation, and individual consumer actions.

For the Energy Strategy to be useful, it will be important that each energy goal is reviewed to determine if it is currently on track to achieve the desired outcomes. Models should include accurate market saturation rates to take a baseline of where we are today, and the anticipated trajectory of market transformation. Cost/benefit analysis and economic modeling is likewise essential since all pathways to decarbonization will have tradeoffs and could have significant economic impacts on ratepayers, industry, and small businesses. The inclusion of co-benefits should likewise be balanced with the need for continued energy reliability, affordability, and system resilience and should factor for leakage of employees, jobs, and emissions to other states. Without acknowledgement that some outcomes may not currently be achievable, the strategy may unintentionally become an aspirational document, rather than a practical roadmap.

Energy Policy Objectives

ODOE lists the Climate Protection Program as one of the key policies driving energy policy objectives in Oregon. However, the CPP was invalidated by The Oregon State Court of Appeals following a ruling which showed the Environmental Quality Commission (EQC) did not fully meet disclosure requirements

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in 2021. Although an alternative rule is now in development, the CPP referenced in ODOE's modeling assumptions has been officially invalidated and no longer in effect.

Until the new CPP rulemaking is complete and that program has been finalized and enacted, there is no formal program from which ODOE can base or model these assumptions as modeling from a replacement to the CPP would be premature.

Reference Case Policy and Supply-Side Assumptions

Achievement of the state's targets will require a holistic approach to decarbonization that provides a robust portfolio of options, particularly those that do not add additional strain to an already resource constrained electric grid. Such technologies may include lower carbon fuels like renewable natural gas and hydrogen, as well as non-combustion solutions like networked geothermal. However, during the August 22 Working Group Meeting, geothermal energy appeared to have been removed as an option to support Oregon's State Energy Strategy. Cascade believes this technology should not be dismissed and is a potentially significant tool to support the state's emissions reduction goals.

In Washington State, a Thermal Energy Network (TENs) law was recently passed that empowers natural gas utilities to invest in projects that provide heating and cooling through the use of non-combustion liquids as a conduit for ground-source heat pump technology. The law allows local distribution companies to embrace non-gas alternatives while reducing the strain on the electric system associated with traditional electrification pathways. Not limited to geothermal, TENs technologies could encompass a range of heat sources including wastewater/sewage generated thermal energy, thermal energy from abandoned coal mines, and waste heat reclamation from data centers.

As more states embrace the inclusion of networked thermal energy as pathways toward a just energy transition, Oregon should likewise consider these pathways in its strategic planning efforts.

Reference Case Demand-Side Assumptions

In developing its reference case demand-side assumptions, ODOE included the targets and goals of the Climate Protection Program. However, as previously stated, the Climate Project Program (CPP) is not currently in effect. The rule was overturned by the Oregon State Court of Appeals and a replacement rule is currently in rulemaking by DEQ. It is therefore premature for the Oregon Energy Strategy to include the CPP alternative program as part of its modeling, since this program has not yet been finalized or approved.

We are also concerned that building electrification input assumptions are unrealistic and will not provide an accurate assessment of the policies and actions needed to support effective decarbonization. Cascade recommends that ODOE consult with the Northwest Energy Efficiency Alliance (NEEA) and Energy Trust of Oregon to confirm these assumptions are consistent with their plans and modeling regarding equipment availability and market transformation.

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What-If Questions

Cascade encourages ODOE to continue exploring "what if" questions and emerging topics such as the availability of transmission to support aggressive electrification, and concerns over limiting natural gas in homes, which were communicated on slides at their August 22 meeting.

These concerns are consistent with a poll conducted by DHM Research in 2023, which indicates that voters in Deschutes County, an area which represents a large number of Cascade customers, overwhelmingly opposes all types of bans on natural gas. It was likewise shown these voters supported local government encouragement of renewable natural gas, and wanted Cascade to focus on providing opportunities and incentives to purchase renewable energy, and to make energy efficient appliances and heating more available.

Quite simply, decarbonization pathways should not be narrowed to a single technology or pathway and should be responsive to the energy affordability and resiliency needs of the state. Technologies such as dual-fuel heat pumps, and the increased proliferation of renewable natural gas can help ease carbon impacts while placing less pressure on the grid. Likewise, technologies such as networked thermal energy may be particularly well-adapted to help with this issue and could also be an excellent tool for supporting state decarbonization goals. These pathways should be given due consideration and be fully included in modeling as the State Energy Plan continues to develop.

Thank you again for the opportunity to provide comments regarding the Oregon Energy Strategy. We maintain the importance of having all voices at the table during this important process, and reiterate our request that Cascade be added to the Advisory Group for this proceeding. Regardless, we will continue to participate in the public process as appropriate to ensure the perspective of Cascade as a rural service provider is brought to the table as these critical conversations are taking place.

Sincerely,

Alyn Spector
External Affairs Manager
Cascade Natural Gas Corporation

September 4th, 2024

Edith Bayer
Energy Policy Team Lead
Oregon Department of Energy

RE: Comments on the Draft Reference Scenario for the State Energy Strategy

Climate Solutions thanks the Oregon Department of Energy ("ODOE") for the opportunity to submit these comments on the draft reference scenario. Climate Solutions is a nonprofit organization working to accelerate clean energy solutions to the climate crisis. We are grateful to serve on the advisory group and several working groups for the State Energy Strategy. As ODOE has articulated, the State Energy Strategy "serves as a resource over time through continued analysis and engagement to help Oregon achieve emissions reductions in line with state energy and climate policy goals." The modeling exercise we are now undertaking will be foundational and instrumental in creating a resource that is fit for this purpose. We thank ODOE staff for their diligent work on this challenging endeavor, and we remain committed to supporting the agency through to the 2025 delivery of the State Energy Strategy to the legislature.

General Comments

As an initial matter, we have concerns with ODOE's very swift pace in drafting and finalizing the reference scenario. We are aware of and understand the time pressures ODOE is facing in submitting the scenarios to the modeling team. However, this fast pace resulted in all eight working groups being facilitated during a constrained three week time period. Additionally, the advisory group will have very limited time to review the draft scenario. Getting the modeling right is crucial. We are cognizant that the scenario modeling will be a foundation from which much of the first iteration of the state energy strategy will be built. Therefore, we recommend that in considering revisions to and iterations of the modeling, ODOE continue to receive feedback from stakeholders and review the adequacy of data sets utilized. ODOE should also make data sheets, a complete list of technologies, and relative performance measures available to the working groups.

We also recommend that ODOE make efforts to ensure it has adequate and comprehensive data sets to inform the scenarios. While we understand there are limited resources and time to identify data sets, we reiterate the point above that this modeling exercise will be a foundational component of the energy strategy. The results of the modeling will be dictated in part by the data inputs. We recommend that ODOE identify additional data for the following areas:

1. Energy Service Demand projections, including data sources and methodology
2. Existing and New technology options with cost and performance data, and constraints (growth rates, resource limits, market share constraints, etc.). These should be categorized by sector and energy service.
3. Existing and new energy resource supply options, cost curves and resource projections for all fossil, renewable and imported resource options.
4. Existing and projected load duration curves for electricity demands
5. Methodology and assumptions (e.g., reserve margin) for determining peak loads (and capacity needs).
6. Discount rates

ODOE should articulate its criteria for determining when *specific technologies* are existing vs emerging, and the modeling should reflect the potential scaling of generation and fuel technologies accordingly. Below are a few examples of technologies that are more nuanced in terms of growth.

- Floating offshore wind is an existing technology and has been deployed in several regions globally. A total capacity of 3 GWs by 2030 is possible for offshore wind on the Oregon coast.
- SMRs are not operational in any geographies yet and therefore can be considered emerging.
- Some geothermal technologies are existing and operational, but nextgen geothermal is still emerging.
- Green electrolytic hydrogen is an existing technology that has been deployed extensively in Europe and in limited areas in the US.
- Microgrids and small-scale renewable energy facilities are existing technologies, have limited deployment in Oregon, and can potentially be scaled to provide substantial energy capacity, resilience, and economic benefits.

Buildings

- The model is currently set to allow investment in dual fuel electric and gas boilers as well as hydrogen boilers. We'd like to ensure that there is transparency about how the model considers these dual fuel boilers, to what extent they are forecasted and in what applications.

Direct Use Fuels

If the model is going to use utility IRPs to forecast fuel uses, we'd like that to be restricted to only **acknowledged** IRPs. So far, the PUC has not acknowledged gas utility proposals that rely on hydrogen blending. For RNG forecasting, the model should take into account that despite attempts by gas utilities to procure and blend RNG at rates of 3%, so far they have not even reached 0.5% blend rates.

We thank ODOE staff for your attention to these comments.

Sincerely,

Joshua Basofin

Joshua Basofin
Clean Energy Program Director
Climate Solutions

COLUMBIA RIVER INTER-TRIBAL FISH COMMISSION
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September 5, 2024

Janine Benner
Director
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Dear Director Benner:

The Columbia River Inter-Tribal Fish Commission (CRITFC) appreciates the opportunity to participate in the development of the Oregon Department of Energy's Oregon State Energy Strategy (OSES).

CRITFC was formed in 1977 by the Nez Perce Tribe, the Confederated Tribes and Bands of the Yakama Nation, the Confederated Tribes of the Warm Springs Reservation of Oregon, and the Confederated Tribes of the Umatilla Indian Reservation ("member tribes"). CRITFC provides technical, policy coordination, and enforcement services to our member tribes on issues related to their treaty-reserved fishing rights and the fishery resources they have managed since time immemorial.

Through the comments below, CRITFC provides recommendations for the OSES that will reduce the damage to salmon and steelhead and other tribal resources caused by the electrical system. The energy developments of the twentieth century produced benefits for parts of the Pacific Northwest but came at the expense of aquatic ecosystems, tribal resources, economies, and cultural practices. Salmon and steelhead populations throughout the Columbia Basin are struggling to survive in a significantly altered river system, and many populations are headed for extinction. Most of CRITFC's member tribes are served by investor-owned utilities that don't receive power from BPA, and most tribal communities pay higher rates than BPA's customers. The Hanford Reservation, located on tribal ceded lands, is an environmental disaster, and various energy facilities have damaged tribal lands and resources throughout the Columbia Basin.

The tribes embrace the clean energy transition and insist that their treaty-secured resources must be protected, mitigated, and enhanced during this next era of resource development. The recent dramatic reductions in Columbia Basin salmon populations and changes in the West Coast energy planning environment prompted CRITFC to undertake a third major revision to its Energy Vision for the Columbia Basin.[1] CRITFC's 2022 *Energy Vision for the Columbia River Basin* (*Energy Vision*) is available at *www.critfc.org/energy-vision/* and includes 43 specific recommendations to guide the region to a fish-friendly energy transition. It includes recommendations intended to protect the tribes' treaty-secured fish, wildlife, cultural, and other resources.

A major theme of the 2022 Energy Vision is that renewable resources in combination with increased storage, reductions in peak demand, and increased energy efficiency can provide clean, adequate, reliable, affordable electricity that reduces the damage to salmon and steelhead and other tribal resources caused by the Columbia Basin dams, transmission lines, and new resource development. The corresponding recommendations reflect concerns that increased reliance on the Columbia hydropower system will be detrimental to fish, particularly the alternating peaking/low flow operations that result from using hydro to balance periods of low solar and wind generation and other high-demand periods. We ask that ODOE incorporate the concepts of the Energy Vision in the OSES and provide the following comments toward the current modeling stage of the OSES development consistent with this vision and binding commitments for salmon recovery.

I. Hydro modeling should reflect hard constraints of ESA Biological Opinions and federal commitments to the Six Sovereigns.

We appreciate ODOE's effort to include accurate hydropower system operations forecasts in this baseline model by incorporating current energy budgets, flow-constraints, and low/ medium/ high hydro year data. These are important considerations because the Columbia River is not a pliant battery but a dynamic ecosystem. Today, the region is 4 million salmon a year short of meeting interim rebuilding goals, while many populations throughout the Basin risk extinction. The Columbia River dams must be operated to ensure a clean energy future while restoring salmon and other aquatic species to healthy and abundant levels, supporting economic and climate resilience, building ecosystem function, and honoring longstanding unmet commitments to Tribal Nations.

The OSES model should reflect baseline legal frameworks and policy commitments for salmon recovery. For more than forty years, fishery managers have been calling for higher flows in the spring and summer to help young salmon migrate from their natal streams to the ocean. In recent decades, lawsuits effectuating the Endangered Species Act (ESA) and Clean Water Act (CWA) have limited rather than expanded hydro generation capabilities.[2]

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[1] The first Tribal Energy Vision in 2003 included recommendations to avoid another energy shortage like that of 2001 that damaged fish and wildlife and the economy. The second Energy Vision in 2013 focused on reducing hydroelectric dam impacts on salmon populations and decreasing costs for consumers.
[2] *See* Figures 25 and 26 in the *Energy Vision* and accompanying text that describes current Clean Water Act temperature violations associated with hydropower dams. *Also see, Columbia*

Further, climate scientists have found that, while climate change will likely increase average highwater years in the Columbia Basin, it will also increase flow variability and draught, reducing the hydropower system's capacity as a reliable baseload resource.[3] Finally, these constraints are embraced at the highest levels of policy and planning. Recent federal commitments in the Resilient Columbia Basin Agreement (RCBA) move the region toward reducing hydropower reliance while restoring healthy and abundant salmon populations.[4]

For these reasons, the following comments identify additional data to include in this baseline model to more closely reflect future generation constraints from both ESA requirements and binding federal-state-tribal agreements to protect and restore abundant fish populations.

The Baseline should reflect minimum biological constraints.

To begin, ODOES's current approach to incorporate data from the Northwest Power and Conservation Council (NPCC) is an appropriate starting point. NPCC's GENESYS model integrates both historic and future flow simulations, taking into account climate projections and some requirements for fish survival. However, care should be taken to ensure the GENESYS model fully reflects minimum flow requirements for fish survival established in Biological Opinions.[5] In Section 3.1 of CRITFC's *Energy Vision* we noted, for example, that samples from the GENESYS model at that time showed periods in the near future where demands on the hydropower system to follow peak loads and intermittent resources would significantly alter daily flow regimes—from extreme high to extreme low flow levels. We pointed out that these dramatic water fluctuations would be devastating for migrating salmon.

Riverkeeper v. Wheeler, 944 F.3d 1204 (9th Cir. 2019) (Ninth Circuit compels EPA to issue a temperature TMDL for the Columbia and Lower Snake Rivers after state inaction).

[3] *See* Monica Samoyoa, "Hydropower expected to increase throughout the U.S., but climate change could affect how—and when—we use it", Oregon Public Broadcasting (August 21, 2024), https://www.opb.org/article/2024/08/21/hydropower-electricity-pacific-northwest-renewable-energy-climate-change/. (*Discussing* Daniel Broman et al, *Multi-scale Impacts of Climate Change on Hydropower for Long-term Water-Energy Planning in the Contiguous United States*, Environ. Res. Lett. 19 094057 (2024).

[4] For reporting on the RCBA commitments (formerly known as the Columbia Basin Restoration Initiative), *see* Mathew Daly, *White House, Tribal Leaders Hail 'Historic' Deal to Restore Salmon Runs in Pacific Northwest*, Ass. Press, Feb. 23, 2024, https://apnews.com/article/salmon-dams-tribes-columbia-snake-river-biden-51408c120a2e2dc147e6b07fe01d3531.

[5] *See* U.S. National Marine Fisheries Service, *Operation & Maintenance of the 14 Federal Dam & Reservoir Projects in the Columbia River System*, ESA Sec. 7 Consultation (2020), https://repository.library.noaa.gov/view/noaa/26460.

We understand that NPCC staff are addressing this problem, which is not inherent to the GENESYS model. But to ensure the baseline OSES model does not also inadvertently overestimate hydro capacity for load-following and peaking, we recommend ODOE work directly with NPCC to ensure the model accounts for minimum flows, spill requirements, and other fish constraints detailed in fish and water management plans.[6] If, as a result, Oregon's energy needs require additional generation, storage, grid flexibility, or efficiency measures to meet both clean energy targets and minimum fish requirements, the baseline model should reflect this fundamental reality.

The Baseline should incorporate binding USG Commitments improving hydro operations.

Critically, to our knowledge, neither the baseline OSES model nor NPCC's modeling yet reflects new, binding commitments by the U.S. government (USG) to replace hydro reliance with new renewable capacity and steer salmon survival toward healthy and abundant levels. The USG Commitments are binding settlement conditions following a multi-decadal lawsuit over the disastrous impacts of the four lower Snake River dams (LSRD). The USG Commitments essentially enact a joint initiative to restore salmon in the Basin originally envisioned and proposed by the states of Washington and Oregon, and CRITFC's four member tribes ("the Six Sovereigns").[7]

As interim measures, the USG Commitments obligate federal dam operators to increase spill for juvenile fish passage, limit "zero flow" operations, and maintain reservoirs at minimum operating pools to benefit salmon migration. A full list of interim project operation changes can be found in Appendix B of the USG Commitments.[8] We expect these provisions will remain in effect as a floor for harmonizing salmon restoration and energy operations, while additional measures will be added as the energy transition and climate impacts develop. Additionally, the federal government has committed to funding a study of regional energy needs to achieve climate targets while replacing the capacity of

the lower Snake River dams. The Pacific Northwest National Laboratories (PNNL) is currently developing this model. We urge ODOE to coordinate with PNNL and identify how the OSES model can integrate the core dataset and starting assumptions of this basin-wide energy needs study.

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[6] *See* U.S. Army Corp of Engineers, *2023 Fish Operations Plan* (2023), https://pweb.crohms.org/tmt/documents/fpp/2023/final/FPP23_AppE_03-27-2023.pdf; U.S. Army Corp of Engineers, *2023* Water Management Plan (2023), https://pweb.crohms.org/tmt/documents/wmp/2023/Final/20221231_2023_WMP_Final.pdf

[7] The motivating proposal by the Six Sovereigns is called the Columbia Basin Restoration Initiative. A fact sheet is available here: https://www.critfc.org/wp-content/uploads/2024/02/crbi-fact-sheet.pdf

[8] Available online at https://earthjustice.org/wp-content/uploads/2023/12/snake-river-litigation-usg-commitments.pdf.

Finally, the USG Commitments provides funds to replace the generation losses of the LSRD through direct investment in tribal energy projects. These projects will account for 1000-3000 MW of additional clean energy generation capacity across the four CRITFC tribes, two of which are located in Oregon. The model should forecast these tribal energy contributions with the same weight as utility IRPs.

Integrating these Commitments may require further consideration of other aspects of the OSES model. This could include forecasts for meeting peak load, reliability, and resource adequacy in recognition of the ways utility providers and regulators may adapt to changing dam operations and associated load generation capability. These considerations also figure in to questions posed by ODOE and other parties about the relative importance of, for example, emerging demand response technology, reduced transmission capacity, and changing distribution costs. Without suggesting answers, we express our appreciation for ODOE's forthright approach and thoughtful consideration of all the issues. It is important that the baseline study set out to build on the known science and federal commitments we have outlined here precisely because Oregon stands at a critical crossroads in achieving its goal of transitioning to clean, renewable energy while protecting communities and ecosystems. The Oregon Strategy will be an important tool in this regard and should be built on a strong foundation.

Additional comments on hydro assumption inputs:

- Hydro operations have changed significantly over time, which affects the ability to use historic hydro calculations for future analysis. What is the timeframe for the historic calculations in the model? The last 10 years, the last 20 and/or the last 5 years? The further out the timeframe, the further the assumptions are from what is actual.
- Spring operations have been altered a lot in the last two to four years; the model is likely to overestimate the capabilities or load capacity of the Columbia hydro system current operations. Appendix B in the RCBA should help clarify how the current operations match up with historic.
- The new summer operations actually have an opposite effect since spill has been reduced on August 1. If the model is using data from 2005 when summer spill was added through August 31, the current reduced summer spill operations should actually show as a net positive in hydro capacity.
- The ramp rates of 1 and 6 hours need to be clarified for where the control points are. Is this Grand Coulee ramp rates? Do the rates change daily? seasonally? The time of year plays a major role in this. Also, do they account for different flow years since it is easier to change the ramp rates in low to medium flow years than high flow years.

- The model being developed for the USG commitments considers breach of the LSRD in its longer-term forecast. Because this outcome is a real possibility for the region, the OSES model should incorporate replacement reliability needs from the Snake River dams, especially in the model's forecast of energy reliability in future decades.

II. **Looking ahead, ODOE should model a scenario for a low-peak, low-hydro reliance energy future that aligns with recommendation in the *Energy Vision*.**

CRITFC's 2022 *Energy Vision* presents a holistic approach for a fish-friendly PNW energy transition. Together with hydro-operation and siting recommendations, its recommendations focus on reducing energy demand and reducing peak energy loads to curtail reliance on the hydropower system and particularly, the load-following ramping operations that are especially detrimental to fish.

The *Energy Vision* recommendations can be used to elicit a natural and cultural resource-friendly energy scenario for the OSES to model. Components of such scenario would include:

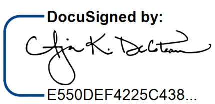
- Reduced hydro capacity. The hydro-modeling capabilities of the OSES model are not fine enough to capture the intricacies of future hydro operations that support healthy and harvestable fish operations. Reduced hydro capacity assumptions may provide a coarse substitution for these necessary future operations.
- Increased energy efficiency. Energy efficiency actions have the least impact on tribal resources and offers opportunities for improving conditions for fish, wildlife, and cultural resources. Energy efficiency actions can reduce the pressures on the hydro-system and reduce needs for transmission and large-scale renewables which come with siting concerns. Included in energy efficiency are increases in heat pump and water heater adoption.
- Increased demand-side management. Similar to energy efficiency, actions that increase demand-side management of energy uses can improve conditions for tribal resources by reducing energy demand on the grid.
- Accelerate distributed solar coupled with storage. Renewable, intermittent resources can help address the climate crisis affecting everyone's resources if they can be integrated into the power system in a way that reduces the large fluctuations in daily flows that kill migrating salmon and steelhead. Distributed solar with storage again reduces demands on hydropower and reduces transmission and large-scale renewable siting issues.
- Large-scale storage. Large-scale storage, implemented alone or together with grid-scale renewable projects, can help to alleviate pressures on the hydropower

system by helping to meet demand during peak times or times of low variable renewable generations. Note that large-scale storage, however, brings with it siting and other concerns, e.g. water concerns in the case of pumped storage facilities. The other avenues above should be prioritized.

The above are provided as initial "what if" scenario suggestions for a tribal-resource-friendly scenario. Specifics of such scenario should be elaborated on and discuss in more details as alternative scenarios are defined.

Conclusion
Thank you for the opportunity to make these comments. We are happy to talk to you further about aligning the Oregon Strategy with CRITFC's Tribal Energy Vision. Please contact Chris Golightly at golc@critfc.org to discuss.

Sincerely,



Aja K. DeCoteau
Executive Director

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September 4, 2024

To: Oregon Department of Energy

Submitted through online portal: https://odoe.powerappsportals.us/en-US/energy-strategy/

Re: Comments on Draft Reference Scenario, Oregon Energy Strategy

Thank you for the opportunity to participate in the development of the Oregon Energy Strategy. Columbia Riverkeeper is a non-profit organization with a mission to restore and protect the water quality of the Columbia River and all life connected to it, from the headwaters to the Pacific Ocean. Columbia Riverkeeper has over 16,000 members and supporters who live, work, and recreate throughout the Columbia River Basin, including thousands of members and supporters in Oregon.

The Columbia River has been at the center of the region's economy and energy systems since time immemorial. It has always been a place where communities have come together to share ideas and goods, and harvest life-giving salmon and other sustaining foods. The river has been a place of abundance, connection, and energy.

In the past 150 years, the river and those who call it home have borne the brunt of the extraction of energy from the Columbia. An extractivist worldview has harnessed the energy of the Columbia in ways that have caused devastating harm to the river and people who depend on it.

Today, as we face climate chaos, we must embrace new paradigms to ensure that a life-sustaining Columbia River is here for future generations. We submit these questions and comments to help the Oregon Department of Energy apply the principles of a just transition to a clean energy future to the Columbia Basin as part of its Energy Strategy.

The Oregon DOE's extremely short notice and compressed timeframe for work group meetings and input has made it difficult for our staff to engage meaningfully in this process and prevented us from engaging our wider membership. We encourage you to slow down the process of creating an energy strategy to allow for meaningful input from Oregonians.

In response to Oregon DOE's request for questions and comments on the reference model and alternative models, Columbia Riverkeeper submits the following:

Tribal Engagement

- What does the modeling consider to be Tribal lands? It appears that it may only include reservations. We would support a broader definition of Tribal lands that includes culturally significant sites and will defer to comments from Tribes about how to more accurately characterize Tribal lands.

- Is the reference and alternative modeling and the broader development of Oregon's energy strategy taking into account the Columbia River Inter-Tribal Fish Commission's Energy Vision for the Columbia River Basin? We suggest that this excellent resource be utilized in the planning.

Nuclear Power

- Is new nuclear power built in other states being included in the reference scenario or alternative scenarios? And if so, how are you calculating the cost and timeframe for any nuclear projects? In its 2024 report, the Institute for Energy Economics and Financial Analysis (IEEFA) finds that "small modular reactors still look to be too expensive, to slow to build, and too risky to play a significant role in transitioning from fossil fuels in the coming 10-15 years." They also caution that the opportunity costs associated with investing in SMNRs will restrict funding for renewable energy.

- We note that small modular nuclear reactors should not be considered an existing technology since they have not been built in the U.S. We suggest that energy from new nuclear power should not be included in the reference scenario as there are not credible datasets available to support accurate modeling.

- Given Oregon's moratorium on building any new nuclear power plants until there is a vote of the people and a national waste repository, it does not seem consistent with the spirit of current Oregon law to propose the burden of additional nuclear plants and nuclear waste on communities outside our state to supply energy to Oregonians.

Existing Hydro

- Lower Snake River Dams Removal: Does the reference scenario or other modeling include removal of the four lower Snake River dams? Given the Columbia Basin Restoration Initiative lays out a pathway toward breaching the dams, this is a realistic scenario that should be included in one of the models. Our energy future should be compatible with a thriving salmon population.

- Does the reference scenario consider significant snowpack reduction or other changes in precipitation volume and timing? This would have significant impacts on hydro power. Is this included in the modeling? Does the model add more burdens to that ecosystem through increasing over-reliance on hydro resources? Does the reference scenario make any assumptions around hydropower? If so, what are they?

Hydrogen:

- Does the reference scenario or other scenario include hydrogen as an electricity generating resource? If so, does it include hydrogen blending with methane gas? Is it limited to "green" hydrogen and reserved exclusively for the most difficult to electrify sectors?

- How is declining water supply in eastern Oregon being considered for any potential use of groundwater for electrolysis?

Biomass:

- Is biomass included in the reference scenario, and if so, how will you model the air pollution impacts from it?

Biogas:

- Are biogas facilities included in the reference scenario, and if so, how will you model the air pollution impacts from facilities producing biogas?

Energy Efficiency

- Will robust energy efficiency investments be included in the reference model or other models? As discussed in the CRITFC Energy Plan, one of the benefits of this focus is that it is a fish-friendly policy. This is a critical environmental justice opportunity.

Distributed Energy

- Will a robust plan for rooftop solar, community solar and storage, and other distributed energy be included in the reference model or other models? How are co-benefits being considered? How is environmental justice being prioritized?

Bio Fuels

- What kinds of alternative fuels will be included in the reference model or other models? Will the greenhouse gas lifecycle emissions from these fuels be accounted for in the modeling?

Data Centers and AI

- How, if at all, is energy for additional data centers and AI being addressed in the reference scenario and other scenarios? Is there an option to propose new policy to limit these in Oregon?

Methane Gas

- Pipe leaks: Does the reference scenario acknowledge and account for pipeline leakage?

Net Zero Scenario?

- Will the reference scenario or other scenarios model a true net zero, or will they be including carbon offsets? We would encourage a true net zero model that does not place our energy burden on other communities.

Regional Energy Markets

- How will the reference scenario or other scenarios model the effects of expanding regional day-ahead and other energy markets? What assumptions are you making about how those regional markets, and participation in them, will change over the next decade or more?

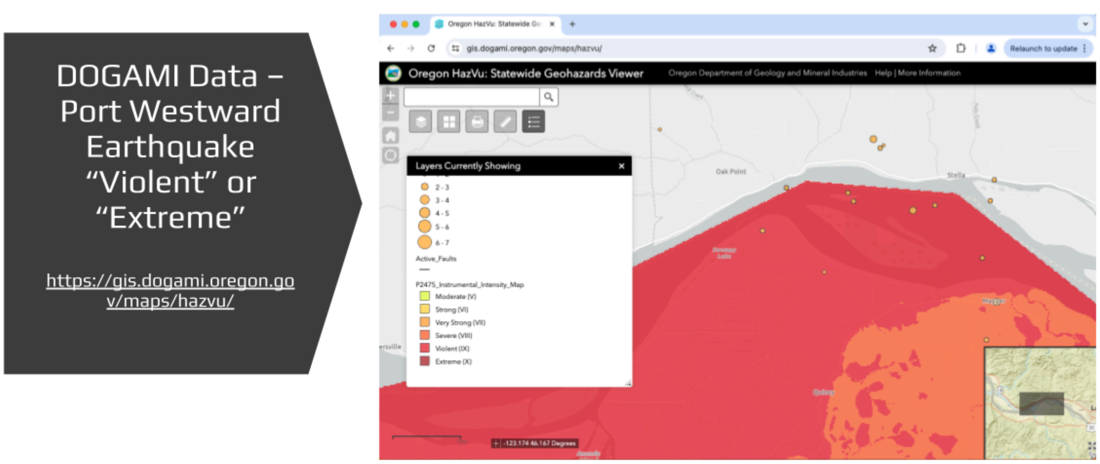
Water Quality

- Energy systems impact water quality in a major way. How does the Oregon Energy Plan incorporate considerations of water quality?

Seismic and Land Use Assumptions

- How are the reference model and other models taking into account seismic concerns? For instance, are you using [DOGAMI](https://gis.dogami.oregon.gov/maps/hazvu/) data?

- For example, zooming in on one potential energy infrastructure location where the local community has identified obvious problems that do not appear easily recognized in the ORESA tool, Port Westward is built on unstable soil, where dikes at risk of overtopping in a 100-year flood (see figures below from DOGAMI)



We appreciate the opportunity to submit these questions and comments at this state of the process and throughout the development of the Oregon Energy Strategy and we look forward to more information to help us better understand how these models will inform the strategy.

Sincerely,

Kelly Campbell

Policy Director, Columbia Riverkeeper

kelly@columbiariverkeeper.org

541.953.5475

Energy Trust Comments in Response to ODOE's Suggested Changes to Assumptions in the Buildings Workgroup

Assumption: 95% of electric HP sales in Residential by 2040
Planning feedback: This percentage seems too high. 80% seems optimistic and more achievable.
Additional Notes:

- This assumption seems to be more aggressive than the assumptions we are using in our electric utility IRP work.
- This seems particularly aggressive for the multifamily and rental markets where there are significant economic barriers to getting HPs installed that replace end of life gas HVAC equipment.
- A 95% share of equipment sales is extremely high, this level of HP sales seems like it might only be achievable though something like a code requirement (e.g. it becomes illegal to sell gas equipment except for certain rare circumstances which account for the remaining 5% of sales).

Assumption: 75% commercial HPs sales by 2045
Planning feedback: This feels a bit high due to the difficulty in switching some commercial buildings from gas to electric systems. 60% feels optimistic and more achievable.

Assumption: 95% HPWH sales in residential and small commercial by 2045.
Planning feedback: same as residential space heat assumption, 95% is a really high number unless there is a standard that eliminates gas equipment from the market. 75% seems optimistic and more achievable.
Additional notes:

- Technical suitability for HPWHs is not 100%. There are fairly significant space constraints and comfort issues related to HPWHs when the equipment is not located in a garage or basement.

Assumption: Building Electrification, 95% new appliance sales electric by 2035
Planning feedback: this % seems too high. 80% seems optimistic and more achievable.
Additional Notes:

- Other jurisdictions (e.g., Berkely gas appliance ban) have tried to get to 100% electric appliance sales through policy but have not been successful.
- Small commercial restaurants getting to 95% electric sales seems unrealistic.
- Are gas fireplaces included here, and if so, is it realistic to assume the market for these will disappear almost entirely?

Assumption: Industrial Processes. 1% average improvement to process efficiency per year in all sectors. Fuel switching measures from fuels to electricity.
Planning feedback: Seems reasonable.

Assumption: Res EV Flex Load, 2/3 residential EVs participating in managed charging
Planning Feedback: This seems is a little high given consumer anxiety about range and the desire to make sure their car is charged when they need it.
Additional Notes:

- Policy and rate changes could make this more realistic.
- Surprising that COM participation in managed charging is assumed to be lower than RES. Fleet managers have stronger reasons to participate in managed charging.

Possible Scenarios for Consideration

- Efficiency is installed at aggressive rates envisioned in assumptions above.
- Solar photovoltaic and storage options become much more accessible. Costs come down and products and installation become much more widely available.
- Renewable natural gas market is established and renewable natural gas becomes widely available to make up significant portions of natural gas utility loads.

ETM™

"Driving on Sunshine"

Oregon's Energy Strategy Advisory Group

-Public Comment-
ODOE Strategy Meeting Webinar
July, 2024

Prepared by
Toby Kinkaid
EV4 / EV Global
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Portland, OR 97202
toby@evglobal.net
EV4.website
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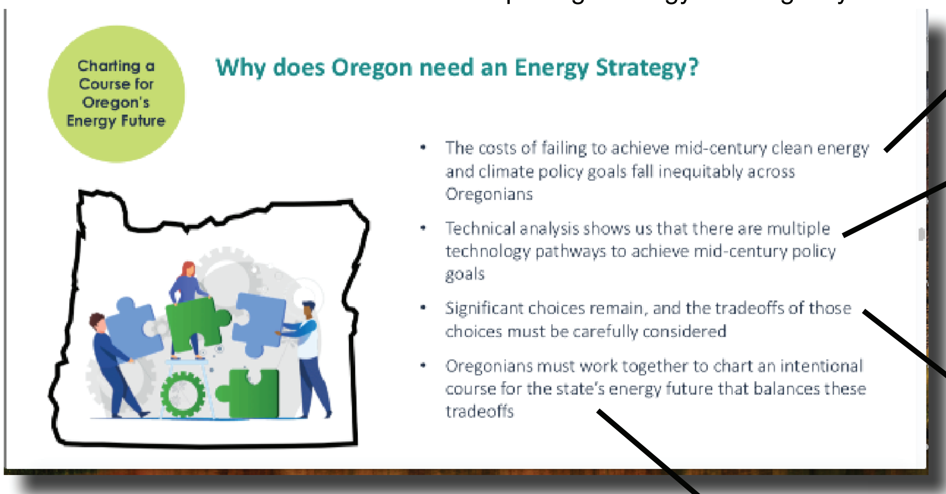
"There's no one policy telling us how to do it all..."

- Edith Bayer
Team Leader
Oregon's Energy Strategy Advisory Group
Opening Strategy Meeting July '24

FALSE

A Clean Hydrogen Economy offers the one policy paradigm with a comprehensive ability to produce 100% clean energy in Oregon for Oregon's economic prosperity across all sectors with no toxicity or imports.



TRUE

FALSE

There is only one pathway, mathematically, not multiple ones, to actually achieve climate goals at scale

FALSE

A comprehensive solution doesn't require tradeoffs. A comprehensive solution offers economic development, high paying jobs, reliable energy and fuels produced entirely in Oregon and with 100% non-toxicity across all sectors.

TRUE

Presents lowest environmental impact with no Carbon involved. The Clean Hydrogen Economy maximizes local electricity and fuel production using reliable, robust, resilient, long-lived, low water use and comprehensive clean energy technology.

Produces Oregon's energy independence across the entire economy from transportation, residential, commercial, industrial, construction, mining, and Agricultural energy needs.

Clean Hydrogen Economy for Oregon's Energy Independence

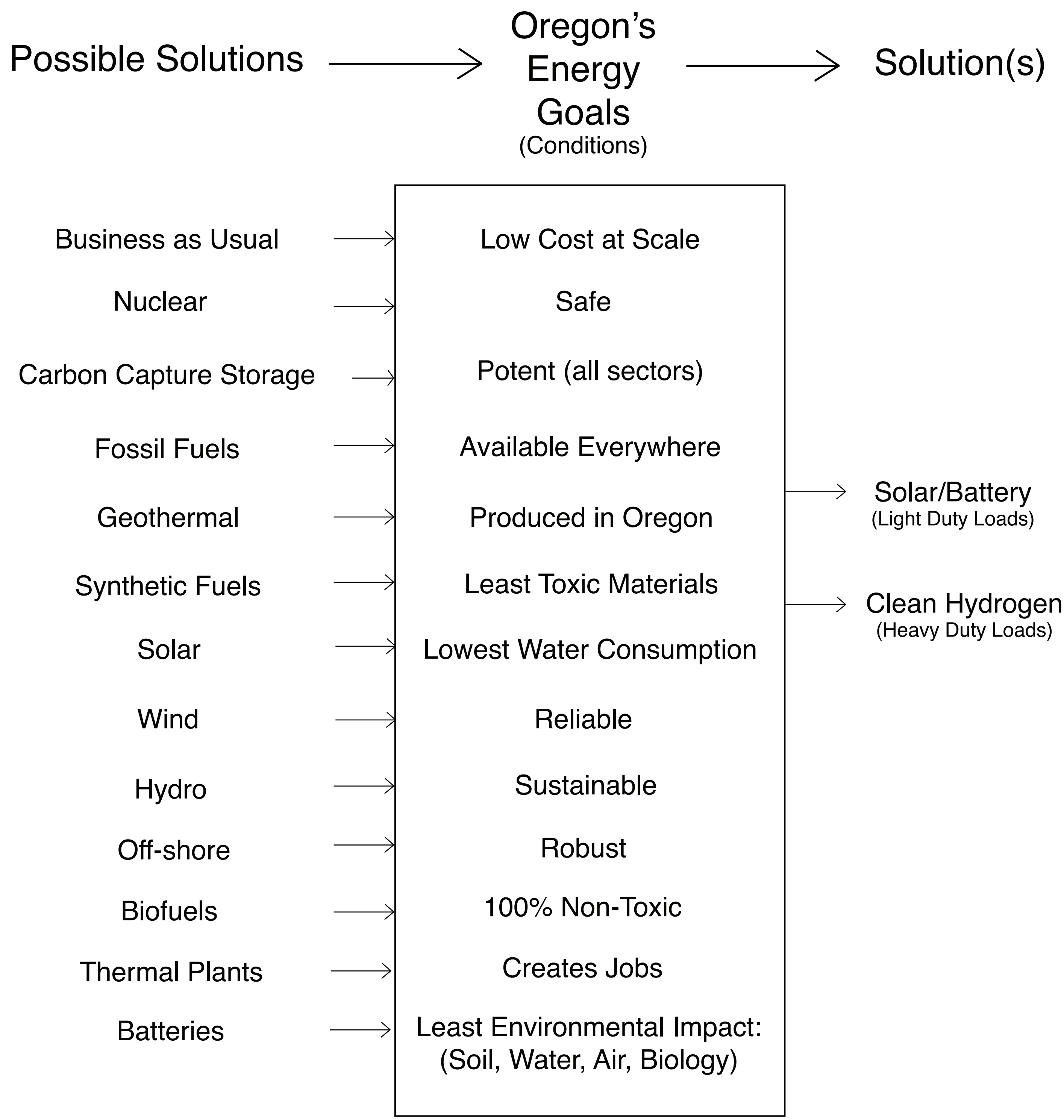
All Energy produced in Oregon

Robust - Reslilient - Reliable - Low Cost at Scale - Available throughout Oregon

Produces thousands of Jobs transitioning Oregon from Fossil Fuels to Clean H2

Oregon's Energy Future: what is the Goal?

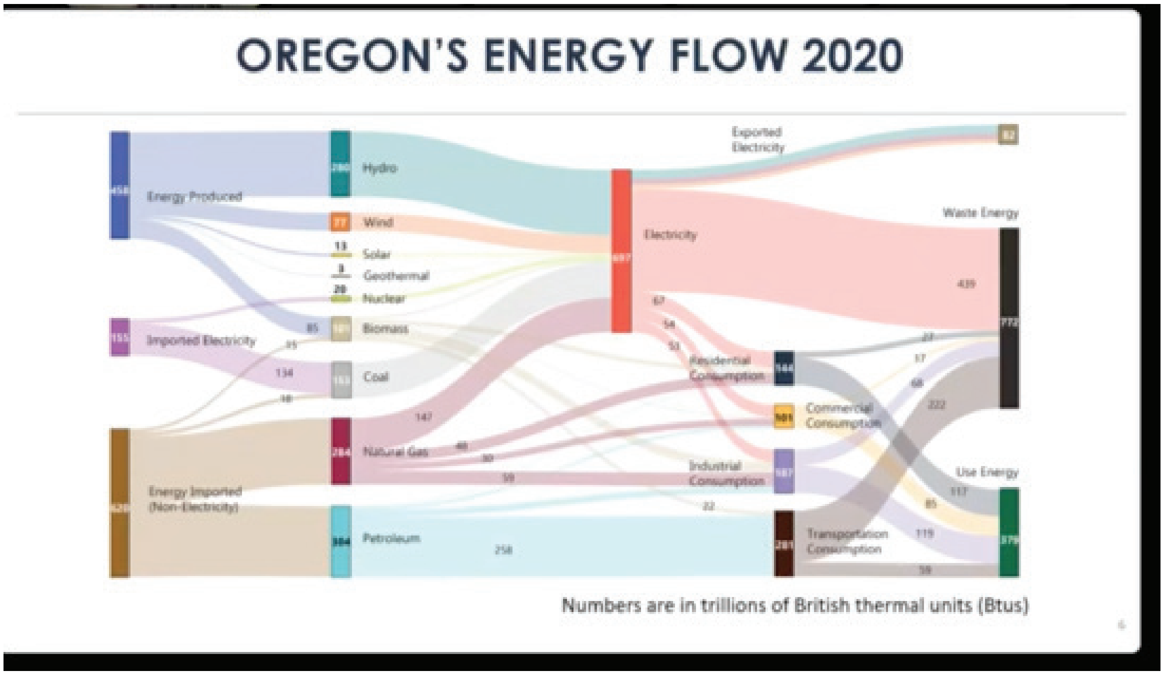
Proposed Oregon's Energy Mission Statement and Vision: ***Zero Emission Economy***



NOTE: Any actual Solution(s) must satisfy All conditions listed above simultaneously, or, it's not a solution

Oregon’s Current Energy Paradigm:

Sankey Flow-chart



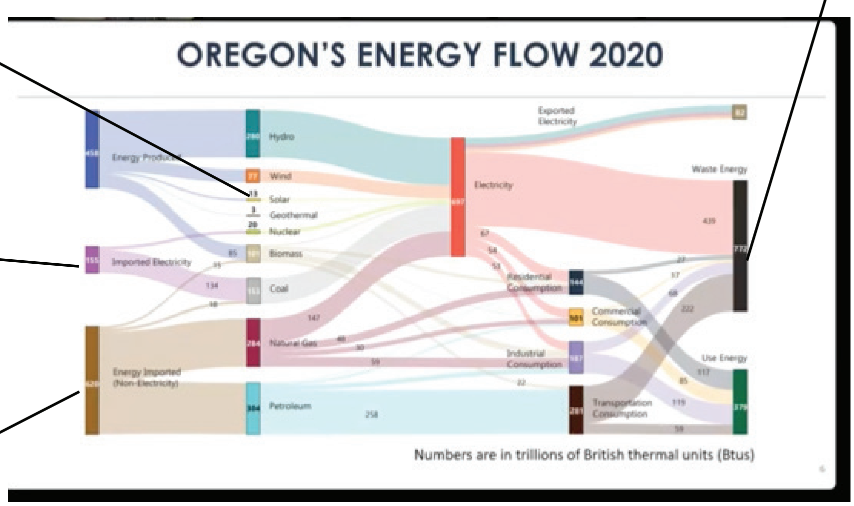
2024 ODOE

Low Solar Component

The Problems?

High Toxicity and Waste

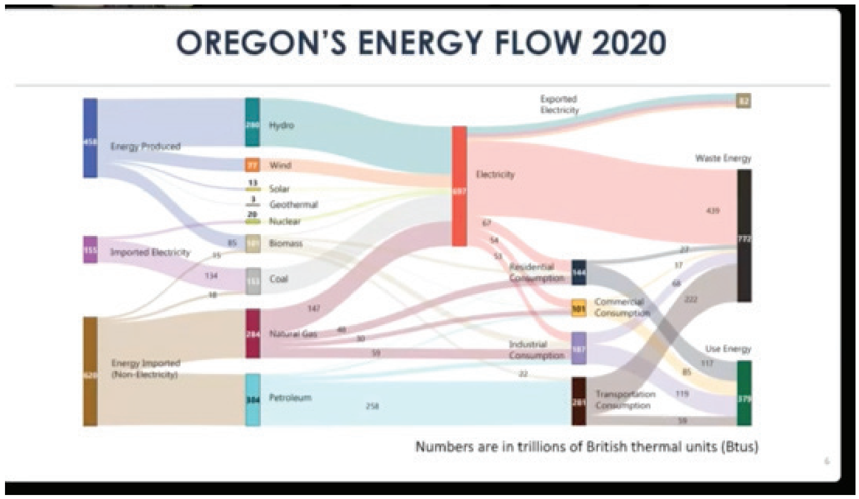
Undesirable Coal/Nuclear Imports



High-Cost Imports of Fuel Net-loss Balance of Payments

How to turn Oregon’s expensive,
toxic and vulnerable Energy Flow
into an Energy-Independent, efficient,
resilient, sustainable & clean energy paradigm
for Oregon’s assured economic prosperity

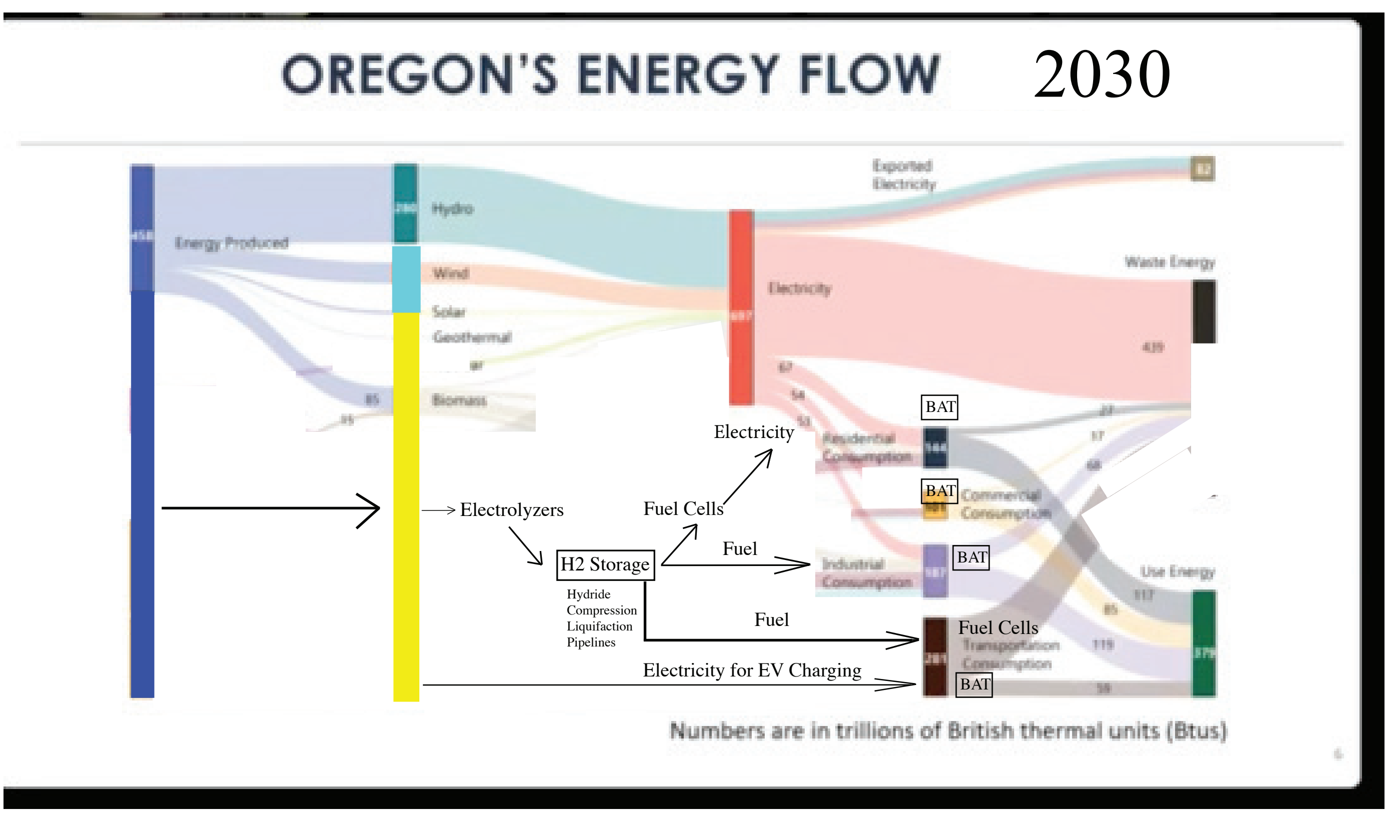
Today:



2024 ODOE

- Into -

Tomorrow:



Oregon's Clean Energy Future:

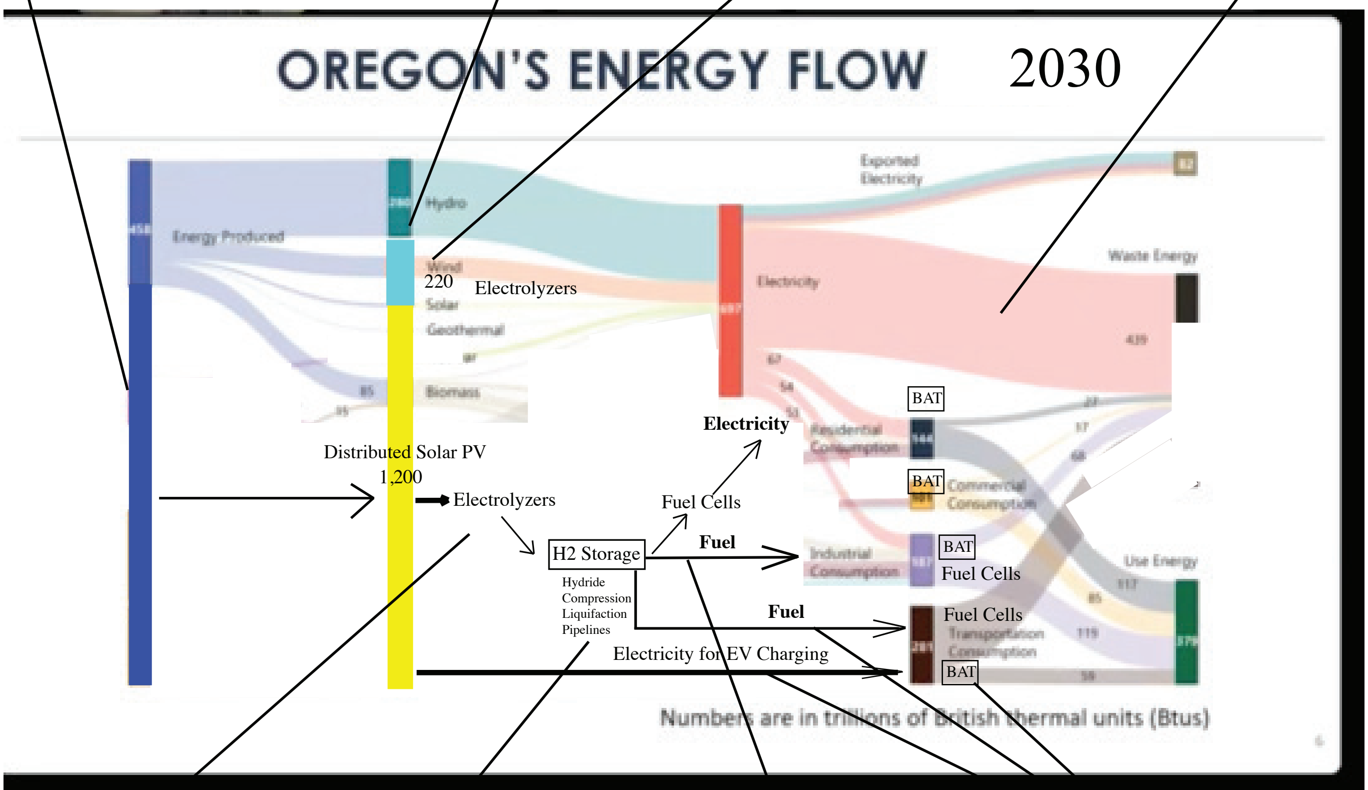
All energy produced in Oregon

All over-production or curtailed RE energy and Hydro is used to produce clean H2 using electrolyzers

Wind expanded with all excess energy used to produce clean H2 using electrolyzers

Replace Natural Gas consumption with electric appliances i.e. heat-pumps (HVAC), induction cooking with high efficiency

Repurpose Natural Gas pipelines for clean H2



Electrolyzers convert electricity and water into Oxygen, heat and Hydrogen Fuel.

Dedicated solar arrays power electrolyzers directly earning Federal Production Tax Credit of $3/Kg

Energy storage is vital to provide power and energy on-demand 24/7 365 d/yr, and during emergencies.

H2 stores about 60X more energy than LiON batteries.

Stable, safe, long-lived, H2 can be used to produce electricity through onsite Fuel Cells and distributed directly as Fuel for use by all vehicle types i.e. LDV, MDV, HVD, Construction and Agriclture.

Pipelines provide mass storage and distribution.

Fuel Cells, fueled from Natural Gas pipelines converted to Hydrogen, provide electrical power on-demand for all buildings onsite.

24/7 and through emergency situations Fuel Cells are twice as efficient as Internal Combustion Engines being potent, safe, long-lived, and using clean H2 100% non-toxic. Waste-heat can be used directly.

Fuel Cells can replace all fossil fuel power trains.

Distributed solar PV arrays deployed in parking lots across Oregon charge batteries onsite for DC Fast Charge (DCFC) with no grid impacts or expansion required.

Absorbs energy production at night from excess hydro and wind to charge distributed batteries. DC Fast Charge, using onsite Batteries and/or Fuel Cells provide high power fast charging - with no grid impacts or grid upgrade costs for Zero-Emission transportation.

Oregon's Transportation Car Fleet Solution:

33% of the Fleet Battery EVs (BEV)
67% of the Fleet Fuel Cell EVs (FCEV)

Oregon has 4.1 Million total registered vehicles in 2024.
3.2 Million are cars driven on average 12,800 Miles per year - each.
Oregonians travel by car over 40 Billion Miles per Year!

How much Solar Energy would it take to power all the cars in Oregon?

33% Battery EVs:

A third of 40 Billion miles per year divided by 365 days/year =

36 Million Miles / day @3 Miles/kWh=

12 Million kWh / day

Dividing by 4 sun peak hours/day = **3 GW of Solar PV**

footprint is 6 Square Miles

67% Fuel Cell EVs:

Two thirds of 40 Billion miles per year divided by 365 days/year =

73 Million Miles per day @65 Miles/Kg =

1.12 Million Kg per day @60 kWh/Kg =

68 Million kWh per day

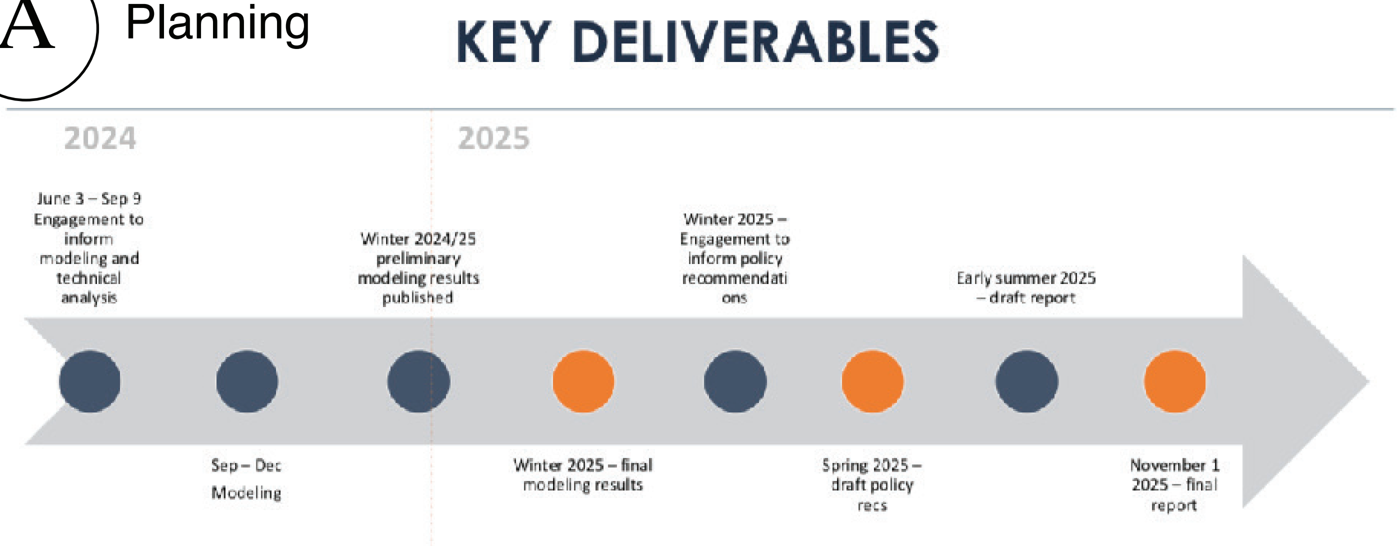
Dividing by 4 sun peak hours/day = **17 GW Solar PV**

footprint is 34 Square Miles

*Total solar footprint for the combined fleet is about 40 sq. miles which is (40mi2/100,00mi2), or 0.04% of Oregon's total land. An area which can be largely met using distributed existing Parking Lots across Oregon to totally power Oregon's Light DutyVehicle fleets both public and private.

Action Item Recommendation: do both

A Planning



B Immediate Action

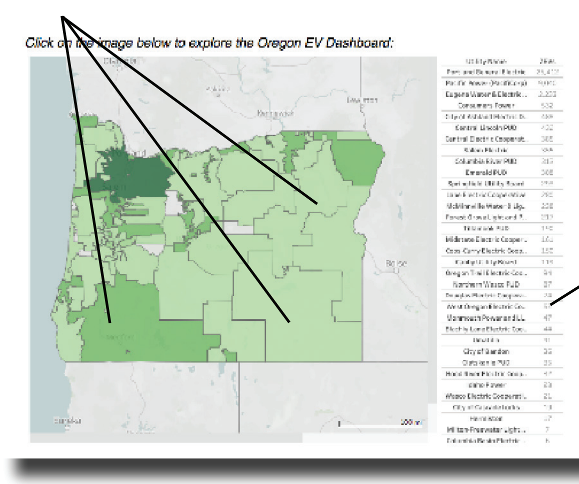
Energy Transfer Merchant (ETM™)

November - 2025

Solar/Battery DC Fast Charge Infrastructure

Intel Santa Clara, CA

Program to Install (11) ETM™ Solar/Battery Charging Stations per County in Parking Lots across Oregon



EVs per County

Program installs (400) ETM™ Solar/Battery DC Fast Charge Stations drop-in EV Infrastructure installed across all Oregon Counties by Nov. '25 producing over **1 Million Miles per Month of 100% clean mobility** plus emergency fast charge services for First Responders state-wide when the grid goes down.

Oregon’s 21 Year Energy Strategy

by Toby Kinkaid

If I were an Oil Company, I’d move to Oregon fast -
In Oregon, they suffer amnesia, and forget their own past

For a Governor, Kulongowski, proclaimed, back in 2003 -
That Oregon would be sustainable, for our 21st Century

By Executive Order, number 03-03 -
The old Oregon economy, would soon shed it’s toxicity

That all Land, and Species therein -
Would no longer suffer our industrial sin

Our use of the oceans and atrmosphere as dumps
Discarding our pollutants in air streams and sumps

That Oregon has long burned the fossil fuels from the ground -
And gives no concern to them, ya know, hanging around

But, a new century had dawned, and finally a stand -
A “Sustainable Oregon”, for the people and land

The “Oregon Sustainability Act” of 2003 -
There were only two tasks, given to thee

Define what “sustainability” for Oregon is? -
And, produce policy recommendations, so we can get on with the biz

The Govenor made his decree -
And seems now most remarkably

That he wanted it done is just 90 days -
A time when the expectation of Government was action - not endless delays

Now, 21 years later the question remains still un-asked -
Replaced now by apathy, and monies well masked

The “question” has been delayed, now 21 years on -
Citizens worn down, and declarations of emergency, just get a yawn

Under the bill HB3630, $400K is to be shared amongst Oregon counties all -
To find their own resiliency plans, before they all fall

However, $4 Million, over ten times as much -
To be spent on “ODOE internal thinking,” again, far out of touch

For 21 years we wait, again for the path -
Sustainability to be defined, with policies that match

The Energy Strategy of Oregon be, a never ending delay -
Sadly, sure to never see, in Oregon a sustainable day

TOP 10 THINGS I want to See in Oregon's Energy Strategy
- if, I were an Oil Company

by Toby Kinkaid

#1: SHIFT all references from "Citizens of Oregon" to the word "STAKEHOLDERS" changing with one word perceived responsibility from CONSUMER PROTECTION, to VENDOR PROTECTION

#2: Make sure the "ISSUE" is always defined as "COMPLICATED" obstructing any disscussion of "Solutions" or "Clear Answers"

#3: Make the "ISSUE" always require STUDY - not ACTION

#4: Make the "STUDY" always unending, and unbounded - to proclude any FUTURE ACTION

#5: Set "ALL GOALS" so far off into the futre there is No Accountability of anyone for anything

#6: ABSORB as much new public funding intended for clean energy action with increased STAFFING, and hiring CONSULTANTS carefully selected to only pursue "LEAST-COST MODELING" to provide the least-value at the greatest cost to the taxpayer - prolonging and revisting the "STUDY" indefinately

#7: Make sure any DISCUSSION of "BEST-VALUE MODELING" is labeled "TOO HARD" or "TOO CONTENTIOUS" to pursue

#8 Make sure only PAST DATA is considered, NO FUTURE LOOKING

#9 Eliminate any DISCUSSION of "SOLUTIONS" or "CLEAR ANSWERS" in any effort or program

#10 Only requirement for any and every scenario must include some "CARBON-DIOXIDE REMOVAL" scheme - disregarding DR. HOWARTH'S STUDY at CORNELL UNIVERSITY who debunks Carbon Capture and Storage schemes as ineffective as the Methane burned to drive the process, nor the multiple FUGITIVE METHANE LEAKS which occur from the process are considered, captured, or accounted for, thus "you're better off just burning the Methane in the first place" reports Dr. Howarth.

...

PUBLIC COMMENT:
If I were an oil lobbyist I'd want everything listed above in Oregon's Energy Strategy. It keeps Oregon tethered to Fossil Fuels indefinately. And, indeed, everything I'd want as an oil lobbyist - you're already doing.

Please reconsider your methodology. You're funded through an emergency declaration. It's important you respond sooner than two years after the declaration of an emergency. And, more to the point, make the County's of Oregon, individually, and together your focus. With the resources your spending on a modeling exercise, you could do much more good for Oregon by focusing on solving problems at the county level. Please study the Oregon Sustainability Act of 2003. We're waiting a long time (21 yrs) for a sustainable Oregon (in this decade) energy policy recommendation.

Public Comment continued next page;

Public Comment; continued

The Oregon Department of Energy's (ODOE) hiriing of CETI under HB3630 ticks every box (above top 10 list) of an Oil Lobbyist agenda, as CETI is indistinguishable from an oil lobbist.

The Oregon Energy "Strategy" on developing a "strategy" seems designed to protect existing Vendors from any disuption of business as usual. The effort to "model" with Least-value is by definition non-inclusive of minimum requirements outlined in Sec. 2 through 8 of HB3630. This model diverts public funds for and to perceived "stakeholders," internal staffing, and consultants to absorb any short-term action, keeping sustainability OFF-THE-TABLE in Oregon indefinately.

County's are left on their own to use a paultry $50K each - to develop a county-wide energy resilience plan? Not a very realistic sum. I would urge ODOE and CETI to develop an energy resilience plan for each county in Oregon - and help them. The spirit of HB3630, if not the letter, requires you define "..optimized pathways to achieving the States energy objectives.."

How can a Least-cost model satisfy the requirements of "Optimized pathways" as defined in HB3630? Clearly, only a Best-Value model should be your focus as defined by law which funded your effort.

Least-cost modeling is unresponsive, and not in the interests of Oregon's citizens or future generations, and represents a misguided use of public funds as it violates the inherent public trust which hold the expectation of energy solutions (or, at least the pursuit thereof) for Oregon by its State Energy Office. If not, whom do you serve?

ODOE's "REMEDY" hiring CETI to produce an internal least-cost "Study" for $1.4 Million is unresponsive to the energy emergency declared in HB3630 as Least-Cost modeling offers the least value by not including social values, thus unresponsive to HB3630's core requirements. An "emergency" was declared, with ODOE's first deliverable (a policy recommendation) over 2+ years after HB3630 was declared law? Again, unresponsive.

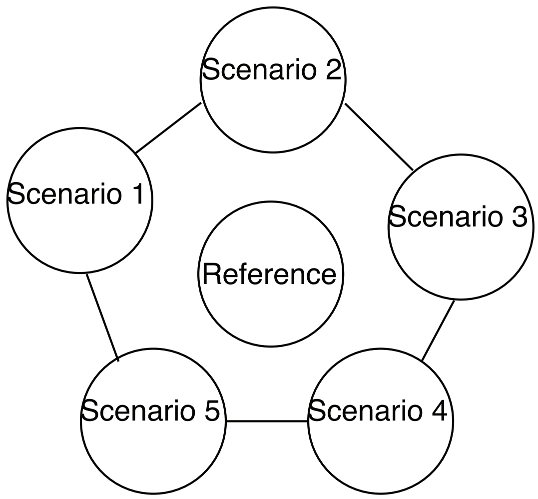
ODOE's team leader sayng publically "... the intent of the study is not to find solutions or clear answers, the intent is to inform our thinking.." is heartbreaking. The logic breaks down, after your thinking is informed - will you look for a solution then? Sadly, it's a disquaifying statement as it condems Oregon to a "slow walk", insuring a fossil fueled Oregon, and is therefore unresponsive to the public emergency declared in HB3630. If you're not even looking for "solutions" or "clear answers," then you are voilating the public trust which thinks you are.

I'm very sorry to disagree with your efforts, but using three times the resources as given to all the county's to share - just for an internal model, seems misguided and unresponsive to the law which funded this effort. I hope you'll reconsider. There is a real emergency being experienced by Oregonians where climate disruption, directly resulting from continued fossil fuel use must be taken to heart, as Oregonians are increasingly dying from extreme weather events. We need an ODOE which only has one stakeholder at heart: the citizens of Oregon.

I hope Oregon's Energy Strategy be a bee-line to the establishment of a "Zero Emission Economy" offering Oregon's economy great benefits and a truly Optimized Pathway to acheiving energy independence, non-toxicity, resilience, and universal access for all Oregonians.

Thank you, Toby Kinkaid, Portland, Oregon

ODOE-CETI's "least cost model" architecture Reference Case (below) "surrounded" by Senario's 1-5?

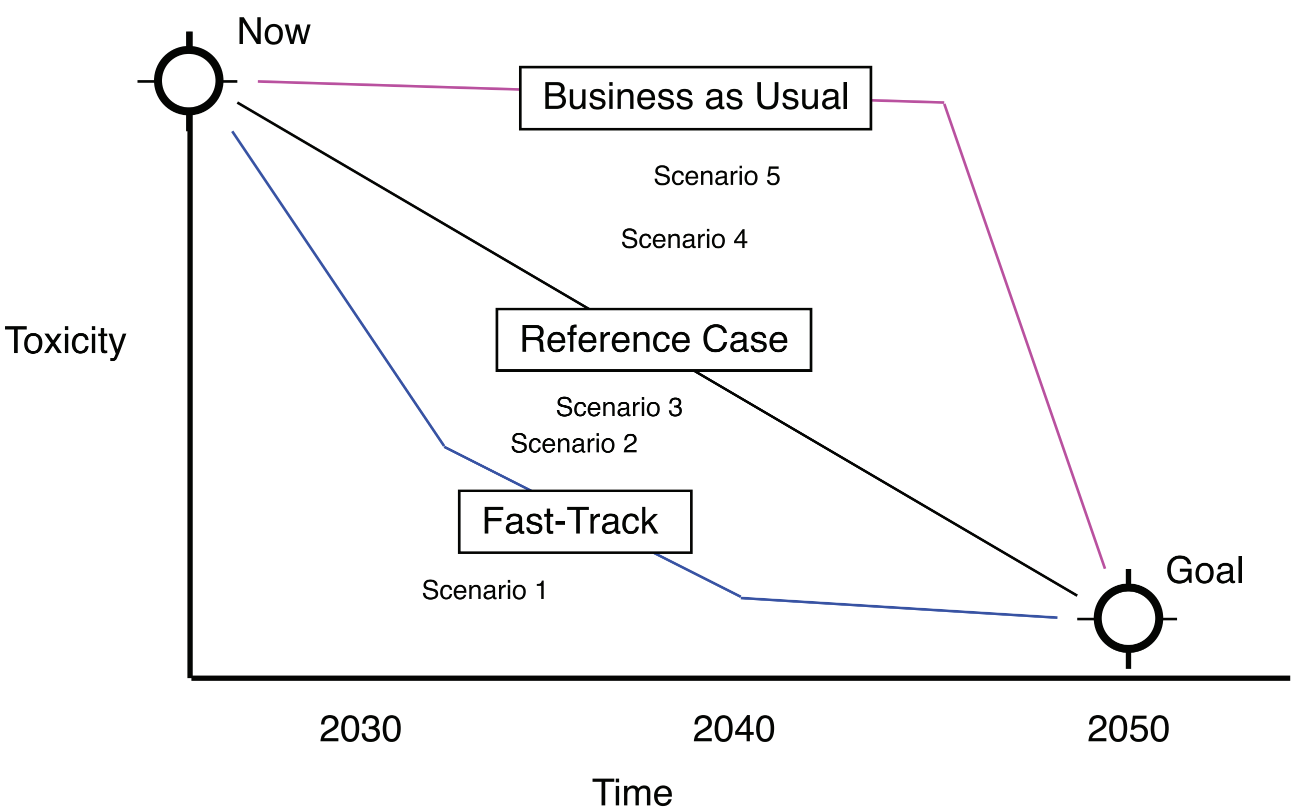


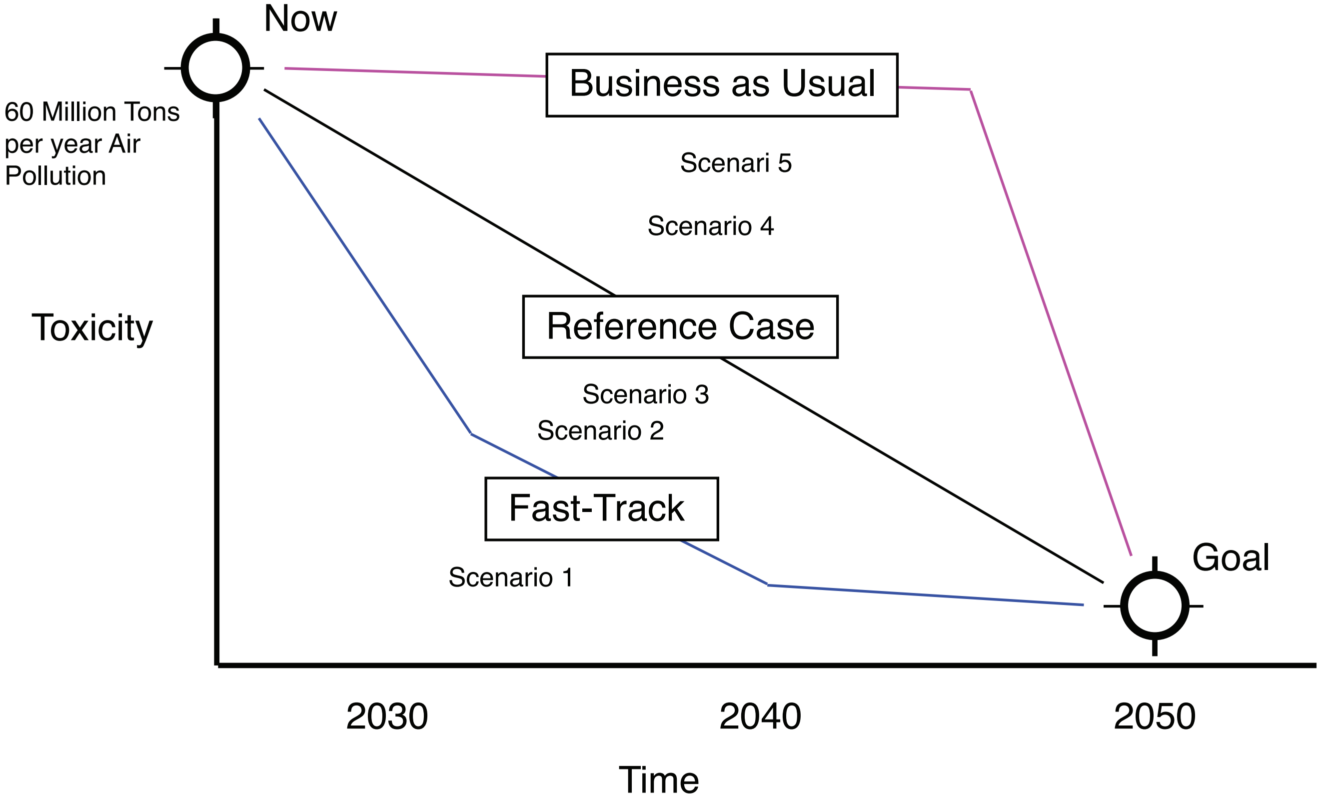
The Problem starts with Iconography - There is no direction or action in this graphic (left). We don't have any context for the "Reference" case, nor its relationship with any other Scenario. Though Scenarios are joined by lines, this makes little sense as each Scenario is independent of the other.

If each Scenario is a variant of the Reference case, however, then the lines should be drawn Radially from the Reference case to each Scenario. This graphic as drawn, is totally static, and reflects there is no particular direction or internal relationships to any of it. There is no context revealed in this graphic.

Conveys little information or context about the task. This is not the best use of iconography (left).

Proper Model of and definition for Reference Case and its relationship to any scenario, with internal comparisons on effectiveness.





Oregon's Energy Strategy can be simply defined. The Reference Case is the direct line to achieving Oregon's Climate 2050 goals (HB3630).

Once a Reference Case if defined then each Scenario can be "judged" by how it falls under this Graph (above). Toxicity is the metric which HB3630/HB2021 is written to mitigate. Any modeling should reflect this priority.

Using Toxicity (now at 60 Million tons/year for Transportation in Oregon) the HB goals read as an "intent" to lower toxicity. If this is so, then the Modeling structure described above may be more effective than current plans for a "Least-cost Model" which offers the least value for Legislators as HB3630 stipulates that at a "Minimum" Social values must be considered which least-cost modeling, by definition, does not include.

The most telling Metric for social values is Toxicity. If toxicity increases, people, species and the economy suffer. If toxicity goes down, all of the environment gains in resiliency including social welfare and the economy.

My recommendation is the modeling above which offers context, clear goal description, and Scenario comparison between the "limits" of Fast Track, and Business-as-Usual which is Oregon Today, may be of use to your team to give context to the effort. Thank you.

Toby Kinkaid, Portland, Oregon

FOOD NORTHWEST We Feed You

ENERGY STAR PARTNER

September 4, 2024

Edith Bayer, Team Lead
Oregon Department of Energy
Oregon Energy Strategy
Oregon Energy Strategy Comment Portal

RE: Food Northwest Comments on Draft Reference Scenario

Dear Ms. Bayer,

Food Northwest serves on the Direct Use Fuels & Industry Working Group and appreciates the opportunity to participate in the Oregon Energy Strategy process. We are submitting the following comments on the Draft Reference Scenario.

Established in 1914, Food Northwest is a trade association of food processors with manufacturing facilities in Oregon, Washington, and Idaho. On average, the energy use of our food processors is about 73% natural gas and 26% electricity (primarily process cooling). We are currently focused on decarbonization in the food processing sector as many of our facilities are directly regulated by the Oregon and Washington greenhouse gas emissions reduction programs.

Industry – Key Assumptions

1% process efficiency improvements per year in all sectors: This seems to be a reasonable assumption, including for the food industry.

Electrification

- **100% of refrigeration by 2040** – seems reasonable assumption given the current use of electricity in the food industry.
- **80% of integrated steam production in food manufacturing by 2045** – this seems high given the many barriers to adoption. We recommend 50%. Alternative scenarios could use higher and lower numbers.
- **90% of industrial HVAC loads across industrial subsectors**. This seems high. Washington state Energy Strategy has a target of 75% of building heating and cooling by 2050.

8338 NE Alderwood Road, Suite 160, Portland, OR 97220
Phone: 503.327.2200 • Website: www.foodnorthwest.org

- **100% of machine drives by 2035**. Probably reasonable, especially if opportunities for incentives continue.

Food Northwest agrees with Oregon Department of Energy (ODOE) that there is not a lot of data on industrial decarbonization potential or realistic timelines for technology adoption. There has been comparatively little focus on the industrial sector as Northwest programs and funding have targeted the residential and commercial sectors. Given the lack of data, a simple annual efficiency improvement approach is best.

U.S. Department of Energy's (USDOE) Industrial Decarbonization Roadmap identifies strategies, technologies, costs, and pathways for several industrial sectors, including food processing. https://www.energy.gov/sites/default/files/2022-09/Industrial%20Decarbonization%20Roadmap.pdf It also discusses challenges and barriers. While electrification is sometimes viewed as an easy solution to decarbonize food processing, the transition from natural gas may be slower than desired. USDOE states "While the technology solutions to decarbonize FandB [Food and Beverage] may be comparatively simple, there is a challenging case for investment, given the industry's low margins." They go on to say that "The low margins of FandB players are often a limiting factor to upfront capex investment, even if there is potential for long-term economic benefits." See Pathways to Commercial Liftoff: Industrial Decarbonization, p. 48-49 https://liftoff.energy.gov/wp-content/uploads/2024/02/LIFTOFF_DOE_Industrial-Decarbonization_REV022724.pdf Food Northwest's experience is consistent with USDOE's assessment and leads us to lower targets in the reference case.

Other concerns of food processors with electrification are availability, reliability, and costs. Electric service upgrades to accomplish facility electrification will be very costly and must be included in the costs of transition to electrification. Reliability is extremely important as power interruptions can result in millions of dollars of product loss due to food safety issues or degraded products. Availability and reliability concerns also arise from the unexpected increase in electricity demand from proliferation of data centers in the Pacific Northwest. See recent article https://washingtonstatestandard.com/2024/08/26/energy-demand-from-data-centers-growing-faster-than-west-can-supply-experts-say/ We appreciate ODOE including Data Center Load Growth in the reference case. What assumption will be used for the increase in demand? There is a considerable difference between the Council's projection and PNUCC's.

Greenhouse Gas Emissions Reduction Target

What greenhouse gas emissions reduction target will be used in the reference case? The Executive Order target is 80% below 1990 levels, while the Climate Protection Program (CPP) target is 90% below 1990 levels. Some are calling for a greater reduction target. Food Northwest urges ODOE to use the 90% target since this is in the CPP. Alternative scenarios could have higher targets in the interest of determining the requirements and costs to achieve them. We believe, however, that it will be very difficult and costly to achieve even 90%.

Food Northwest appreciates the opportunity to participate in the Working Group and to provide these comments. We look forward to continuing to work with ODOE throughout the development of the Oregon Energy Strategy. Please contact me if you have any questions on our comments or would like additional information.

Sincerely,

Pamela T. Barrow

Pamela Barrow
Vice President
Food Northwest

KALMIOPSIS AUDUBON SOCIETY
P.O. Box 1265 • Port Orford OR • 97465

To: Michael Freels
From: Ann Vileisis, President, Kalmiopsis Audubon Society
Re: Input for Oregon Energy Strategy, Land Use and Natural Resources Working Group
Date: Aug. 8, 2024

Hi Michael,
Greetings from the South Coast! I am writing to share some thoughts following our recent Land Use and NR working group meeting since I know you were hoping to get some input ahead of the next meeting. As requested, I will include some related "what if" questions.

SUPPORT SPATIAL PLANNING APPROACH and BROWNFIELDS for ENERGY DEVELOPMENT
In general, I appreciate the spatial planning framework of the "Power of Place" analyses, and I urge that ODOE to adopt a similar spatial planning approach, with some caveats that I will explain below.

I strongly support a scenario that is most protective of the natural resources that Oregonians cherish—including our birds, fish and wildlife, our beautiful wild natural areas, our marine ecosystems—and that also maintains intact and functional ecosystems that can conserve biodiversity and "ecosystem services" into the future.

For that reason, I am strongly supportive of an approach that favors "brownfields" for development of new, energy infrastructure. By "brownfields," I mean, areas that have already been developed for other purposes, such as existing transmission corridors, existing built structures as opposed to opening up undeveloped, unroaded, or pristine ecosystems to new industrial development. *(eg. rooftop solar on big box stores/ France requiring solar panels atop parking lots/ China experimenting with installation of solar pavers on some highways)*

I notice there is data layer identified in the *Oregon Renewable Energy Siting Assessment*: *Natural Resources, Environment, and Development: Opportunities and Constraints* (Sept. 2021) report associated with ORESA that is focused on this very element (Human modification in the Western US, 2011 data layer), but it marked to be considered only for context. I think it would be ideal to focus on these already modified ecosystems for future energy development, and so I'd like to see us consider these areas for analysis not just context. As indicated in the "Power of Place" reports, such an approach would reduce controversy and therefore be more efficient -- plus it would help to sustain the values that Oregonians have been working to conserve for decades through the state's land use planning and through engagement with federal lands and wildlife planning and conservation efforts.

In the lingo of the "Power of Place" reports, I would support the Tier 3 level of protections for the same reason.

Q. What if we focused installing new energy infrastructure / supply chain development on "brownfields" rather than installing new infrastructure/ increasing supply extraction from natural habitats? Are there opportunities for co-benefits of siting with agriculture/industry?

SUPPORT CONSIDERATION OF FULL LIFE CYCLE ANALYSIS FOR DIFFERENT ENERGY OPPORTUNITIES

Through my engagement with siting /leasing for Floating Offshore Wind, one of the most frequent critiques I hear is that this form of energy generation is not truly sustainable IF you consider all the inputs that must actually go into it --eg. hundreds of miles of very thick copper cable to transmit energy from far offshore, massive amounts of rock to secure anchors in turbulent deep-sea contexts, balsa wood from the Amazon Rainforest needed in turbines, more inputs for upgrade of trans coast range transmission, ongoing difficulty and hundreds of back-and-forth ocean trips for maintenance in rough seas—and the relatively short life cycle of turbines (estimated at about 30 years, I gather?). There is a perception that the NREL cost of energy studies are not realistic when considering the full costs of inputs and the actual physical contexts of this new technology in one of the world's most tempestuous marine contexts—the North Pacific.

That makes better understanding of the LIFE CYCLE ANALYSIS of different energy sources an important thing to consider. Eg. Which form of energy generation is truly most efficient for decarbonization when all inputs are considered? Having a better understanding of what each energy pathway would take to implement would certainly help citizens to understand the true costs and benefits of each one--and could help us ensure that we are making the best choices moving forward and to have confidence in those choices.

Q. What if we consider full LIFE CYCLE ANALYSIS (carbon emissions plus other) of various energy infrastructure options? Does this affect which options are considered to be most cost-effective and efficient for timely decarbonization?

SUPPORT ENERGY OPTIONS THAT REDUCE AND MANAGE DEMAND AND INCREASE EFFICIENCY

Another question I often hear relates to the need to think more about ways to reduce or manage energy demand in our state rather than just allowing the energy demand to balloon. At our recent work group meeting, cryptocurrency mining and data centers were brought up as a matter of environmental justice, because these industries use so much energy, even as everyone is trying to reduce carbon emissions. We need to be thinking about policies to encourage sustainable and efficient industries --not ones that cause us more problems. I appreciate that other Oregon Energy Strategy working groups are working on these topics.

Q. What if we do other things in the economy/ pull other policy levers to reduce demand, increase efficiencies, and encourage more sustainable development to meet human energy needs and wants?

FLOATING OFFSHORE WIND ENERGY DEVELOPMENT SHOULDN'T BE CONSIDERED A "BLOW-OUT SCENARIO"

Finally, I was surprised and, honestly, taken aback to hear from the project modeler at the last meeting that we may end up going with Floating Offshore Wind as a "blow out scenario" if there are too many land use or natural resource constraints or conflicts on land. As one of few people (maybe the only one?) in this Natural Resources-Land Use Working Group who has been participating very closely in offshore wind siting issues over the past three years, I am concerned that this statement suggests a lack of awareness about the many important natural resource values, issues, constraints, and conflicts in our marine environment.

I was interested to read in the 2021 *Oregon Renewable Energy Siting Assessment*: *Natural Resources, Environment, and Development: Opportunities and Constraints* report that Offshore Wind Energy was one perceived to be the *most* controversial method of energy procurement considered. I'd say that, based on my experience --working in the Oregon Consensus Group on Floating Offshore Wind Energy and being a conservation advocate and elected local official in a coastal community --I am not surprised.

I'd hate for the ODOE process to focus its careful spatial modeling in this context on terrestrial ecosystems--in eastern and western Oregon-- and then conclude that there are too many conflicts and therefore decide to just move things offshore, as implied by the blowout scenario comment.

If floating offshore wind energy is considered to be feasible, then ideally there will be a comparative analysis that is not just energy generated per acre or one based on levelized costs of energy --but one that includes spatial consideration of values and existing uses as well as full costs associated with installation, transmission feasibility, plus operations and maintenance.

Q. What if the costs and time horizon of FOSW are far higher and greater than what NREL has predicted owing to many on-the-ground realities excluded from their model, such as intense local opposition (communities, fishers, tribes); high expenses of new/ untested technology; high expenses of installation (eg. Enormous amounts of copper lines, massive rock for stabilizing anchors); transmission upgrades and transmission challenges (wildfire and unstable Franciscan geology); ongoing maintenance to far offshore sites in very rough ocean condition?

SUGGESTIONS FOR MARINE SPATIAL ANALYSIS
Hearing at our work group meeting that the ORESA mapping tool will be the key resource in spatial planning for natural resources and land use planning in this ODOE strategy process, I reviewed the descriptive document for that tool, *Oregon Renewable Energy Siting Assessment*: *Natural Resources, Environment, and Development: Opportunities and Constraints* (Sept. 2021), and have a few comments to make specifically about the offshore component of that report.

There will be a need to integrate updated layers for marine mammal Biologically Important Areas (BIAs) and for seabird distributions. These should be available in OROWIND, the Oregon DLCD's mapping tool related to marine spatial planning for offshore wind energy (should be relatively parallel to ORESA). Also, there is more recent distribution data for endangered albatrosses. This may seem too granular for the project at hand, but it underscores the need to figure out how to integrate new information/ data as it becomes available, and I could supply it if need be.

Also, while I appreciate the "Power of Place" framework, I have to underscore that that report's analysis for Oregon is adequate for its coverage and analysis of marine ecosystems. I'll mention a few important shortcomings.

First, Oregon's ocean ecosystems hold a lot of unknowns. Our understanding of marine environments is far less comprehensive than our understanding of terrestrial ecosystems, in general, because it's so much more challenging to study and learn about the ocean and its life. But just because there are not values mapped on GIS layers, that does not mean important values do not exist.

Even in recent years, we've come to learn that about new Oregon ecosystems we didn't even know were there: unique hydrothermal vent ecosystems, glass sponge communities that are thousands of years old, and bamboo coral habitats that are unique in their own right and also serve as important nursery habitat for marine fishes --and fisheries. We have little understanding of the dynamic, wind-based ecosystems that draw birds, fish and wildlife from all around the Pacific to Oregon's offshore areas.

If you review the data layers explanation in the "Power of Place West" executive report and then the published paper (and National Report) about how they determined, which areas were included in Tier 1, Tier 2 and Tier 3 for the marine maps in that report, there is really no explanation of the analysis behind the mapping. In fact, it looks as if there is no consideration of impacts to specific marine species—in contrast to specific species and habitat types listed for terrestrial ecosystems in the national report. This is probably because our ocean ecosystems do not have as advanced data assembled nor or as many protections as do our terrestrial.

Truly, conservation efforts for Oregon's marine ecosystems remain a work in progress. The State of Oregon has just two small Marine Protected Areas and has only just recently added a few designations for Rocky Protected Areas --nothing like a network of protected areas based on identification and need for conservation. This likely owes to the difficult politics and issues related to conservation of marine areas. But that does not mean that Oregon does not have extremely high value marine conservation areas. Some high value ecosystems that the conservation community has endeavored to map as part of offshore wind energy leasing process include high value biogenic habitats, such as rocky reefs, coral forests, vents. These may be insufficiently covered by other data layers in the ORESA database. The bottom line is that --to be credible in what the ODOE report creates, there needs to be a more transparent and robust data foundation for any marine component.

Finally, the "Power of Place West" analysis did not include consideration of important social and cultural values, which go hand-in-hand with effective planning for conservation. For example: in marine ecosystems, areas of fisheries use are highly important to consider, and least conflict analysis could also be very important. As you probably are aware, the legislature recently directed DLCD (together with other state agencies) to develop a Roadmap for Offshore Wind Energy in Oregon, in large part because the federal energy leasing process did such a poor job of engagement with local communities and tribes about cultural and ecological values that form the basis for local economies and ways of life. Ideally, ODOE, can work together with DLCD --or follow that agency's model-- to integrate stakeholder perspectives in its process. Given that I may be the only person on the Natural Resources Working Group representing a coastal perspective and engagement with offshore wind energy siting, it suggests to me that important other voices and interests may be missing from this process (eg. commercial fishers).

That's all for now. If you have any questions or want to discuss further, please don't hesitate to be in touch. Thank you for considering my perspective. I appreciate that ODOE is embarking on this important process and appreciate the opportunity to participate.

All best,

Ann

Ann Vileisis
President
Kalmiopsis Audubon Society

KALMIOPSIS AUDUBON SOCIETY
P.O. Box 1265 • Port Orford OR • 97465

To: Michael Freels, Oregon Department of Energy
Re: Oregon Energy Strategy, Natural Resources and Land use working group, and general comments con't
Date: August 30, 2024

Dear Michael,
Thank you for the opportunity to provide input regarding the Oregon Energy Strategy and also the Reference Scenario that will be used in the initial modeling exercise. These comments build on comments we submitted earlier, after the working group's first meeting.

The Kalmiopsis Audubon Society has more than 400 members in southwestern Oregon who are concerned about conserving healthy habitats for birds, fish, and wildlife as we consider ways to modernize our state's energy system to address the climate crisis.

SUPPORT FOR SPATIAL PLANNING APPROACH
We strongly support a spatial planning approach that identifies areas of conservation importance early on, such as called for on the Smart-from-the-Start renewable energy approach and The Nature Conservancy's Power of Place West report—as a way to reduce conflicts, improve process, and ensure that renewable energy development will not damage and degrade valuable ecosystems that Oregonians have spent decades aiming to conserve. We'd like to see a scenario that considers at the highest level of conservation, eg. Tier 3 in The Nature Conservancy's Power of Place West framework.

MODEL NEEDS SUBSTANTIAL MARINE SPATIAL DATA UPGRADE IF THERE WILL BE A FLOATING OFFSHORE WIND ENERGY SCENARIO
Since the ODOE is considering using the Power of Place West data as a starting place for a base scenario, it's important to underscore that the data layers used to model marine ecosystems in the Power of Place West report are wholly inadequate. To improve the credibility of scenarios, marine data must be improved with additional consideration of layers as identified in the report*, Oregon Renewable Energy Siting Assessment, Natural Resources, Environment, and Development: Opportunities and Constraints, September 2021,* authored by the Conservation Biology Institute. Most of the identified layers are already available in Oregon DLCD's OROWIND database.

Because ODOE has already indicated that, given limited time for the Oregon Energy Strategy modeling process, such an upgrade may not be possible, a short cut would be to constrain the model to current West Coast Wind Energy Areas (WEAs) as already identified by BOEM. Although BOEM's spatial assessment process was flawed, in our view --with too few natural resource and wildlife parameters incorporated to accurately assess values, using the now established WEAs could be a pragmatic and realistic stand-in for consider of a Floating Offshore Wind Energy scenario in the current process.

Also, floating offshore wind energy development shouldn't be considered a "blow-out scenario" if there are conflicts on terrestrial ecosystems, as indicated in the first Natural Resources working group meeting. If floating offshore wind energy is considered to be feasible, then ideally there will be a comparative analysis that is based on not just energy generated per acre or solely on levelized costs of energy --but one that includes spatial consideration of values and existing uses as well as full costs associated with installation, transmission feasibility, plus operations and maintenance in the ocean environment.

SUPPORT FOR SCENARIO THAT PRIORITIZES BROWNFIELDS for ENERGY DEVELOPMENT
We strongly supportive of an approach that favors "brownfields" for development of new, energy infrastructure. Focusing on areas that have already been developed for other purposes, such as existing transmission corridors, existing built structures --as opposed to opening up undeveloped, unroaded, or pristine ecosystems to new industrial development—will reduce conflicts and help to decarbonize more quickly.

SUPPORT FOR SCENARIOS AND POLICIES THAT REDUCE AND MANAGE DEMAND AND INCREASE EFFICIENCY
We strongly support consideration of a scenario—and policies—that focuses on reducing and managing energy demand and increasing energy efficiency. We are concerned about the projected demand in energy use from data centers and crypto-currency mining operations that will quickly supersede efforts to limit GHG emissions from all other sectors of the economy. It seems important to envision paths forward that require a higher level of energy innovation and conservation from these energy demanding industries.

CONSIDER A SCENARIO THAT PRIORITIZES IMMEDIATE ACTIONS TO DECARBONIZE IN THE SHORT TERM
Because the climate crisis demands rapid decarbonization, ODOE should consider a scenario that prioritizes short term actions that can be taken to reduce GHG emissions sooner rather than later.

SUPPORT FOR CONSIDERATION OF FULL LIFE CYCLE ANALYSIS FOR DIFFERENT ENERGY OPPORTUNITIES
To create a credible assessment of the costs and benefits of different energy sources, the Oregon Energy Strategy process should consider a full life cycle analysis for different energy generation opportunities. If it's not possible to include such accounting in the least cost modeling, there should be some way to address these considerations later in the process.

Understanding of the life-cycle analysis of different energy sources would help us to understand which forms of energy generation are truly most efficient for decarbonization when all inputs are considered. Having a better understanding of what each energy pathway would take to implement would certainly help citizens to understand the true costs and benefits of each one--and could help us ensure that we are making the best choices moving forward and to have confidence in those choices.

CAUTION ABOUT CONSIDERATION OF TIMBER BIOMASS FOR ELECTRICITY GENERATION
The ODOE Energy Strategy Electric Generation Working Group identified interest to further explore biomass from Oregon's "timber basket" as a potential means for future electric generation, based on the vision set forth in the U.S. DOE's 2023 Billion-Ton Biomass study. That study focused on agricultural crops to generate biomass for liquid fuels and energy generation. Using biomass from forest materials as a means of electric generation is higher cost compared to other potential renewable energy sources, but most important, using Oregon's forest resources to generate electricity has a higher potential to create conflict and environmental harms without very careful constraints.

Thank you for considering our comments, and we look forward to learning what the modeling effort will reveal.

Please keep us apprised of next steps in the Oregon Energy Strategy process, and again thank you for the opportunity to provide input.

Sincerely,

Ann Vileisis,
President
Kalmiopsis Audubon Society

Oregon Energy Strategy
Draft Reference Scenario
Key Data and Assumptions

Introduction

This document provides the draft inputs for the Reference Scenario of the Oregon Energy Strategy model. The modeling phase of the Oregon Energy Strategy involves development of a Reference Scenario and five alternative scenarios. The modeled scenarios produce different pathways to meeting Oregon's energy and climate objectives. They provide information on the effects of different energy choices and will serve as foundational information for policy discussions in Phase 2 of the Oregon Energy Strategy process. These discussions are where policy recommendations will be developed. The final Oregon Energy Strategy will be submitted to the Governor and Legislature by November 1, 2025.

The model must solve to meet Oregon's anchor climate and clean energy goals: Executive Order 20-04 (80 percent economy-wide reduction in greenhouse gas emissions by 2050); HB 2021 (100 percent clean electricity for the state's largest investor-owned electric utilities and Electricity Service Suppliers), and the Climate Protection Program (90 percent reduction in greenhouse gas emissions from fuels by 2050). This is a requirement of HB 3630, which directs ODOE to develop the energy strategy and identify pathways to achieving the state's energy policy objectives.

These goals are ambitious, and there are many uncertainties surrounding what combination of technologies and measures will allow Oregon to meet its clean energy and climate goals over time and out to 2050. What is relatively clear based on a range of studies ODOE has evaluated is that: (1) aggressive energy efficiency and electrification are key pillars of cost-effective decarbonization; (2) we have a suite of diverse technologies to choose from to decarbonize the electricity sector; and (3) clean fuels will play a key role.[i]

The modeling exercise requires well-informed, data-driven judgment calls on many of the assumptions relating to energy efficiency and electrification. This is because the transition to economy-wide decarbonization by mid-century requires a pace and scale that is much greater than past trends. And we are still working to understand the combination of consumer behaviors, market forces, and policy supports necessary to accomplish our goals. In order to ensure the Reference Scenario is built on the best available data and aggressive but achievable assumptions, ODOE has collaborated with industry and community experts to inform the modeling inputs. Using that feedback, ODOE and its technical contractor CETI developed a draft Reference Scenario inputs list. The table below represents key data and assumptions that inform how the model will create the Reference Scenario.

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[i] 2022 Biennial Energy Report. *Charting a Course for Oregon's Energy Future*.

How the Model Works

At the highest level, the model uses data on the existing state of energy production and consumption and combines this with forecasts on population growth, load growth, technology evolution, and weather patterns to assess future statewide energy demand. The model then determines the supply of energy resources across the entire energy sector to meet that future demand, considering reliability and cost.[ii]

For the Oregon Energy Strategy, the Reference Scenario is informed by Oregon's energy consumption across its state-wide economy (residential, commercial, industrial, agricultural, fuel, and transportation sectors). To determine energy demand, it looks at energy-consuming technologies across 80 different sub-sectors (space heating, cooking, cars and trucks, and many others), and makes assumptions about how these technologies change over time, including improvements in energy efficiency, when these technologies are expected to turn over, and what they will be replaced with when they reach the end of their useful life.

The Reference Scenario also considers factors like weather, population growth, and industrial load growth (including from industrial data centers and chip manufacturing) to account for how energy demand is changing over time. Through this process, the model comes up with a picture of Oregon's energy needs every 5 years, from now to 2050.

Once we have a picture of how much energy we will need over time, the model searches for the most affordable mix of resources to meet demand across all energy consuming sectors while meeting our key climate and energy goals and maintaining reliability.[iii] It draws on everything from utility-scale resources to smaller-scale and distributed energy resources to do this. The model also considers the availability of energy supply infrastructure (i.e., gas pipes and electricity wires) to deliver that energy to customers.

How Model Results are Used

Model scenarios do not predict the future, rather they provide insights into pathways that meet our clean energy goals by considering differences in costs, energy efficiency, feasibility, and availability. The Reference Scenario will be compared against alternative scenarios that produce different energy pathways that are used to explore "What if?" questions. For example: What if transmission development is further delayed? What if we do not achieve as much electrification as in the Reference Scenario and instead rely more on clean fuels? What does this mean for overall system costs? What does it mean for the mix of resources we'd need to meet our clean energy goals? And most importantly: what do we learn from this exercise on the technologies and measures that are most likely to deliver a lowest-cost, highest-benefits energy transition for our state? The information we gather will provide a basis for analysis and discussion around

[ii] 294abc_c5f79e16ca7a470b8168e1bbe7d98c7f.pdf (evolved.energy)

[iii] The model can incorporate some non-energy constraints, such as land use protections. However, much of the analysis on non-energy costs and benefits will happen when we are evaluating the results of the modeling. ODOE will be working with our consultant to evaluate the effects of different scenarios on equity, environmental justice, air quality and public health, and employment.

what policies are needed to achieve our energy objectives while maintaining a resilient and affordable energy system — and create a more equitable energy future for Oregon.

The following are key data and assumptions for the Reference Scenario of the Oregon Energy Strategy. ODOE is accepting comments on these inputs until **5 p.m. on September 4, 2024.**

Note: **Bolded text** indicates points of discussion in working group meetings.

Key Assumptions for the Reference Scenario

Key Demand-Side Assumptions (Buildings, Industry, Transportation)

1. Buildings

1.1 Buildings: Data sources for stocks

Residential Space Heating	Northeast Energy Efficiency Alliance (NEEA) Residential Building Stock Assessment & Home Energy Score Data*
Commercial Space Heating	NEEA Commercial Building Stock Assessment
Residential Water Heating	NEEA Residential Building Stock Assessment & Home Energy Score Data*
Commercial Water Heating	NEEA Commercial Building Stock Assessment
Residential Building Shells	NEEA Residential Building Stock Assessment & Home Energy Score Data*
Commercial Building Shells	NEEA Commercial Building Stock Assessment
Residential Technology Stock Replacement	Energy Information Administration (EIA) Residential Energy Consumption Survey, potentially supplemented by local/regional data (still in discovery)
Commercial Technology Stock Replacement	EIA Annual Energy Outlook, potentially supplemented by local/regional data (still in discovery)
Residential Cooking & Other Appliances	NEEA Residential Building Stock Assessment
Commercial Cooking & Other Appliances	NEEA Commercial Building Stock Assessment
Residential Lighting	NEEA Residential Building Stock Assessment
Commercial Lighting	NEEA Commercial Building Stock Assessment

Commented [TE1]: Council is using ITRON's SAE forecasting model which has some appliance and equipment lifetimes embedded in it. The prior Council forecasting model (Energy 2020) may have had more end uses represented so the 8th Plan data may have lifetimes/stock turnover rates represented for more appliances.

**Oregon's Home Energy Score data comes from Earth Advantage*

1.2 Buildings: Key Assumptions

Residential Space Heating	Assume existing policies play out for all space heating technologies **Electric heat pump sales 95% of overall sales by 2040**
Commercial Space Heating	**Weighted average of large and small commercial space heating loads, with the following framing:** - **Small commercial: follow residential** - **Large commercial: electric heat pumps 75% of overall sales by 2045**
Residential Water Heating	**Incorporate Federal Energy Conservation Standards for Consumer Water Heaters (from May 6, 2029)** **Electric heat pump sales rising to 95% of overall sales by 2045**
Commercial Water Heating	**Weighted average of large and small commercial water heating loads, with the following framing:** - **Small commercial: follow residential** - **Large commercial: 25% of all new sales are electric heat pumps by 2035 and 90% by 2045**
Cooking	**95% sales of new appliances are electric by 2035**
Technology stock replacement	**Dual gas/electric heat pump systems, differentiated by climate zone, compete with other electric technologies in line with sales shares above**
Building shells	**Weatherize 80% of existing commercial and residential home envelopes by 2040 and 95% by 2050.** **Weatherization measures assumed to achieve a 10% reduction in overall building energy use on average.**
Lighting	100% LED sales by 2025 (HB2531)
Hybrid Boilers	Model can invest in dual fuel electric and gas boilers as well as hydrogen boilers

2. Industry – Key Assumptions

Industrial Processes	1% process efficiency improvements per year in all sectors Fuel switching measures from fuels to electricity
Electrification	**100% of machine drives by 2035** **100% of heat by 2050, including in Oregon's largest industrials such as computer and electronics products** **50% of integrated steam production, and 80% of integrated steam production in food manufacturing, by 2045** **100% of refrigeration by 2040** **90% of industrial HVAC loads across industrial subsectors** **80% of industrial vehicles including in agriculture by 2050**

Commented [NAM2]: See table 8 in this report for assumptions from a variety of sources on HP sales shares for residential heating, water heating, commercial heating, and commercial water heating. The high end for all of them is 100% from one study. I excluded the 100% in my comments below to give a better sense of the range used in several studies.

All tables from article are attached as an excel spreadsheet to email

Commented [TE3]: May be data from Washington on the share of heat pumps in new residential construction given their new energy code requirements. I've heard rumors that heat pumps are being installed in over 90% of new homes. Energy code requirements are a policy lever to achieve very high levels of technology adoption. Q – What share of all residences in 2040/50 will be built after 2026?

Commented [NAM4]: Range in Table 8 of report is 76-90% by 2050 (max is 100%; excluded from this range)

Commented [NAM5]: Range in Table 8 of report is 42-75% by 2050 (max is 100%, excluded from this range)

Commented [NAM6]: Range in Table 8 of the report is 55-85% by 2050. Max value is 100%; excluded from this range.

Commented [NAM7]: Range in table 8 of the report is 30-60% by 2050; max value is 100% and excluded from this range

Commented [NAM8]: The aggressive case of this report estimates 74% of commercial cooking is electric and 96% of residential is electric in 2050.

Formatted Table

Commented [NAM9]: Table 2 (aggressive case) in this report estimates residential envelope retrofits at 3% of existing homes per year from 2023-2050 (81% in 2050) and 1.6% of existing commercial square footage per year from 2023-2050 (44% of SF in 2050)

Commented [TE10]: These savings interact with the conversion to heat pumps, so do the heat pump savings reflect the fact that by 2050 95% of residential and commercial buildings are weatherized? 8th Plan supply curves might provide a basis for this assumption, at least for the residential sector, since the Council's analysis should reflect this interaction. The RTF estimates weatherization savings by heating system type, including for gas heated homes.

Commented [TE11]: While this (18% less process ***energy*** use in 20 years) sounds aggressively reasonable for some industries, I am not sure it's realistic for all sectors. May be it's better stated as the average process efficiency improvement across the entire industrial sector.

Switch to Hydrogen	**50% of heat in bulk chemicals (not a large industry in OR)** **20% of construction energy demand** **20% of industrial vehicles by 2050**
Cement	Cement process is optimized in the model, including retrofits and new build rotary kilns to include direct separation, oxy-combustion, biomass fuel, and CCS (not a large sector in Oregon)
Thermal Energy Storage	Economic adoption modeled in industrial sector

3. Transportation

3.1 Transportation: Data sources for stocks

Light duty vehicle (LDV)current stocks	OR Dept. of Transportation – Driver & Motor Vehicle division (DMV) Data
Medium- and heavy-duty vehicle (MHDV) current stocks	OR Dept. of Transportation – Combination of Commerce and Compliance Division (CCD) and DMV data (depending on vehicle weight) *Note: propose to use Environmental Protection Agency's (EPA's) Motor Vehicle Emission Simulator (MOVES) model if cannot obtain CCD data
Transit Buses current stocks	National Transit Database / EPA MOVES
School Buses current stocks	OR Dept. of Transportation – DMV Data
Fuels current	OR Dept. of Environmental Quality Clean Fuels Program Data
Vehicle Miles Traveled (VMT) current	Dept. of Environmental Quality / EPA MOVES (data comes from Highway Performance Monitoring System)
Fuel Economy current	EPA MOVES, Historical average fuel economy by vintage and vehicle type
LDV sales shares	Advanced Clean Cars I / Advanced Clean Cars II Internation Council on Clean Transportation (ICCT) forecasts based on IRA incentives
MHDV sales shares	Advanced Clean Trucks through 2035 ICCT forecasts based on IRA incentives

3.2 Transportation: Key Assumptions

MDV and HDV sales shares – post 2035	**Post 2035: 100% zero emission vehicle (ZEV) sales by 2040 for Class 2b-8 vehicles (excluding buses)** **For long haul: 75% battery electric vehicles (BEVs)/25% hydrogen fuel cell vehicles (FCEVs)** **All other classes 100% electric**

Commented [NAM12]: The CA DR Potential study: To estimate the DR potential from EV charging in the residential sector, EV level 1 and level 2 chargers are considered. The current saturation of level 2 chargers (among homes with EVs) is estimated at 50%, which will increase to 67% by 2030. All level 2 chargers at home are expected to be networked by 2050 increasing the saturation to 100%.

Commented [NAM13]: 75% by when? Also, what does this represent? Vehicles made, operated, etc?

Commented [TE14]: I am no expert on kWh/H2 transport technology, but long-haul trucks seem better suited to H2 that batteries unless there's a significant improvement in charging time and weight/capacity ratios. Maybe best addressed in alternative scenario because its an unknowable/uncontrollable factor.

Transit Buses future	**100% ZEV sales by 2036 (75% BEV / 25% FCEV by 2040)**
School Buses future	**100%BEV sales by 2036 (100% electric)**
Rail future	**20% electric, 70% hydrogen by 2050 (logistic growth starting in 2030)**
Maritime Shipping future	**Domestic: 10% electric, 20% H2, 50% ammonia by 2050** **International: 20% H2, 60% ammonia by 2050**
Vehicle Fuels future	Clean Fuels Program + Portland's Renewable Fuel Standard
Vehicle Lifetimes	15 years
Fuel economy: Light duty cars and trucks	EPA SAFE 2022-2026, constant after 2026
Fuel economy: Medium duty & heavy-duty vehicles	EPA Phase 3 standards through MY 2032; Annual Energy Outlook (AEO) projection after 2032
Fuel economy: Buses	Buses: AEO projection of fuel economy
Fuel economy: Aviation	15-20% efficiency gain through 2050, to reflect International Air Transport Association (IATA) Net Zero Roadmap
VMT Assumption	**20% reduction in VMT per capita by 2050**
Vehicle costs	Light, Medium, and Heavy-Duty Vehicles: International Council on Clean Transportation Report: Analyzing the Impact of the IRA on EV Uptake in the U.S. Transit / School Buses: International Council on Clean Transportation Rail / Aviation / Maritime: Costs assumed to be same as fossil alternatives due to lack of data
Fuel costs	Annual Energy Outlook 2023 Oil and Gas Forecasts
Infrastructure costs	EV Charging: NREL Electrification Futures Study Hydrogen: U.S. Dept. of Energy Technical Targets for H2 Delivery Looking into using NREL's EVI Pro
EV Charging Estimates	NREL Electrification Futures Study Looking into using NREL's EVI Pro

Commented [TE15]: Is this based on current trends? The improvement in mass transit availability and use assumptions? Response to the cost of electricity for vehicle charging? Just seems like a behavioral change that deserves some rationalization/supporting data.

Key Supply-Side Assumptions (Electricity, Fuels, Pipes & Wires)

4. Direct Use Fuels

Demand Side Assumptions	Modeled residential, commercial, and industrial demand end use using assumptions about sales shares in EnergyPATHWAYS
Supply Side Assumptions	Existing natural gas utility Integrated Resource Plans (IRPs) for near-term investments and operations Survey of peer reviewed and government agency sources of capital

	and operating costs and performance (ADP Technical Documentation 2023, p. 61)
Fuel supply and price forecasting	Energy Information Administration (EIA) Annual Energy Outlook NW Power and Conservation Council's Fuels Advisory Committee natural gas price forecast **Department of Energy Billion Ton Study**
Alternative Clean Fuel Investment	DEQ's Climate Protection Program
Alternative Clean Fuels	Biomass-derived fuels, hydrogen, and hydrogen-derived fuels qualify as clean (if green hydrogen used). Imported fuels are counted as zero emissions (credit for negative emissions from processes like BECCS are retained by producing state). Clean Fuel Standard incorporated

5. Energy Efficiency and Load Flexibility

Behind the Meter Photovoltaic (BTM PV)	Northwest Power and Conservation Council March 2024 rooftop solar projections
BTM Storage Adoption	**Energy Information Administration's (EIA) June 2024 Survey: 10 MW assumed today** **(Note: ODOE is also calculating data from the Oregon Solar and Storage Rebate Program (OSSRP) to compare to EIA data. Please share if there is another data source ODOE should consider.)** ***What should be assumed for the total amount of BTM storage by 2050?*** ***What should be assumed for the total amount of BTM storage by 2050?***
Flexible Load Parameters	**Space heating loads can be delayed or advanced by 1 hour** **Water heating loads can be delayed or advanced by up to 2 hours** **Air conditioning can be delayed or advanced by 1 hour** **Residential vehicle charging can be delayed by up to 8 hours and commercial vehicle charging up to 3 hours**
V2G	**No V2G assumed**
Data Center Load Growth	Northwest Power and Conservation Council Pacific Northwest Power Supply Adequacy Assessment for 2029 base case, with load differentiated across modeling zones
Demand Response – Households participation	**50% of electric appliance installations by 2050 (linear growth from 2025)**

Commented [AS16]: Brattle assumed 1% of eligible participants by 2035 for a recent CA study. See page 13 of https://www.brattle.com/wp-content/uploads/2024/04/Californias-Virtual-Power-Potential-How-Five-Consumer-Technologies-Could-Improve-the-States-Energy-Affordability-Technical-Appendix.pdf Could double the participation rate after that until you reach 2050.

Commented [TE17]: It seems to me that the total amount of BTM Storage consist of "Powerwall" type systems that may or may not be coupled with BTM PV and vehicle battery storage. There may be different limitations on how the grid might be able to access these two types of systems, but by 2050 it seems to me that ignoring the large capacity in vehicle batteries would vastly understate the total amount of storage capacity. When you have a very large amount, each individual battery does not need to be relied upon in the same way at the same time.

Commented [NAM18]: These seem conservative. It may be worth looking at longer duration shifting, see next comment.

What about commercial refrigeration and batteries? The biggest shift resources from the phase 3 CPUC DR Potential study are process, pumping, refrigeration, pool pump, ev charging, HVAC

Commented [NAM19]: CA Phase 4 DR potential study: When estimating the shed DR potential in this study, we use the performance data for a four-hour shed period, since this is the event duration required for DR to be included in CPUC RA compliance filings (CPUC 2021a). This is also consistent with the duration assumed for shed in the Phase 2 study. Since most enabling technologies are able to shed more load over shorter periods of time, considering a shorter shed event duration would yield a larger apparent resource. We consider the shed potential for a one-hour event duration in Appendix D.

Commented [NAM20]: See BPA's DR Potential study for DR assumptions on residential, commercial and industrial.

Commented [NAM21]: The CA DR Potential study estimated potential by technology. I couldn't find all of the percentages, but what I did find are quite a bit lower than 50%.

Residential electronics: The instantaneous shed fraction is assumed to be 50% based on the assumption that ~50% of electronics power draw is discretionary at any given time. Based on the current LBNL-2001596 80 saturation of 2% and projected saturation of 10% in 2030 from the EE P&G study, we extrapolate the saturation to be 26% in 2050.

...

	Note: ODOE is still calculating the starting point in 2025 and welcomes any data related to existing household participation in demand response programs **Residential EVs: Start at 0, ramp up to 2/3 of residential EVs participate in managed charging by 2030**
Demand Response - Commercial	**50% of electric appliance installations by 2050 (linear growth from 2025)** ***Note: ODOE is still calculating the starting point in 2025 and welcomes any data related to existing household participation in demand response programs*** **Commercial EVs: Start at 0, ramp up to 1/3 of commercial EVs participate in managed charging by 2030**
Demand Response - Industrial	**Includes dual fuel boilers, thermal energy storage, process flexibility, heating, cooling** ***ODOE is still reviewing what figure to include, and would welcome feedback on current levels of industrial participation in demand response programs as well as future projections***
Emissions constraint target accounting	Emissions reduction on anthropogenic emissions, natural climate solutions, and sequestration not eligible
Carbon Capture and Storage (CCS)	No CCS in Oregon permitted
Non-CO2, non-energy	EPA developed supply curves of measures to reduce non-CO2 and non-energy emissions, e.g. reducing methane (CH_4) leakage, reducing f-gasses in industrial processes and products, reducing nitrous oxide (N_2O) from soil management. Optimized by the model against energy emissions reduction measures.

6. Electricity Generation Technologies

Energy Demand	Results from EnergyPATHWAYS model informs Regional Investment and Operations Model (RIO) (both Evolved Energy Research models) Data center and chip fabrication load growth trajectory (see above) Rooftop solar scheduled additions (see above)
Electric Supply	Existing supply minus announced coal/gas retirements Siting restrictions apply to new generation, interconnection, transmission Out-of-state generation requires transmission

Commented [TE22]: Both the Council and BPA have developed estimates of either regional (Council) or service area (BPA) DR potential. Both the Council and BPA DR potential studies include assumptions regarding participation in current DR programs (mostly irrigated ag) as well as assumptions regarding expected participation by DR program type. Appendix B of the BPA potential study lists their assumptions for program participation and in most cases has citations supporting those assumptions. BPA also commissioned a study of DR program participation "elasticities". BPA's contractor (Cadmus) performed an elasticity study to estimate the amount of demand response capacity that could be achieved through changes in customer incentive payments. This study analyzed data from 2010 to 2015 on utility demand response programs from the U.S. Energy Information Administration (EIA) Form 861, which collects comprehensive information about utility demand response programs, including capacity from demand response and customer incentive payments for providing capacity. Note that the Council's 8th Plan regional estimate of DR potential used the same model (developed by Cadmus) and elasticities that were used in BPA's service area assessment. ...

Commented [NAM23]: Table 5-4 of PAC's 2023 potential study has Oregon's DR starting point as 4.8 MW of summer peak for residential and sm/med commercial

Table 5-3 provides potential for OR by 2042. Res+sm/med commercial is about 150 MW of summer peak and another 43MW from residential only, primarily driven by ...

Commented [NAM24]: CPUC DR Potential study:
Phase 4 -
Warehouse controls with ADR are assumed capable of shedding load by 65% for up to 2 hours. The saturation remains constant at 70% until 2050. ...

Commented [TE25]: See prior comment

Commented [NAM26]: CA phase 4 DR Potential study
In particular, this study forecasted the growth of electrified loads in buildings and for LDEV and MHDEV charging and found that these new loads had a dramatic impact on both the DR need and the DR potential in California. An important missing piece of the electrification puzzle is the electrification of present-day fossil-fuel end uses in the industrial sector. At the ...

Commented [TE27]: See prior comment

Commented [NAM28]: Table 5-4 of PAC's 2023 potential study has Oregon's DR starting point as 60 MW of summer peak for industrial

Table 5-3 provides potential for OR by 2042, about 20 MW of industrial summer peak. I would think that PAC could translate those into percentages that you could use. ...

Generation Options	Hydropower Solar (photovoltaic and thermal) Wind (onshore, offshore) Biomass (woody, manure, biogas) Biogas, hydrogen, renewable natural gas Geothermal Coal, gas, nuclear (siting restrictions – no new natural gas or nuclear sited in Oregon)Coal, gas, nuclear (siting restrictions – no new natural gas or nuclear sited in Oregon)
Transmission Availability	The Nature Conservancy Power of Place West (inter-zonal) Bonneville Power Administration (BPA) (for Oregon East-West zones) No new inter-zonal transmission is built until 2035
Inflation Reduction Act Incentives	Supply-side incentives include for hydrogen production, renewable electricity generation, battery storage, carbon capture, clean fuels, out-of-state nuclear

Commented [AS29]: Just wondering if coal is really intended as option and especially one in OR? Given the goals, it seems like it wouldn't be included, but just flagging it.

7. Land Use and Natural Resources

7.1 Land Use Screens

The Reference Scenario will restrict the use of legally protected (Level 1) and administratively protected areas (Level 2) in Oregon for energy development using The Nature Conservancy's Power of Place West study as a framework to select land use screens.

Categories of Exclusion	Definition of Category	Examples	Biomass
Level 1	Legally protected: Areas with existing legal restrictions	National Wildlife Refuges, National Parks, Marine Sanctuaries, Military Training Areas	All feedstocks included, exclude potential supply from conservation reserve program land
Level 2	Administratively protected: Level 1 + areas with existing administrative and legal designations where state or federal law requires consultation or review and lands owned by non-governmental organizations (NGOs) on which there are conservation restrictions.	Critical Habitat for Threatened or Endangered Species, Sage Grouse Priority Habitat Management Areas, vernal pools and wetlands, tribal lands	No net expansion of land for purpose-grown herbaceous biomass crops. Specifically, land available for herbaceous biomass crops (miscanthus and switchgrass) is limited to the share of land currently cultivated for corn that is eventually consumed as corn ethanol, which is

			phased out in all net zero scenarios by 2050.
Level 3	High conservation value: Level 1 + Level 2 + areas with high conservation value as determined through multi-state or ecoregional analysis (e.g., state, federal, academic, NGO) and lands with social, economic, or cultural value.	Prime Farmland, Important Bird Areas, big game priority habitat and corridors, TNC Ecologically Core Areas, "Resilient and Connected Network"	Same as Level 2

7.2 Land Use Key Assumptions

Emissions constraint target accounting	Emissions reduction on anthropogenic emissions, natural climate solutions, and sequestration not eligible
Carbon Capture and Storage (CCS)	No CCS in Oregon permitted
Non-CO2, non-energy	EPA developed supply curves of measures to reduce non-CO2 and non-energy emissions, e.g. reducing methane (CH4) leakage, reducing f-gasses in industrial processes and products, reducing nitrous oxide (N2O) from soil management. Optimized by the model against energy emissions reduction measures.

8. Transmission and Distribution

The Transmission and Distribution working group had insufficient time to address all the data and assumptions that will be incorporated into the model. ODOE is posing the following questions for consideration.

Timing of Electricity Transmission Development	**No new transmission until 2035**, except for certain priority transmission projects that are currently planned and/or under development – examples include: **New Lines** – IPC's Boardman to Hemingway (B2H) project online in 2030 and PAC's Gateway project online in 2035 **Reconductoring/Rebuilding Existing Lines** - BPA's Big Eddy to Chemawa project and PGE's Round Butte to Bethel project, both expanding East to West transfer capacity from 230 kV to 500 kV and both online in 2035 (conservative assumption) or 2030 (liberal assumption) ***Are there other "in-flight" projects (new lines/reconductoring/rebuilding) that should be considered?***

Electricity Distribution System Cost Assumption	Proxy value based on historic costs from Energy Information Administration (EIA) ***Should the proxy value be increased to account for higher costs needed to support electrification and adaptation to extreme weather events, including wildfires? If yes, what data source would support forecasted costs?***
Pipeline Infrastructure Assumptions	No new infrastructure development beyond operations and maintenance. ***Should we be considering any other future costs? Including costs of repurposing pipelines for alternative fuels?*** ~~***Should we be considering any other future costs? Including costs of repurposing pipelines for alternative fuels?***~~
Electricity transfer capacity between East and West Oregon	Publicly available Bonneville Power Administration (BPA) data on historical path flows. Account for East to West transmission expansion projects noted above (B2H, Big Eddy to Chemawa, and Round Butte to Bethel) ***How/when do we account for BPA and PGE's planned rebuild projects across the Cascades? Such as: Big Eddy to Chemawa and Round Butte to Bethel?***

Commented [TE30]: Council's 2021 plan used data from five transmission utilities and four distribution utilities to estimate this value: $3.08/kW-yr for deferred transmission and $6.85/kW-year for deferred distribution (both in 2016$). Here's a link to the issue paper discussing their derivation and associated issues.

Commented [AS31]: For what it's worth the aforementioned Brattle study includes avoided distribution costs.

Commented [AS32]: You'd have to rebuild the pipelines nearly in their entirety for hydrogen transport. Does EnergyPathways not include any output information about storage and transport of hydrogen?

<u>LineVision Comments – ODOE Transmission & Distribution Strategy Working Group</u>

Thank you for the opportunity to submit comments. I represent LineVision, a provider of Dynamic Line Ratings (DLR). I attended only the Transmission & Distribution Working Group session, and my comments follow on from that session's discussion. Much of the discussion centered around the lack of the existing transmission system capacity under today's constraints. The study leader noted that Dynamic Line Ratings, which can increase the capacity of the existing transmission system, are not captured in the initial proposed modeling approach.

Because this is a long-range modeling approach, a failure to capture any deployment of Dynamic Line Ratings is not likely to represent reality. For example, FERC recently issued an ANOPR, which proposes a framework that would require transmission providers to deploy DLR. And while that framework is not final nor formally ordered, it is likely that FERC will issue a DLR mandate, in some form, in the coming 1-3 years. Further, DLR deployments have accelerated in the U.S. in 2023 and 2024, a trend that is likely to continue. Portland General Electric issued an RFP for DLR in July, 2024, which is likely to be deployed by 2025. The U.S. DOE and White House have both announced initiatives related to federal support for DLR. In sum, given the major momentum for deploying DLR in Oregon and across the U.S., an approach to modeling that excludes consideration of DLR benefits - like increased capacity - is not representative of the likely future of Oregon. We recommend that the model incorporate DLR's capacity expansion benefits, and clarify in its solution set to what extent DLR should be deployed in Oregon over the long-term to meet the state's capacity needs in a cost-effective manner.

In WestTEC's transmission study efforts, they have explicitly told stakeholders in public meetings that they anticipate DLR to be a major component in the 10-year study outlook timeframe, in large part, because of the ability to quickly deploy DLR (often under 3 months) and the often 10+ years it takes to build new transmission. Simply given the timeframe that it takes to build new transmission, DLR should be part of the portfolio of solutions to expand the grid's capacity. To be clear, DLR is not a panacea, and under every long-term circumstance, there will certainly be a need to build new transmission infrastructure, rebuild some, and reconductor more. However, excluding DLR entirely will result in Oregon ratepayers missing out on the lowest hanging fruit of transmission capacity expansion. DLR is approximately 5% of the cost of new-build transmission infrastructure on a per-mile basis, and can also be deployed in a matter of months. We recommend that ODOE ensure DLR is reasonably captured in its modeling efforts as part of its strategy to ensure the state aligns with likely policy and utility deployment outcomes that would occur regardless.

Thank you for the opportunity to comment, and please do not hesitate to reach out with any questions or for further discussion.

Eli Asher

LineVision

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Edith Bayer,
Oregon Department of Energy
energy.strategy@energy.Oregon.gov

Subject: Comments on the Oregon Energy Strategy Modeling Approach and Reference Scenario Design

MCAT (Mobilizing Climate Action Together) is a community of volunteers working on advancing a healthy climate and a green economy for future generations. MCAT has already provided several questions requesting clarification on the nature of both the Energy Pathways and the RIO models, included as Annex 1. A few of these questions were answered in the recent "Draft Reference Scenario Key Data and Assumptions" document, but most were not. *We believe these questions are reasonable and need to be addressed, especially those clarifying the ways that the model accounts for the timing of electrical demands.*

The recent "Draft Reference Scenario Key Data and Assumptions" document provides data sources but no cost and performance specifics regarding the types of technologies included in the 80 different sub-sectors (space heating, cooking, cars and trucks, and many others) that could be used to satisfy useful energy demands. Nor does it provide any specific on how the cost and performance of these technologies change over time. All that's clear is that key model assumptions are the market shares for new devices (technologies) when they reach the end of their useful life and must be replaced. *We request that simple data tables for key technology categories be provided such that sector experts can review and comment on the scope and completeness of the data, as well as any constraints that restrict the performance of a technology.* See Annex 2 for more details.

In general, we do not have any specific complaints about the key assumptions defining the Reference Scenario. ODOE and the modelling team have been open to local data inputs, and the proposed market shares are consistent with known pathways to cost-effective deep decarbonization. Our most significant concern is the lack of specificity and detail on the supply technology types - in addition to the general lack of technology cost and performance numbers, as discussed above. Each of the categories listed under "Generation Options" on Pages 8 and 9 of the "Draft Reference Scenario Key Data and Assumptions" document should have specific details. For example, solar photovoltaic systems should be defined for residential rooftops, commercial rooftops, community solar, and utility-scale solar, as a minimum. These cost and performance assumptions can significantly influence model results.

In Annex 2, we also provide some initial thoughts on expected model results, and we hope to have a discussion of these at the Sept 9 meeting.

Finally, in Annex 3, we have crafted for your consideration a possible Scenario Matrix for the study. It identifies five alternate scenarios that explore the Impact of what if questions of:

1. Limited New Transmission Capacity
2. Slower than Expected Electrification
3. Faster than Expected Electrification
4. Focused Distributed, Smart and Resilient
5. Focused Distributed, Smart and Resilient w High Demand and Stretch Targets

Thank you for providing this opportunity to comment. We look forward to participating in the public workshops to come.

Dr. Pat DeLaquil, DecisionWare Group LLC (www.decisionWareGroup.com)

On Behalf of the MCAT Steering Committee:
Brett Baylor, Rick Brown, Linda Craig, Pat DeLaquil, Dan Frye, Debby Garman, KB Mercer, Michael Mitton, Rich Peppers, John Perona, Rand Schenck, Joe Stenger and Catherine Thomasson

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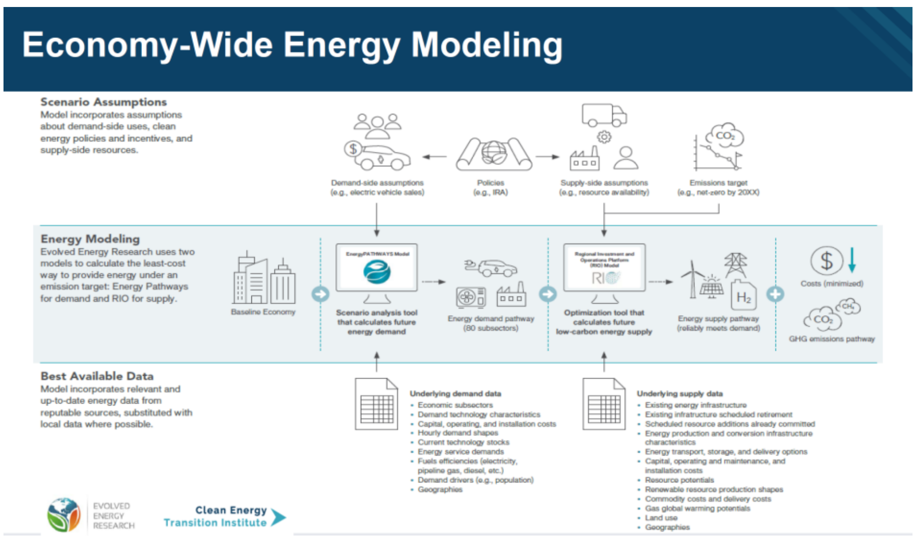
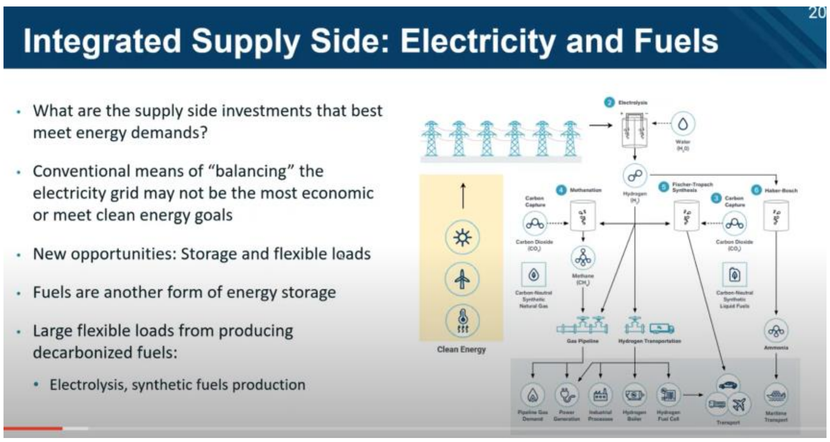
Annex 1: Comments on Modeling Approach:

1. Please clarify the nature of both the Energy Pathways and the RIO models (i.e., optimization versus simulation).
2. Please clarify the time steps used in each model and how the results from one model are provided to the next, and if any iteration is involved. My understanding is that the Energy Pathways model uses 5-year time steps, and RIO is an hourly model.
3. How do you determine hourly demand shapes for the Energy Pathways model?
4. As I understand it, EnergyPathways is a scenario simulation model that needs to make assumptions regarding new device market shares. Does the model require iteration to achieve the GHG targets, and if so, how if that performed.



5. I appreciate the level of detail included in the model for the demand sectors. What types of input data templates will be provided for review? Preferably structured by resource options and individual demand sectors, to facilitate expert review. See the Minimum Data Requirements section below.

6. In the Energy Pathways model, how do you characterize the timing of demand devices and what options exist for demand-avoiding technologies?
7. Can we provide technology characterization for emerging supply and demand devices that are in early commercial operation?
8. How will the model incorporate expected improvements in technology costs through learning curve effects?
9. I was surprised to the amount of time spent on the hydrogen module in their model. It's good that the model has this capability, but I would have liked to have seen similar detail on each sector of the model. Question: How are H2 infrastructure costs developed?



10. What are the timelines for each option? GETs, Reconductoring, Co-location and New. Like their use of the higher cost data set.

› Power of Place – West: Identified major substations for interties between states, the existing corridors, the potential to reconductor or co-locate transmission in those corridors, and new potential right of ways for additional transmission expansion

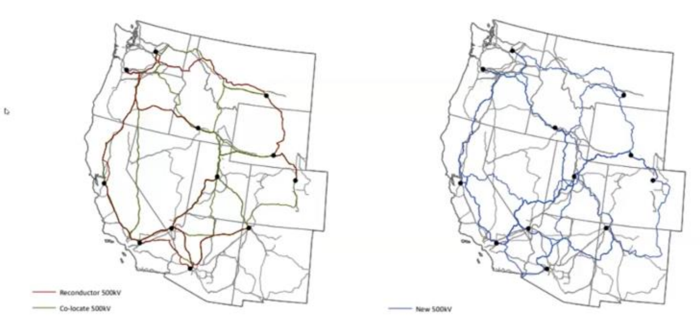


Fig. S8. Least cost path model results showing 500 kV transmission lines. Left: reconductored and co-located 500 kV lines only. Right: new 500 kV lines only.)
Source: Power of Place-West

11. Biofuel discussion: Will the model use carbon intensity for biofuels? e.g., Agricultural emissions for biomass resources: resource transportation, processing and fuel delivery emissions – many of which are non-energy emissions or incremental to the historical transport demands.

12. What infrastructure improvements does you pipe flow transmission modelling allow for? What are the key data inputs?
13. What is the data source for transmission capacity?

Annex 2: Reference Scenario Design

The recent "Draft Reference Scenario Key Data and Assumptions" document, provides data sources but no specific regarding the types of technologies included in the 80 different sub-sectors (space heating, cooking, cars and trucks, and many others) that could be used to satisfy useful energy demands. Nor does it provide any specific on how the cost and performance of these technologies change over time. All that's clear is that key model assumptions are the market share for new devices (technologies) when they reach the end of their useful life and must be replaced.

We request that simple data tables for key technology categories be provided such that sector experts can review and comment on the scope and completeness of the data. Also, models often contain constraints that restrict the performance of a technology, and these should be identified. Finally, the ways that the model accounts for the timing of electrical demands needs better clarification.

Minimum Data Requirements:

1. Energy Service Demand projections, including data sources and methodology
2. Existing and New technology options with cost and performance data, and constraints (growth rates, resource limits, market share constraints, etc.). These should be categorized by sector and energy service.
3. Existing and new energy resource supply options, cost curves and resource projections for all fossil, renewable and imported resource options.
4. Existing and projected load duration curves for electricity demands
5. Methodology and assumptions (e.g., reserve margin) for determining peak loads (and capacity needs).
6. Discount rates

Reference Scenario Assumptions

In general, we do not have any specific complaints about the key assumptions defining the Reference Scenario. ODOE and the modelling team have been open to local data inputs, and the proposed market shares are consistent with known pathways to cost-effective deep decarbonization. Our most significant concern is the lack of specificity and detail on the supply technology types - in addition to the general lack of technology cost and performance numbers, as discussed above. Each of the options listed under "Generation Options" on Pages 8 and 9 of the "Draft Reference Scenario Key Data and Assumptions" document should have specific details. For example, solar photovoltaic systems should be defined for residential rooftops, commercial rooftops, community solar, and utility-scale solar, as a minimum. These cost and performance assumptions can significantly influence model results.

Expected Model Outputs

There has been little discussion of expected model results. The table below is a suggested list of modle outputs that could be made available for review:

- Total Discounted System Cost
- Cumulative (and by period) GHG Emissions to meet Targets
- Resource utilization levels and marginal costs, if constrained
- Technology results
  - Level of new capacity installed by sector and type, end use, mode, etc.
  - Annual investments in new capacity
  - Annual fixed and variable operating and fuel costs
  - Annual and season/time-of-day (for power plants) utilization
  - Marginal cost, if constrained
- Energy consumed by each technology (sector)
- Marginal prices for all energy carriers (by season/time-of-day for electricity)
- Emission level by resource/sector/technology for each period, and marginal costs in target years

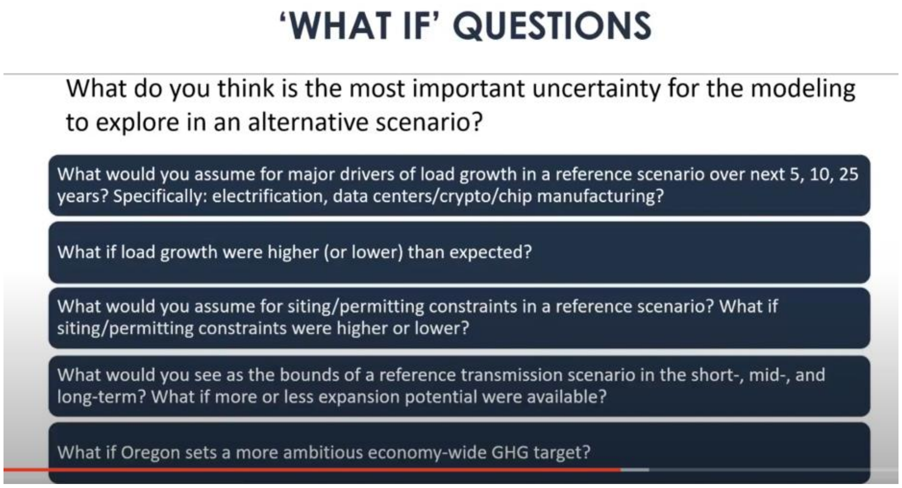
Additional Question

What specific model results will be used to develop the following other metrics that will be used for the policy portion of this analysis?

1. Job Creation and Economic Development
2. Environmental Justice & Equity
3. Energy burden & affordability
4. Energy security and impacts of broader markets
5. Energy resilience
6. Community energy resilience

Annex 3: Possible Scenario Matrix

ODOE and the analysis team have done a good job of identifying and framing the possible what-if questions that the analysis can answer.



All of the questions above assume some changes from the Reference case, and now that the Reference scenario's key parameters have been defined, a possible set of scenarios, with projected levels of change from the Reference can be developed. Below is a Possible Scenario Matrix. Many others could be developed, but the one below addresses what we consider to be the Key Modelling Parameters.

We have extracted the key model parameters defining the Reference scenario from ODOE's PowerPoint and the Draft Reference Scenario Key Data and Assumptions document, and then postulated 5 alternate scenarios. The key attributes of each scenario are identified in the Name, and the specific changes in model parameters relative to the Reference scenario are listed specifically. For each of the proposed Scenarios, we have highlighted changes stronger than the Reference in green and those weaker than the Reference in orange. The five alternate scenarios defined below are:

1. Limited New Transmission Capacity
2. Slow Electrification
3. Fast Electrification
4. Distributed, Smart and Resilient
5. Distributed, Smart and Resilient w High Demand and Stretch Targets

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Parameter	Reference	Limited New Transmission Capacity	Slow Electrification	Fast Electrification	Distributed, Smart and Resilient	Distributed, Smart and Resilient w High Demand
GHG Targets	HB-2021, CPP & other existing policies	HB-2021, CPP & other existing policies	HB-2021, CPP & other existing policies	HB-2021, CPP & other existing policies	HB-2021, CPP & other existing policies	Stretch??? 90% overall GHG reduction in 2050
Demand Growth	NPCC Assessment	NPCC Assessment	NPCC Assessment	NPCC Assessment	NPCC Assessment	High??? Increased GDP projection
Transmission Capacity to Oregon	Completion of existing projects and nothing else before 2035	Limited new capacity after 2035 (how much?)	Completion of existing projects and nothing else before 2035	GETs and Reconductoring	GETs and Reconductoring	GETs and Reconductoring
Electricity Generating Technologies Central	Established technologies: hydropower, solar, on/offshore wind, biomass, gas, renewable natural gas, etc.) No siting of new natural gas or nuclear power plants in OR	Accelerate Distributed Solar and Storage, Offshore Wind and Geothermal	Established technologies: hydropower, solar, on/offshore wind, biomass, gas, renewable natural gas, etc.) No siting of new natural gas or nuclear power plants in OR	Accelerate Off-shore wind, Grid-scale storage, Offshore Wind and Geothermal	Accelerate Distributed Solar and Storage, Offshore Wind and Geothermal	Accelerate Distributed Solar and Storage, Offshore Wind and Geothermal
Building Efficiency	Weatherize 80% of existing commercial and residential home buildings by 2040 and 95% by 2050.	Weatherize 80% of existing commercial and residential home buildings by 2040 and 95% by 2050.	Weatherize 80% of existing commercial and residential home buildings by 2040 and 95% by 2050.	Same rate, but measures assumed to achieve a 15% reduction in overall building energy use on average.	Same rate, but measures assumed to achieve a 15% reduction in overall building energy use on average.	Same rate, but measures assumed to achieve a 15% reduction in overall building energy use on average.
Demand Response	Limited flexible load devices (What share?)	Limited flexible load devices (What share?)	Limited flexible load devices (What share?)	Smart appliances Appliances with storage Aggregators	Smart appliances Appliances with storage Aggregators	Smart appliances Appliances with storage Aggregators
Agriculture	80% of agricultural vehicles electrified by 2050	80% of agricultural vehicles electrified by 2050	50% of agricultural vehicles electrified by 2050	80% of agricultural vehicles electrified by 2050	80% of agricultural vehicles electrified by 2050	80% of agricultural vehicles electrified by 2050
Space heating	Residential: Electric heat pump sales 95% of sales by 2040	Residential: Electric heat pump sales 95% of sales by 2040	Residential: Electric heat pump sales 75% of sales by 2040	Residential: Electric heat pump sales 95% of sales by 2040	Residential: Electric heat pump sales 95% of sales by 2040	Residential: Electric heat pump sales 95% of sales by 2040
	Small Commercial: Follows residential	Small Commercial: Follows residential	Small Commercial: Follows residential	Small Commercial: Follows residential	Small Commercial: Follows residential	Small Commercial: Follows residential
	Large Commercial: Electric heat pump sales 75% of overall sales by 2045	Large Commercial: Electric heat pump sales 75% of overall sales by 2045	Large Commercial: Electric heat pump sales 50% of overall sales by 2045	Large Commercial: Electric heat pump sales 75% of overall sales by 2045	Large Commercial: Electric heat pump sales 75% of overall sales by 2045	Large Commercial: Electric heat pump sales 75% of overall sales by 2045
Water heating	Residential: Electric heat pump sales 95% of sales by 2045.	Residential: Electric heat pump sales 95% of sales by 2045.	Residential: Electric heat pump sales 75% of sales by 2045.	Residential: Electric heat pump sales 95% of sales by 2045.	Residential: Electric heat pump sales 95% of sales by 2045.	Residential: Electric heat pump sales 95% of sales by 2045.

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Parameter	Reference	Limited New Transmission Capacity	Slow Electrification	Fast Electrification	Distributed, Smart and Resilient	Distributed, Smart and Resilient w High Demand
	Small Commercial: Follows residential.	Small Commercial: Follows residential.	Small Commercial: Follows residential.	Small Commercial: Follows residential.	Small Commercial: Follows residential.	Small Commercial: Follows residential.
	Larger Commercial: 25% heat pump sales by 2030 and 90% by 2045	Larger Commercial: 25% heat pump sales by 2030 and 90% by 2045	Larger Commercial: 25% heat pump sales by 2030 and 50% by 2045	Larger Commercial: 25% heat pump sales by 2030 and 90% by 2045	Larger Commercial: 25% heat pump sales by 2030 and 90% by 2045	Larger Commercial: 25% heat pump sales by 2030 and 90% by 2045
Appliances	95% sales of new appliances are electric by 2035	95% sales of new appliances are electric by 2035	75% sales of new appliances are electric by 2035	95% sales of new appliances are electric by 2035	95% sales of new appliances are electric by 2035	95% sales of new appliances are electric by 2035
Distributed Energy Resources	Northwest Power and Conservation Council March 2024 rooftop solar projections	Allow solar and storage on warehouses, malls and schools using new commercial model	Northwest Power and Conservation Council March 2024 rooftop solar projections	Northwest Power and Conservation Council March 2024 rooftop solar projections	Allow solar and storage on warehouses, malls and schools using new commercial model	Allow solar and storage on warehouses, malls and schools using new commercial model
Transportation	Light duty vehicles: 100% BEV sales by 2035	Light duty vehicles: 100% BEV sales by 2035	Light duty vehicles: 80% BEV sales by 2035	100% BEV sales by 2035	100% BEV sales by 2035	100% BEV sales by 2035
	Transit vehicle: 75% BEV / 25% hydrogen by 2036	Transit vehicle: 75% BEV / 25% hydrogen by 2036	Transit vehicle: 50% BEV / 25% hydrogen by 2036	100% BEV by 2036	100% BEV by 2036	100% BEV by 2036
	Medium, Heavy duty & Long Haul: 75% BEV / 25% hydrogen by 2040	Medium, Heavy duty & Long Haul: 75% BEV / 25% hydrogen by 2040	Medium, Heavy duty & Long Haul: 50% BEV / 25% hydrogen by 2040	75% BEV / 25% hydrogen by 2040	75% BEV / 25% hydrogen by 2040	75% BEV / 25% hydrogen by 2040
EV Load Flexibility	2/3 of residential EVs and 1/3 of commercial EVs participate in managed charging by 2030	Current Policies	1/2 of residential EVs and 1/4 of commercial EVs participate in managed charging by 2030	100% of residential EVs and 75% of commercial EVs participate in managed charging by 2030	100% of residential EVs and 75% of commercial EVs participate in managed charging by 2030	100% of residential EVs and 75% of commercial EVs participate in managed charging by 2030
	No V2G	No V2G	No V2G	25% V2G by 2035 & 50% by 2050	25% V2G by 2035 & 50% by 2050	25% V2G by 2035 & 50% by 2050
	No distributed storage?	No distributed storage?	No distributed storage?	Grid and substation battery storage	Residential & Substation battery storage	Residential & Substation battery storage
Industry	Process efficiency: 1% average improvement per year in all sectors	Process efficiency: 1% average improvement per year in all sectors	Process efficiency: 1% average improvement per year in all sectors	Process efficiency: 1% average improvement per year in all sectors	Process efficiency: 1% average improvement per year in all sectors	Process efficiency: 1% average improvement per year in all sectors
	Electrification: 100% of machine drives by 2035 100% of heat for computer and electronics products by 2050	Electrification: 100% of machine drives by 2035 100% of heat for computer and electronics products by 2050	Electrification: 75% of machine drives by 2035 80% of heat for computer and electronics products by 2050	Electrification: 100% of machine drives by 2035 100% of heat for computer and electronics products by 2050	Electrification: 100% of machine drives by 2035 100% of heat for computer and electronics products by 2050	Electrification: 100% of machine drives by 2035 100% of heat for computer and electronics products by 2050
	50% of heat in bulk chemicals production by 2050, 25% of heat in glass production	50% of heat in bulk chemicals production by 2050, 25% of heat in glass production	Electrification: 25% of heat in bulk chemicals production by 2050, 10% of heat in glass production	Electrification 50% of heat in bulk chemicals production by 2050, 25% of heat in glass production	Electrification 50% of heat in bulk chemicals production by 2050, 25% of heat in glass production	Electrification 50% of heat in bulk chemicals production by 2050, 25% of heat in glass production

Parameter	Reference	Limited New Transmission Capacity	Slow Electrification	Fast Electrification	Distributed, Smart and Resilient	Distributed, Smart and Resilient w High Demand
	50% of integrated steam production, and 80% of integrated steam production in food manufacturing, by 2045	50% of integrated steam production, and 80% of integrated steam production in food manufacturing, by 2045	Electrification: 25% of integrated steam production, and 50% of integrated steam production in food manufacturing, by 2045	Electrification 50% of integrated steam production, and 80% of integrated steam production in food manufacturing, by 2045	Electrification 50% of integrated steam production, and 80% of integrated steam production in food manufacturing, by 2045	Electrification 50% of integrated steam production, and 80% of integrated steam production in food manufacturing, by 2045
	100% of refrigeration by 2040 90% of industrial HVAC loads across all subsectors 80% of industrial vehicles by 2050	100% of refrigeration by 2040 90% of industrial HVAC loads across all subsectors 80% of industrial vehicles by 2050	Electrification: 75% of refrigeration by 2040 70% of industrial HVAC loads across all subsectors 50% of industrial vehicles by 2050	Electrification: 100% of refrigeration by 2040 90% of industrial HVAC loads across all subsectors 80% of industrial vehicles by 2050	Electrification: 100% of refrigeration by 2040 90% of industrial HVAC loads across all subsectors 80% of industrial vehicles by 2050	Electrification: 100% of refrigeration by 2040 90% of industrial HVAC loads across all subsectors 80% of industrial vehicles by 2050
	Hydrogen: 50% of heat in bulk chemicals; 20% of construction energy demand and 20% of industrial vehicles by 2050	Hydrogen: 50% of heat in bulk chemicals; 20% of construction energy demand and 20% of industrial vehicles by 2050	Hydrogen: 75% of heat in bulk chemicals; 40% of construction energy demand and 40% of industrial vehicles by 2050	Hydrogen: 50% of heat in bulk chemicals; 20% of construction energy demand and 20% of industrial vehicles by 2050	Hydrogen: 50% of heat in bulk chemicals; 20% of construction energy demand and 20% of industrial vehicles by 2050	Hydrogen: 50% of heat in bulk chemicals; 20% of construction energy demand and 20% of industrial vehicles by 2050
Transportation mode shifting	20% reduction in VMT per capita by 2050	20% reduction in VMT per capita by 2050	20% reduction in VMT per capita by 2050	30% reduction in VMT per capita by 2050	30% reduction in VMT per capita by 2050	30% reduction in VMT per capita by 2050
Methane Gas Infrastructure	Current Policies	No expansion	No expansion	Managed decommissioning	Managed decommissioning	Managed decommissioning

ModernHydrogen

Introduction
Modern Hydrogen appreciates the opportunity to participate in the public comment process for the Oregon Energy Strategy currently under development. Modern Hydrogen is a world leader in distributed hydrogen technologies, methane pyrolysis, and carbon management. Modern provides practical, clean energy solutions using existing natural gas infrastructure for hard-to-decarbonize sectors. Founded in 2015, Modern is headquartered in the Pacific Northwest and is backed by investors and customers such as Bill Gates, NextEra Energy, National Grid, and Northwest Natural. The company's mission is to make energy both cleaner and cheaper.

Accelerating the Clean Energy Transition
Oregon must accelerate its clean energy transition to meet urgent climate goals. Currently, clean, decarbonized energy represents less than 30% of the state's overall energy consumption. While existing climate policies are appropriately ambitious, it must be recognized that increased effort, investment, and innovation will be required in the energy sector to achieve success. Every day we delay, we not only fall further behind in our environmental responsibilities but also risk economic stagnation. Leveraging Oregon's businesses, workforce, and infrastructure can turn obstacles into opportunities for clean energy growth.

Utilizing Existing Infrastructure, Resources, and Workforce
Electrification requires complementary solutions to decarbonize key sectors such as industrial heat and heavy-duty transportation at the speed and scale necessary. Relying solely on electrification will delay the energy transition due to delays in siting infrastructure, backlogs in permitting assets, bottlenecks in procuring equipment, and challenges in financing projects.

Methane pyrolysis offers a practical, near-term complementary solution by separating solid carbon from natural gas. The resulting clean hydrogen can decarbonize industrial heat immediately, and the capture carbon co-product can displace bitumen in asphalt binder, thus helping to decarbonize roads, too. Methane pyrolysis is being piloted in Oregon and can accelerate clean industrial heat, low-carbon heavy-duty transport, and infrastructure decarbonization, while also offering dependable clean energy to firm up intermittent renewable energy sources.

By decarbonizing methane, methane pyrolysis turns the existing gas pipeline infrastructure from a climate liability into a clean energy accelerant. We can instantly transform our current workforce to become a vital force in the energy transition. We can immediately begin decarbonizing industrial heat and road infrastructure without waiting for clean electricity to become ubiquitously and affordably available.

20300 Woodinville Snohomish Rd, Suite B

Woodinville, WA 98072

Recommendations

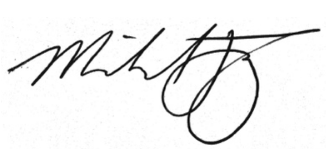
Modern Hydrogen encourages the Oregon Energy Strategy to include decarbonization of natural gas, using methane pyrolysis to remove carbon from both geologic and biogenic methane to produce clean hydrogen and useful solid carbon, as an option for the state's energy future. Importantly, methane pyrolysis technologies should be factored into the modeling that will underlie the strategy's analytical foundations.

Specific Comments on Tables:

- **Page 4, Table 2: Industry – Key Assumptions**
  Clarify if the 100% electrification assumption for industrial heat by 2050 refers to space heat, process heat, or both.
- **Page 7, Table 4: Direct Use Fuels**
  Clarify whether "green hydrogen" refers to hydrogen with low carbon intensity or only hydrogen produced via electrolysis. Specify if this applies to both "hydrogen" and "hydrogen-derived fuels" or just the latter. Additionally, the sentence starting "Clean Fuel Standard" seems incomplete.
- **Page 8, Table 5: Energy Efficiency and Load Flexibility**
  Carbon Capture and Storage (CCS) does not seem to fit in this table. Clarify if the restriction on CCS refers to geologic sequestration specifically or includes above-ground permanent sequestration. How does this apply to technologies like methane pyrolysis of biogenic methane?

These revisions will clarify and strengthen the plan, supporting Oregon's clean energy goals while ensuring a just and inclusive transition. We look forward to working with the Oregon Department of Energy as this energy strategy takes shape.

Sincerely,



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Oregon Energy Strategy

Draft Reference Scenario
Key Data and Assumptions

Introduction

This document provides the draft inputs for the Reference Scenario of the Oregon Energy Strategy model. The modeling phase of the Oregon Energy Strategy involves development of a Reference Scenario and five alternative scenarios. The modeled scenarios produce different pathways to meeting Oregon's energy and climate objectives. They provide information on the effects of different energy choices and will serve as foundational information for policy discussions in Phase 2 of the Oregon Energy Strategy process. These discussions are where policy recommendations will be developed. The final Oregon Energy Strategy will be submitted to the Governor and Legislature by November 1, 2025.

The model must solve to meet Oregon's anchor climate and clean energy goals: Executive Order 20-04 (80 percent economy-wide reduction in greenhouse gas emissions by 2050); HB 2021 (100 percent clean electricity for the state's largest investor-owned electric utilities and Electricity Service Suppliers), and the Climate Protection Program (90 percent reduction in greenhouse gas emissions from fuels by 2050). This is a requirement of HB 3630, which directs ODOE to develop the energy strategy and identify pathways to achieving the state's energy policy objectives.

These goals are ambitious, and there are many uncertainties surrounding what combination of technologies and measures will allow Oregon to meet its clean energy and climate goals over time and out to 2050. What is relatively clear based on a range of studies ODOE has evaluated is that: (1) aggressive energy efficiency and electrification are key pillars of cost-effective decarbonization; (2) we have a suite of diverse technologies to choose from to decarbonize the electricity sector; and (3) clean fuels will play a key role.[i]

The modeling exercise requires well-informed, data-driven judgment calls on many of the assumptions relating to energy efficiency and electrification. This is because the transition to economy-wide decarbonization by mid-century requires a pace and scale that is much greater than past trends. And we are still working to understand the combination of consumer behaviors, market forces, and policy supports necessary to accomplish our goals. In order to ensure the Reference Scenario is built on the best available data and aggressive but achievable assumptions, ODOE has collaborated with industry and community experts to inform the modeling inputs. Using that feedback, ODOE and its technical contractor CETI developed a draft Reference Scenario inputs list. The table below represents key data and assumptions that inform how the model will create the Reference Scenario.

[i] 2022 Biennial Energy Report. *Charting a Course for Oregon's Energy Future*.

How the Model Works

At the highest level, the model uses data on the existing state of energy production and consumption and combines this with forecasts on population growth, load growth, technology evolution, and weather patterns to assess future statewide energy demand. The model then determines the supply of energy resources across the entire energy sector to meet that future demand, considering reliability and cost.[ii]

For the Oregon Energy Strategy, the Reference Scenario is informed by Oregon's energy consumption across its state-wide economy (residential, commercial, industrial, agricultural, fuel, and transportation sectors). To determine energy demand, it looks at energy-consuming technologies across 80 different sub-sectors (space heating, cooking, cars and trucks, and many others), and makes assumptions about how these technologies change over time, including improvements in energy efficiency, when these technologies are expected to turn over, and what they will be replaced with when they reach the end of their useful life.

The Reference Scenario also considers factors like weather, population growth, and industrial load growth (including from industrial data centers and chip manufacturing) to account for how energy demand is changing over time. Through this process, the model comes up with a picture of Oregon's energy needs every 5 years, from now to 2050.

Once we have a picture of how much energy we will need over time, the model searches for the most affordable mix of resources to meet demand across all energy consuming sectors while meeting our key climate and energy goals and maintaining reliability.[iii] It draws on everything from utility-scale resources to smaller-scale and distributed energy resources to do this. The model also considers the availability of energy supply infrastructure (i.e., gas pipes and electricity wires) to deliver that energy to customers.

How Model Results are Used

Model scenarios do not predict the future, rather they provide insights into pathways that meet our clean energy goals by considering differences in costs, energy efficiency, feasibility, and availability. The Reference Scenario will be compared against alternative scenarios that produce different energy pathways that are used to explore "What if?" questions. For example: What if transmission development is further delayed? What if we do not achieve as much electrification as in the Reference Scenario and instead rely more on clean fuels? What does this mean for overall system costs? What does it mean for the mix of resources we'd need to meet our clean energy goals? And most importantly: what do we learn from this exercise on the technologies and measures that are most likely to deliver a lowest-cost, highest-benefits energy transition for our state? The information we gather will provide a basis for analysis and discussion around

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[ii] 294abc_c5f79e16ca7a470b8168e1bbe7d98c7f.pdf (evolved.energy)

[iii] The model can incorporate some non-energy constraints, such as land use protections. However, much of the analysis on non-energy costs and benefits will happen when we are evaluating the results of the modeling. ODOE will be working with our consultant to evaluate the effects of different scenarios on equity, environmental justice, air quality and public health, and employment.

what policies are needed to achieve our energy objectives while maintaining a resilient and affordable energy system — and create a more equitable energy future for Oregon.

The following are key data and assumptions for the Reference Scenario of the Oregon Energy Strategy. ODOE is accepting comments on these inputs until **5 p.m. on September 4, 2024.**

Note: **Bolded text** indicates points of discussion in working group meetings.

Key Assumptions for the Reference Scenario

Key Demand-Side Assumptions (Buildings, Industry, Transportation)

1. Buildings

1.1 Buildings: Data sources for stocks

Residential Space Heating	Northeast Energy Efficiency Alliance (NEEA) Residential Building Stock Assessment & Home Energy Score Data*
Commercial Space Heating	NEEA Commercial Building Stock Assessment
Residential Water Heating	NEEA Residential Building Stock Assessment & Home Energy Score Data*
Commercial Water Heating	NEEA Commercial Building Stock Assessment
Residential Building Shells	NEEA Residential Building Stock Assessment & Home Energy Score Data*
Commercial Building Shells	NEEA Commercial Building Stock Assessment
Residential Technology Stock Replacement	Energy Information Administration (EIA) Residential Energy Consumption Survey, potentially supplemented by local/regional data (still in discovery)
Commercial Technology Stock Replacement	EIA Annual Energy Outlook, potentially supplemented by local/regional data (still in discovery)
Residential Cooking & Other Appliances	NEEA Residential Building Stock Assessment
Commercial Cooking & Other Appliances	NEEA Commercial Building Stock Assessment
Residential Lighting	NEEA Residential Building Stock Assessment
Commercial Lighting	NEEA Commercial Building Stock Assessment

**Oregon's Home Energy Score data comes from Earth Advantage*

1.2 Buildings: Key Assumptions

Residential Space Heating	Assume existing policies play out for all space heating technologies **Electric heat pump sales 95% of overall sales by 2040**
Commercial Space Heating	**Weighted average of large and small commercial space heating loads, with the following framing:** - **Small commercial: follow residential** - **Large commercial: electric heat pumps 75% of overall sales by 2045**
Residential Water Heating	**Incorporate Federal Energy Conservation Standards for Consumer Water Heaters (from May 6, 2029)** **Electric heat pump sales rising to 95% of overall sales by 2045**
Commercial Water Heating	**Weighted average of large and small commercial water heating loads, with the following framing:** - **Small commercial: follow residential** - **Large commercial: 25% of all new sales are electric heat pumps by 2035 and 90% by 2045**
Cooking	**95% sales of new appliances are electric by 2035**
Technology stock replacement	**Dual gas/electric heat pump systems, differentiated by climate zone, compete with other electric technologies in line with sales shares above**
Building shells	**Weatherize 80% of existing commercial and residential home envelopes by 2040 and 95% by 2050.** **Weatherization measures assumed to achieve a 10% reduction in overall building energy use on average.**
Lighting	100% LED sales by 2025 (HB2531)
Hybrid Boilers	Model can invest in dual fuel electric and gas boilers as well as hydrogen boilers

2. Industry – Key Assumptions

Industrial Processes	1% process efficiency improvements per year in all sectors Fuel switching measures from fuels to electricity
Electrification	**100% of machine drives by 2035** **100% of heat by 2050, including in Oregon's largest industrials such as computer and electronics products** **50% of integrated steam production, and 80% of integrated steam production in food manufacturing, by 2045** **100% of refrigeration by 2040** **90% of industrial HVAC loads across industrial subsectors** **80% of industrial vehicles including in agriculture by 2050**

Switch to Hydrogen	**50% of heat in bulk chemicals (not a large industry in OR)** **20% of construction energy demand** **20% of industrial vehicles by 2050**
Cement	Cement process is optimized in the model, including retrofits and new build rotary kilns to include direct separation, oxy-combustion, biomass fuel, and CCS (not a large sector in Oregon)
Thermal Energy Storage	Economic adoption modeled in industrial sector

3. Transportation

3.1 Transportation: Data sources for stocks

Light duty vehicle (LDV)current stocks	OR Dept. of Transportation – Driver & Motor Vehicle division (DMV) Data
Medium- and heavy-duty vehicle (MHDV) current stocks	OR Dept. of Transportation – Combination of Commerce and Compliance Division (CCD) and DMV data (depending on vehicle weight) *Note: propose to use Environmental Protection Agency's (EPA's) Motor Vehicle Emission Simulator (MOVES) model if cannot obtain CCD data
Transit Buses current stocks	National Transit Database / EPA MOVES
School Buses current stocks	OR Dept. of Transportation – DMV Data
Fuels current	OR Dept. of Environmental Quality Clean Fuels Program Data
Vehicle Miles Traveled (VMT) current	Dept. of Environmental Quality / EPA MOVES (data comes from Highway Performance Monitoring System)
Fuel Economy current	EPA MOVES, Historical average fuel economy by vintage and vehicle type
LDV sales shares MHDV sales shares	Advanced Clean Cars I / Advanced Clean Cars II Internation Council on Clean Transportation (ICCT) forecasts based on IRA incentives Advanced Clean Trucks through 2035 ICCT forecasts based on IRA incentives

3.2 Transportation: Key Assumptions

MDV and HDV sales shares – post 2035	**Post 2035: 100% zero emission vehicle (ZEV) sales by 2040 for Class 2b-8 vehicles (excluding buses)** **For long haul: 75% battery electric vehicles (BEVs)/25% hydrogen fuel cell vehicles (FCEVs)** **All other classes 100% electric**

Transit Buses future	**100% ZEV sales by 2036 (75% BEV / 25% FCEV by 2040)**
School Buses future	**100%BEV sales by 2036 (100% electric)**
Rail future	**20% electric, 70% hydrogen by 2050 (logistic growth starting in 2030)**
Maritime Shipping future	**Domestic: 10% electric, 20% H2, 50% ammonia by 2050** **International: 20% H2, 60% ammonia by 2050**
Vehicle Fuels future	Clean Fuels Program + Portland's Renewable Fuel Standard
Vehicle Lifetimes	15 years
Fuel economy: Light duty cars and trucks	EPA SAFE 2022-2026, constant after 2026
Fuel economy: Medium duty & heavy-duty vehicles	EPA Phase 3 standards through MY 2032; Annual Energy Outlook (AEO) projection after 2032
Fuel economy: Buses	Buses: AEO projection of fuel economy
Fuel economy: Aviation	15-20% efficiency gain through 2050, to reflect International Air Transport Association (IATA) Net Zero Roadmap
VMT Assumption	**20% reduction in VMT per capita by 2050**
Vehicle costs	Light, Medium, and Heavy-Duty Vehicles: International Council on Clean Transportation Report: Analyzing the Impact of the IRA on EV Uptake in the U.S. Transit / School Buses: International Council on Clean Transportation Rail / Aviation / Maritime: Costs assumed to be same as fossil alternatives due to lack of data
Fuel costs	Annual Energy Outlook 2023 Oil and Gas Forecasts
Infrastructure costs	EV Charging: NREL Electrification Futures Study Hydrogen: U.S. Dept. of Energy Technical Targets for H2 Delivery Looking into using NREL's EVI Pro
EV Charging Estimates	NREL Electrification Futures Study Looking into using NREL's EVI Pro

Key Supply-Side Assumptions (Electricity, Fuels, Pipes & Wires)

4. Direct Use Fuels

Demand Side Assumptions	Modeled residential, commercial, and industrial demand end use using assumptions about sales shares in EnergyPATHWAYS
Supply Side Assumptions	Existing natural gas utility Integrated Resource Plans (IRPs) for near-term investments and operations Survey of peer reviewed and government agency sources of capital

	and operating costs and performance (ADP Technical Documentation 2023, p. 61)
Fuel supply and price forecasting	Energy Information Administration (EIA) Annual Energy Outlook NW Power and Conservation Council's Fuels Advisory Committee natural gas price forecast **Department of Energy Billion Ton Study**
Alternative Clean Fuel Investment	DEQ's Climate Protection Program
Alternative Clean Fuels	Biomass-derived fuels, hydrogen, and hydrogen-derived fuels qualify as clean (if green hydrogen used). Imported fuels are counted as zero emissions (credit for negative emissions from processes like BECCS are retained by producing state). Clean Fuel Standard incorporated

5. Energy Efficiency and Load Flexibility

Behind the Meter Photovoltaic (BTM PV)	Northwest Power and Conservation Council March 2024 rooftop solar projections
BTM Storage Adoption	**Energy Information Administration's (EIA) June 2024 Survey: 10 MW assumed today** **(Note: ODOE is also calculating data from the Oregon Solar and Storage Rebate Program (OSSRP) to compare to EIA data. Please share if there is another data source ODOE should consider.)** ***What should be assumed for the total amount of BTM storage by 2050?***
Flexible Load Parameters	**Space heating loads can be delayed or advanced by 1 hour** **Water heating loads can be delayed or advanced by up to 2 hours** **Air conditioning can be delayed or advanced by 1 hour** **Residential vehicle charging can be delayed by up to 8 hours and commercial vehicle charging up to 3 hours**
V2G	**No V2G assumed**
Data Center Load Growth	Northwest Power and Conservation Council Pacific Northwest Power Supply Adequacy Assessment for 2029 base case, with load differentiated across modeling zones
Demand Response – Households participation	**50% of electric appliance installations by 2050 (linear growth from 2025)** ***Note: ODOE is still calculating the starting point in 2025 and welcomes any data related to existing household participation in demand response programs***

	Residential EVs: Start at 0, ramp up to 2/3 of residential EVs participate in managed charging by 2030
Demand Response - Commercial	**50% of electric appliance installations by 2050 (linear growth from 2025)** ***Note: ODOE is still calculating the starting point in 2025 and welcomes any data related to existing household participation in demand response programs*** **Commercial EVs: Start at 0, ramp up to 1/3 of commercial EVs participate in managed charging by 2030**
Demand Response - Industrial	**Includes dual fuel boilers, thermal energy storage, process flexibility, heating, cooling** ***ODOE is still reviewing what figure to include, and would welcome feedback on current levels of industrial participation in demand response programs as well as future projections***
Emissions constraint target accounting	Emissions reduction on anthropogenic emissions, natural climate solutions, and sequestration not eligible
Carbon Capture and Storage (CCS)	No CCS in Oregon permitted
Non-CO2, non-energy	EPA developed supply curves of measures to reduce non-CO2 and non-energy emissions, e.g. reducing methane (CH4) leakage, reducing f-gasses in industrial processes and products, reducing nitrous oxide (N2O) from soil management. Optimized by the model against energy emissions reduction measures.

6. Electricity Generation Technologies

Energy Demand	Results from EnergyPATHWAYS model informs Regional Investment and Operations Model (RIO) (both Evolved Energy Research models) Data center and chip fabrication load growth trajectory (see above) Rooftop solar scheduled additions (see above)
Electric Supply	Existing supply minus announced coal/gas retirements Siting restrictions apply to new generation, interconnection, transmission Out-of-state generation requires transmission
Generation Options	Hydropower Solar (photovoltaic and thermal) Wind (onshore, offshore)

	Biomass (woody, manure, biogas) Biogas, hydrogen, renewable natural gas Geothermal Coal, gas, nuclear (siting restrictions – no new natural gas or nuclear sited in Oregon)
Transmission Availability	The Nature Conservancy Power of Place West (inter-zonal) Bonneville Power Administration (BPA) (for Oregon East-West zones) No new inter-zonal transmission is built until 2035
Inflation Reduction Act Incentives	Supply-side incentives include for hydrogen production, renewable electricity generation, battery storage, carbon capture, clean fuels, out-of-state nuclear

7. Land Use and Natural Resources

7.1 Land Use Screens

The Reference Scenario will restrict the use of legally protected (Level 1) and administratively protected areas (Level 2) in Oregon for energy development using The Nature Conservancy's Power of Place West study as a framework to select land use screens.

Categories of Exclusion	Definition of Category	Examples	Biomass
Level 1	Legally protected: Areas with existing legal restrictions	National Wildlife Refuges, National Parks, Marine Sanctuaries, Military Training Areas	All feedstocks included, exclude potential supply from conservation reserve program land
Level 2	Administratively protected: Level 1 + areas with existing administrative and legal designations where state or federal law requires consultation or review and lands owned by non-governmental organizations (NGOs) on which there are conservation restrictions.	Critical Habitat for Threatened or Endangered Species, Sage Grouse Priority Habitat Management Areas, vernal pools and wetlands, tribal lands	No net expansion of land for purpose-grown herbaceous biomass crops. Specifically, land available for herbaceous biomass crops (miscanthus and switchgrass) is limited to the share of land currently cultivated for corn that is eventually consumed as corn ethanol, which is phased out in all net zero scenarios by 2050.
Level 3	High conservation value: Level 1 + Level 2 + areas with high conservation	Prime Farmland, Important Bird Areas, big game	Same as Level 2

	value as determined through multi-state or ecoregional analysis (e.g., state, federal, academic, NGO) and lands with social, economic, or cultural value.	priority habitat and corridors, TNC Ecologically Core Areas, "Resilient and Connected Network"	

7.2 Land Use Key Assumptions

Emissions constraint target accounting	Emissions reduction on anthropogenic emissions, natural climate solutions, and sequestration not eligible
Carbon Capture and Storage (CCS)	No CCS in Oregon permitted
Non-CO2, non-energy	EPA developed supply curves of measures to reduce non-CO2 and non-energy emissions, e.g. reducing methane (CH4) leakage, reducing f-gasses in industrial processes and products, reducing nitrous oxide (N2O) from soil management. Optimized by the model against energy emissions reduction measures.

8. Transmission and Distribution

The Transmission and Distribution working group had insufficient time to address all the data and assumptions that will be incorporated into the model. ODOE is posing the following questions for consideration.

Timing of Electricity Transmission Development	**No new transmission until 2035**, except for certain priority transmission projects that are currently planned and/or under development – examples include: **New Lines** – IPC's Boardman to Hemingway (B2H) project online in 2030 and PAC's Gateway project online in 2035 **Reconductoring/Rebuilding Existing Lines** - BPA's Big Eddy to Chemawa project and PGE's Round Butte to Bethel project, both expanding East to West transfer capacity from 230 kV to 500 kV and both online in 2035 (conservative assumption) or 2030 (liberal assumption) ***Are there other "in-flight" projects (new lines/reconductoring/rebuilding) that should be considered?***
Electricity Distribution System Cost Assumption	Proxy value based on historic costs from Energy Information Administration (EIA) ***Should the proxy value be increased to account for higher costs needed to support electrification and adaptation to extreme weather***

	events, including wildfires? If yes, what data source would support forecasted costs?
Pipeline Infrastructure Assumptions	No new infrastructure development beyond operations and maintenance. ***Should we be considering any other future costs? Including costs of repurposing pipelines for alternative fuels?***
Electricity transfer capacity between East and West Oregon	Publicly available Bonneville Power Administration (BPA) data on historical path flows. Account for East to West transmission expansion projects noted above (B2H, Big Eddy to Chemawa, and Round Butte to Bethel) ***How/when do we account for BPA and PGE's planned rebuild projects across the Cascades? Such as: Big Eddy to Chemawa and Round Butte to Bethel?***

Ryan Brown- NEEA

Page 3:

- Table 1.1 should reference NEEA as the Northwest Energy Efficiency Alliance, not Northeast

Key Assumptions for the Reference Scenario

Key Demand-Side Assumptions (Buildings, Industry, Transportation)

1. Buildings

1.1 Buildings: Data sources for stocks

Residential Space Heating	Northeast Energy Efficiency Alliance (NEEA) Residential Building Stock Assessment & Home Energy Score Data*
Commercial Space	NEEA Commercial Building Stock Assessment

Page 4:

- Comments on Table 1.2:
  - Residential Space Heating:
    - I know policy recommendations come later in the process and the MOU already commits the state to something similar to this, but 95% is very aggressive. The market structures in place are very entrenched and it will require very significant money and systemic interventions that are self-sustaining to make this happen. I understand that the model will compute the costs, but this level of public investment seems like it would be quite historic.
  - Commercial Space Heating:
    - This 75% of large commercial is similarly ambitious to the statement above on residential
  - Residential Water Heating:
    - This federal standard allows for certain sizes and form factors of water heaters to be exempted from the rule so solutions for those products will also need to be widely available and adopted to get to 95%. NEEA is working on this now. In addition, there is a possible future where this rule pushes more of the market towards gas tanked and tankless water heaters if that's an option for the home.
  - Cooking:
    - moving to near 100% electric cooking will be unpopular and may have some cultural equity dimensions to certain culinary traditions based around specific equipment, especially if you're including restaurants.
  - Building Shells:
    - There are limits to weatherization that can be done before other structural improvements and deferred maintenance needs are addressed. Not sure whether the 20% that will remain unweatherized account for those. There is a significant equity concern here however if the policy recommendations

focus on the 80% that is easy to weatherize and leaves out those households with the highest needs.

Page 7:

- Comments on Table 5
  - Demand Response - Households participation:
    - Linear forecasting for 25 years makes me nervous, depends highly on the details of the DR program how may households they can enroll. I know PGE has been working for years and invested a ton and still their program is relatively small (though meaningful and an impressive accomplishment!).
    - You might look to the PNUCC for information about DR and regional peaks: https://www.pnucc.org/wp-content/uploads/2024-PNUCC-Northwest-Regional-Forecast-final.pdf

NW Energy Coalition
for a clean and affordable energy future

Comments of the NW Energy Coalition:
Draft Reference Scenario Key Data and Assumptions
for the Oregon Energy Strategy

September 4, 2024

The NW Energy Coalition (NWEC) thanks the Oregon Department of Energy for the background materials and extensive advisory committee and subgroup review of the inputs for the reference scenario modeling supporting the 2025 Oregon Energy Strategy.

In general we are supportive of the breadth and details of the key data and assumptions, and provide some additional comments and suggestions as follows:

1 Buildings

The introduction to the Key Data and Assumptions document takes an initial perspective that correctly states: "aggressive energy efficiency and electrification are key pillars of cost-effective decarbonization." We encourage ODOE and all involved in the Oegon energy strategy development to consider energy efficiency as a core part of "customer side resources" – also including all forms of flexible load, storage and customer generation. Traditionally, each element has been considered a totally separate resource, but residential, business, government and community customers manage their energy use not only as specific end uses but as combined resources. The ability to motivate customer choices that provide more direct value and also give value back to the energy network is an underappreciated aspect of future energy strategy.

In addition to the data sources from the NW Energy Efficiency Alliance, we encourage ODOE and the Northwest Power and Conservation Council to coordinate further on current data and future projections -- relating to building stock, lighting, appliance and end user behavior -- from the Council's extensive assessment process.

For residential and commercial water heating, we believe market saturation will occur faster than the baseline in the draft: 95% of electric heat pump sales by 2045 (residential) and similar results for commercial (somewhat differentiated by small and large users). On the details, we recommend coordination with the Advanced Water Heater Initiative, a national effort with USDOE support based here in Oregon which has established a goal of all new residential water heating sales of heat pump water heaters by 2030 as well as advanced goals for commercial water heating, and has developed extensive analysis and plans (www.advancedwaterheatinginitiative.org). In addition, NEEA is developing a related load flexibility effort that is closely aligned with its energy efficiency market transformation work. All this goes hand in hand with the very substantial potential for grid-managed water heating that provides hot water when customers need it. Along with other flexible demand efforts, there is potential for major – multi-hundred megawatt and perhaps more – load flexibility for grid reliability and cost containment in Oregon.

2 Industry – no comments at this time

3 Transportation – no comments at this time

4 Direct Use Fuels – no comments at this time

5 Energy Efficiency and Load Flexibility

The draft document sets a target of 50% of electric residential and commercial appliance installations by 2050 (linear growth from 2025). We suggest some basic disaggregation by end use.

For example, grid-managed heat pump water heaters have tremendous potential for market saturation well before 2050. The technologies for both that equipment and grid management are mature and improving, and all standard electric resistance water heaters sold in Oregon today are required to have a grid interaction (CTA-2045) device. The issues with deployment are primarily on setting appropriate customer incentives and scaling up programs.

Other end uses will have different saturation strategies, and within the constraints of the current modeling timeline, we encourage ODOE to consult with NEEA, the NW Council, utilities, AWHI and other initiatives, equipment suppliers and aggregators to refine basic saturation curves for the modeling.

6 Energy Generation Technologies – no comments at this time

7 Land Use and Natural Resources – no comments at this time

8 Transmission and Distribution

We encourage additional consideration of the potential for advanced conductors and other grid-enhancing technologies. For example, we understand PGE is considering a dynamic line rating project for a section of transmission in the Sherwood-Beaverton area. While deployment and timing are at best estimates at this time, setting the overall potential for advanced conductors and grid enhancing technologies at zero would certainly be a significant shortcoming for the strategy, given the serious constraints now prevailing for transmission in Oregon and the strong incentives for developing these measures to expand existing transmission carrying capacity.

We also suggest inclusion of the Cascade Renewable Transmission Project as a potential new transmission resource (www.cascaderenewable.com). While its commercial prospects are still unclear, the project has received a WECC path rating and offers the potential to transfer 1100 MW of new renewable energy from the east side to west side load centers via an HVDC cable on the Columbia River streambed, and we understand it could be in operation by 2030.

For the electricity distribution cost assumption, in addition to reviewing the EIA assumptions, we encourage ODOE to confer with the Oregon PUC and utilities that have filed distribution resource plans which provide plentiful system deployment and cost information.

For transmission flows between the east and west side, we strongly encourage the modeling not to be restricted to historical path flows and instead set constraints at the rated capacity of the respective lines and paths. As the regional load shape and resource mix change, major changes continue to emerge in flow patterns. For example, on the AC and DC Interties connecting the Northwest and California through Oregon, south>north transfers were exceedingly rare until 2019; now they constitute more than half of net annual flows.

Finally, there are several regional transmission studies that will be published during the next year that could be useful for the development of the Oregon strategy: the US DOE National Transmission Study, the Connected West study sponsored by the Western Interstate Energy Board – both expected this fall – and the initial 10-year assessment of the Western Transmission Expansion Coalition (WestTEC) anticipated in the summer of 2025. Each of these will provide access to updated data on loads, resources and transmission topology as well as modeling results, and we encourage ODOE to incorporate all of that to the extent it may be relevant and feasible given the time commitments for the Oregon Energy Strategy.

Respectfully submitted,

Fred Heutte
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Alma Pinto
Environmental Justice Policy Associate
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Joni Sliger
Oregon Department of Energy
August 23, 2024

RE: Electricity Generation Technologies Working Group Comments

Dear Joni Sliger,

Northwest Natural ("NW Natural") recognizes that our company will play a key role in implementing climate solutions and we appreciate the ability to comment on "Electricity Generation Technologies Working Group" meetings.

NW Natural was encouraged by the integrated supply side discussion surrounding increased integration of the electric system and fuels. However, the focus was heavily on green hydrogen adoption and its transformation into other products. There are significant constraints beyond the development of electrolyzers, including the lack of new renewable energy projects—along with the time it takes to develop and interconnect these projects—lack of transmission capacity, uncertainty around policies and incentives for green hydrogen, and the storage and transportation costs to end users. NW Natural recommends a more comprehensive approach to integrated supply could include dual fuel alternatives for residential, commercial, and industrial applications, integrating existing fuels or other forms of hydrogen. Additionally, policies and incentives should be developed for utilities to collaborate on these solutions, determining which would be the most cost-effective.

NW Natural noticed the main drivers mentioned for increased load were electric vehicles (EVs), reduced fuel consumption, and electrification. It is essential to consider the need for a complementary role of dispatchable energy sources such as fuel-based back-up generation. This might be contradictory to reducing fuel consumption but will be crucial for providing grid stability during peak times. Relying solely on batteries and green hydrogen for this purpose might not be feasible due to the high cost and challenges of integrating new renewable energy projects as previously mentioned.

Although reliability is modeled by considering changing demand and supply scenarios, this approach might still be limited in providing a realistic evaluation. On the demand side, the model assumes a higher load than expected in each scenario. For the supply side, instead of using fixed outage rates, a range of possible outages should be incorporated, including correlated failures, climate impacts on renewable resources (including hydro), and the increasing frequency of extreme weather events like wildfires. NW Natural encourages ODOE to update the model to reflect current baselines. Failure to update the model can lead to proposed strategies that may not reflect the real baseline and could be biased toward what we want to see rather than what is realistic.

Thank you for considering our comments. If you have any questions, please reach out to me at Brenda.MontanezBarragan@nwnatural.com.

Sincerely,

Brenda Montanez Barragan

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Michael Freels
Oregon Department of Energy
August 30, 2024
RE: Direct Use Fuels Working Group Comments

Dear Michael Freels,

Northwest Natural ("NW Natural") recognizes that our company will play a key role in implementing climate solutions and we appreciate the ability to comment on the "Direct Use Fuels Working Group" meetings.

NW Natural suggest that ODOE investigate the significant supplies of low-carbon hydrogen shipped via pipeline from Canada including BC and Alberta. Resources regarding this future can be found here at BC Hydrogen and Alberta Hydrogen. In addition to low-carbon hydrogen in Canada, there are significant supplies of synthetic methane produced from green hydrogen and waste CO2 becoming available in the region. While considering an increase in hydrogen fuel sources, ODOE will also need to consider where to store these resources. Large-scale underground storage is available for hydrogen or synthetic methane in Mist, Oregon in concert with or replacement of existing natural gas storage facilities.

NW Natural is concerned by the cost and/or reliability offramps taken by Oregon electric IOUs thereby missing HB2021 decarbonization targets.

NW Natural believes that ODOE should investigate the significantly lower adoption of electric heat pumps due to increased energy costs.

NW Natural wonders why are larger industries, such as pulp and paper, not being considered in the Direct Use Fuels and Industry section?

The comment was made that it was challenging to incorporate technologies like advanced geothermal as limited data are available. There are limited data for other future technologies, such as low and high temperature heat for industry, etc., yet there are back-casted electrification goals for these. Why are these being included? What is backing up these electrification goals? Why have them if there is nothing to support them? NW Natural suggests removing these as they are highly subjective.

NW Natural is curious if there is any consideration in the study around energy resilience? Do different scenarios carry risk around energy resilience for residential, commercial, or industrial sectors?

Finally, NW Natural recommends incorporation of applicable data and analysis produced by GTI Energy around Net Zero Infrastructure: https://nzip.gti.energy/

Thank you for considering our comments. If you have any questions, please reach out to me at Chris.Kroeker@nwnatural.com.

Sincerely,

Chris Kroeker

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Mary Kopriva and Blake Shelide
Oregon Department of Energy
August 30, 2024

RE: Buildings Working Group Comments

Dear Mary Kopriva and Blake Shelide,

Northwest Natural ("NW Natural") recognizes that our company will play a key role in implementing climate solutions and we appreciate the ability to comment on "Buildings Working Group" meetings.

NW Natural recommends looking at efficiency gains outside of heating and cooling equipment. Other efficiency strategies including heat recovery, advanced HVAC controls, and dedicated outside air will have efficiency gains regardless of HVAC / water heating fuel source. Diversifying tools used for efficiency gains will promote a variety of pathways to improving efficiency.

NW Natural is concerned by the assumption "95% of new appliances sales are electric by 2035" and lack of source data to provide insight into why this target was selected. NW Natural asks that this target be removed from the plan. Gas appliances increase a home's resilience by providing reliable energy during extreme weather situations.

NW Natural recommends polling consumers about electric heat pumps policies and incentives and using that data to set a target % for heat pump sales by 2030. NW Natural believes our customers are the best source of information and that inaccurate targets can do more harm than good.

NW Natural has concerns about the modeling around heat pumps. Many ductless heat pump installations, new and retrofit, still rely partly on electric resistance heat (cadet-style) during winter months. NW Natural urge modeling to approximate for these secondary heating sources in electric heat pumps homes. NW Natural also recommends including gas heat pump adoption in some of the modeling scenarios. By updating the model to approximate the secondary heat sources in heat pumps homes and gas heat pump adoption, the model becomes more accurate, giving policy makers a better understanding of energy issues in their area.

Thank you for considering our comments. If you have any questions, please reach out to us at Kevin.Duell@nwnatural.com or Ian.Casey@nwnatural.com

Sincerely,

Kevin Duell and Ian Casey

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Andy Cameron / Edith Bayer
Oregon Department of Energy
August 30, 2024

RE: Energy Efficiency and Load Flexibility Working Group Comments

Dear Andy Cameron and Edith Bayer,

Northwest Natural ("NW Natural") recognizes that our company will play a key role in implementing climate solutions and we appreciate the ability to comment on the "Energy Efficiency and Load Flexibility Working Group" meetings.

NW Natural supports using weatherization as a key energy efficiency driver given the benefits regardless of fuel-type, however, 95% of buildings being weatherized seems like a high percentage. Community action agencies have been doing this work for many years and should be consulted about presumed adoption for residential. Inaccurate estimates discredit meaningful steps in the right direction by minimizing weatherization updates/upgrades made by homeowners.

NW Natural wonders what are the assumptions being used for gas energy efficiency? Commercial gas heat pumps are currently available and residential gas heat pumps are being demonstrated in Canada. Gas heat pumps would push natural gas heating efficiencies above 100% which would greatly improve gas efficiencies in the later portion of the planning horizon.

NW Natural believes that in addition to air-source heat pumps, we should consider ground-source heat pumps too. Networked geothermal systems have a strong potential to replace central systems for campuses or neighborhoods.

NW Natural is setting up a residential "bring your own thermostat" demand response program. There are not a lot of gas programs to point to for reference, but we anticipate being able to share our findings for future iterations of the Oregon Energy Strategy.

NW Natural, Pacific Power, and Portland General Electric are conducting Energy Burden Assessments with the same third-party contractor. We recommend reviewing the findings from the reports for electrification considerations.

Thank you for considering our comments. If you have any questions, please reach out to me at Delaney.Ralph@nwnatural.com.

Sincerely,

Laney Ralph

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Michael Freels
Oregon Department of Energy
September 4, 2024
RE: Comments on ODOE's Energy Strategy Draft Reference Scenario

Dear Michael Freels,

Northwest Natural ("NW Natural") recognizes that our company will play a key role in implementing climate solutions and we appreciate the ability to comment on ODOE's Energy Strategy Draft Reference Scenario.

Buildings

NW Natural is troubled by the statement "95% of new appliances sales are electric by 2035" and lack of source data to provide insight into why this target was selected. NW Natural asks that this target be removed from the plan. Gas appliances increase a home's resilience by providing reliable energy during extreme weather.

NW Natural has concerns about the modeling around heat pumps. Many ductless heat pump installations, new and retrofit, still partly rely on electric resistance heat during winter months. NW Natural urge modeling to approximate for these secondary heating sources in electric heat pumps homes. NW Natural also recommends including gas heat pump adoption in some of the modeling scenarios. By updating the model to approximate the secondary heat sources in heat pumps homes and gas heat pump adoption, the model becomes more accurate, giving policy makers a better understanding of energy issues in their area.

NW Natural worries that the model will just look at which changes have the most emission impacts, which neglects uncertainty in cost impacts. By choosing to only model health impacts and no other non-energy cost/benefit, ODOE is unable to provide an accurate analysis. NW Natural recommends adding other non-energy costs and benefits to the model to improve accuracy. In addition to adding non-energy costs and benefits to the model, NW Natural advocates that data collected be unbiased and any such additional data collected not skew the regional model results in one way or another.

Dual Use Fuels and Industry

NW Natural is concerned that the electrification assumptions across industrial sectors are broad generalizations based on national assumptions without any direct feedback from impacted industries in Oregon. Feedback should be gathered from businesses to make informed electrification assumptions for impacted industrial sectors.

NW Natural recommends using a Computable General Equilibrium (CGE) model, which captures price changes and substitution effects between production, consumption, and trade. CGE models are standard for policy analyses such as the Oregon Energy Strategy to quantify effects of policies and regulations that occur outside directly regulated industries. NW Natural believes a CGE model is the preferred model for this type of policy analysis and recommends running analysis using this type of model.

Electricity Generation and Transmission

Although reliability is modeled by considering changing demand and supply scenarios, this approach might still be limited in providing a realistic evaluation. On the demand side, the model assumes a higher load than expected in each scenario. For the supply side, instead of using fixed outage rates, a range of possible outages should be incorporated, including correlated failures, climate impacts on renewable resources (including hydro), and the increasing frequency of extreme weather events like wildfires. NW Natural encourages ODOE to update the model to reflect current baselines. Failure to update the model can lead to proposed strategies that may not reflect the real baseline and could be biased toward what we want to see rather than what is realistic.

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NW Natural recommends that the Pipeline Infrastructure Assumptions allow for infrastructure development beyond operations and maintenance as the gas system adapts to using clean fuels.

Energy Efficiency and Load Flexibility

NW Natural supports using weatherization as a key energy efficiency driver given the benefits regardless of fuel-type, however, 95% of buildings being weatherized seems like a high percentage. Community action agencies have been doing this work for many years and should be consulted about presumed adoption for residential. Inaccurate estimates discredit meaningful steps forward by minimizing weatherization updates/upgrades made by homeowners.

NW Natural wonders why Carbon Capture Storage, CCS, is not permitted in Oregon under the reference scenario? CCS is supported by the Infrastructure Investment and Jobs Act and the IRA. CCS is an important component of a clean fuels pathway and by leaving it out of the reference scenario it makes it more difficult and expensive to increase the use of clean fuels. NW Natural recommends adding CCS to the reference scenario.

Thank you for considering our comments. If you have any questions, please reach out to me at Mary.Moerlins@NWNatural.com.

Sincerely,

Mary Moerlins
Director of Environmental Policy & Corporate Responsibility
NW Natural

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Michael Freels
Oregon Department of Energy
August 30, 2024
RE: Direct Use Fuels Working Group Comments

Dear Michael Freels,

Northwest Natural ("NW Natural") recognizes that our company will play a key role in implementing climate solutions and we appreciate the ability to comment on "Direct Use Fuels Working Group" meetings.

While NW Natural appreciates that Evolved Energy Research used two models, a demand side and supply side model, for their analysis, we do not agree with this approach. NW Natural recommends using a Computable General Equilibrium (CGE) model, which captures price changes and substitution effects between production, consumption, and trade. NW Natural believes the CGE model is the preferred model for policy analysis and recommends running analysis using this model.

NW Natural is concerned with the electrification assumption made across industrial sectors. NW Natural believes that the best source of information for changes in our state are Oregon residents and businesses and is concerned that electrification assumptions are broad generalizations based on national assumptions. NW Natural implores ODOE to reconsider electrification assumptions.

NW Natural is extremely concerned that the outcomes of the Oregon Energy Strategy are not greenhouse gas emission reductions, but electrification goals. NW Natural is disappointed that ODOE implied that GHG emission reductions can only be achieved through electrification throughout the presentation, discussion, and draft documentation. NW Natural hopes a stronger emphasis on GHG emissions reductions will occur in future discussions.

Thank you for considering our comments. If you have any questions, please reach out to me at Michael.Meyers@NWNatural.com.

Sincerely,

Michael Meyers

RE: Comments on Oregon Energy Strategy Draft Reference Scenario Key Data and Assumptions

Oregon Coast Energy Alliance Network (OCEAN) is a non-profit, Coos Bay Oregon based 501c3 community organization exploring the opportunities and challenges of advanced clean energy technologies for coastal Oregonians. OCEAN's member communities reside at the southwestern edge of the transmission system and are completely reliant upon imported energy to meet our most basic human needs. The transmission and fuel delivery corridors serving our communities navigate catastrophe prone routes which often results in poor power quality and a higher frequency of service interruptions to our isolated coastal communities. We are no strangers taking care of ourselves and each other in times of flood, slide, storm, tsunami, mega wildfire and earthquake when we are isolated from the outside world and the energy and fuel we rely on.

Oregon's coastal communities are among those being hit first and hardest by climate change. Thankfully we are benefited by an abundance of natural renewable resources that can sustain local renewable energy and clean fuel supply, each an essential element of our successful adaptation. They can improve our lives today and we can use them to recover tomorrow. It is imperative that ODOE's work to identify optimal pathways for achieving our state energy policy objectives embraces the reality of increasingly frequent extreme weather events and the opportunities for substantially strengthening our grid resilience with resources locate in and near our communities.

Based on the content and discussion at the meetings of the Strategy Advisors, Generation Workgroup and All Workgroups and after review of the Draft Reference Scenario (Reference) we are concerned about the ability of the proposed policy framework, modeling approach or reference scenario to capture the values to Oregon's grid, communities and ecosystems of local renewable energy, clean fuels and smart grids. As the only readily actionable path that is neither contingent upon nor disruptive of transmission planning and development timelines, extracting maximum value out of our existing infrastructure with community sized, locally accessible resources is a commercially viable pathway demanding adequate, transparent evaluation.

The modeling approach must enable rate payers and lawmakers to compare the full costs, timelines and grid values of local renewables with those of imported energy delivered to Oregon communities. This comparison is not provided in Integrated Resource or Clean Energy Plans and is essential to ODOE's identification of optimized pathways to achieving the state's energy policy objectives.

The "anchor policy" framework of the modeling proposed by ODOE does not include essential components of HB2021 including Sec 2.(2) directing benefits to communities in the forms of creating and sustaining meaningful living wage jobs, promoting workforce equity and increasing energy security and resiliency as well as the rapidly approaching 80% decarbonization by 2030 milestone.

The grid, economic and resilience values of rooftop, community, commercial, small qualifying facilities and utility scale renewables, storage and advanced grid technologies should be able to be reflected by the modeling framework and evaluated in Reference and Alternate scenarios and we do not believe that the proposed approach can do so.

Policy Constructs

Driven by the urgency of our need for local grid resilience and climate adaptation and aware or the opportunities for energy security and economic diversification through renewable energy and clean fuels investment, OCEAN and many others exerted considerable volunteer efforts at infusing HB2021 with requirements for local generation, storage and other community benefits.

HB 3630 directs the Department to develop a comprehensive state energy strategy that identifies optimized pathways to achieving the state's energy policy objectives. The Draft Reference Scenario Key Data and Assumptions proposes to adhere only to "anchor policies" that do not, evidently, include HB 2021 Sec 2.(2) directing benefits to communities in the forms of creating and sustaining meaningful living wage jobs, promoting workforce equity and increasing energy security and resiliency. We strenuously object to this exclusion.

Likewise, the rapidly approaching 80% carbon reduction by 2030 should be included as an anchor policy and strategies imbedded in all scenarios intended to meet this goal. We recognize and appreciate the value and essential nature of planning for and investing in a robust, decarbonized, geographically & technologically diverse, modernly interconnected Western Energy grid as envisioned by the 2050 milestone presented. However, the reference must also reflect near term actions such as distributed resources opportunistically sited closer to load centers and advanced grid management technologies unlocking additional efficiencies, safety measures and hosting capacity within our existing distribution and transmission systems ahead of the 2030 milestone. These measures are neither dependent upon nor disruptive of long horizon planning, increase grid security and planning transparency and will provide valuable insights into our rapidly evolving energy interactions that will strengthen subsequent planning activities.

Modeling Approach

The locational values of clean energy resources for Oregon communities are significant. They include reductions in energy losses from transmission, wildfire risks, planned or unplanned service interruptions as well as the potential for ratepayer savings through non-wire solutions, deferred network upgrades, grid optimization and grid resilience. These critical values must be captured in the modeling approach to inform ODOE's identification optimized pathways.

The modeling approach presented by CETI does not support a comparison of energy made in Oregon, sized and located to meet our load demands and grid constraints vs large new distant generation requiring new transmission. Instead, the approach presented is to aggregate reliability and loads across the entire state and only capture high level transmission conditions across two regions. This does not provide the level of locational resolution necessary to recognize or effectively weigh the significant implications of resource, storage and load locations on grid reliability, community energy security or economic harm or benefit. As such, this approach does not comply with the statutory direction to "identify optimized pathways to achieving the state's energy policy objectives."

The modeling must support an evaluation of the impacts of wildfires, earthquakes, heavy snow and other weather events that impact Oregonian communities access to energy and fuels in both Reference and Alternate scenarios.

Reference Scenario

Clean energy generation and storage assets can be strategically located within Oregon to reduce line loss distances between generation and load, complement legacy and evolving power flows, insert firm generating resources into energy island pockets, increase community energy security, improve power and air quality, reduce wildfire risks and make meaningful contributions of geographic and resource diversity to a robust WECC. The reference scenario should reflect near term in-Oregon, technically feasible infrastructure potential as well as the existing policies, planning and funding streams available to support from rooftop to large scale solar and other non-emitting generation and energy storage within Oregon including:

- PURPA
- Solar For All
- Building Resilience Infrastructure and Communities
- County Energy Resilience Plans
- Tribal Climate Adaptation and Mitigation Plans
- Western Resource Adequacy Program
- Tribal energy funding
- Community Renewable Energy Program

The Reference scenario should include a growing number of moderately sized solar projects located throughout Oregon. Projects of 3 to 60 MW, small qualifying facilities, are easier to site and interconnect than larger utility scale projects, are right sized for many large new clean tech loads, can be more desirable to host communities and, when paired with storage, can make lifesaving contributions to grid and community resilience. In addition to federal grant funding and tax incentives available for these projects, the historically undervalued avoided costs assigned to PURPA and Community Solar is poised for re-evaluation in Oregon PUC's Capacity docket UM2000.

Oregon's coastal communities are served by two community owned utilities served by BPA and may currently be restricted by BPAs preference customer program. However, renewable development within COU preference customer networks remains an open right under PURPA and open access transmission and provides a timely and valuable pathway toward meaningful contributions to achieving state energy, reliability and climate objectives. The reference scenario should not dismiss renewables developed in COU service territory.

The reference scenario should not rely on predicting the success of our neighboring states in accomplishing their energy, climate and technology deployment goals in a manner that can and will accommodate the needs of Oregonians.

The proposed reference scenario should not incorporate the most recently filed Integrated Resource Plans or Clean Energy Plans from PGE or PacifiCorp as neither has been acknowledged by Oregon Public Utility Commission and neither achieves 80% carbon reductions by 2030, which the reference scenario does not appear to acknowledge.

HB 3375 established our state OSW planning threshold of 3 GW, a number designed to balance and maximize the interconnection capacity of Oregon's coastal and inland grid while providing ample variable surplus clean electricity for the generation of green electrolytic hydrogen at and near the International Port of Coos Bay. The values of direct interconnection into Oregon's grid and opportunity for Oregon's coastal communities to access secure, clean fuels to support maritime and land based transportation should not be dismissed nor should reasonable development timelines be deferred by the assumed displacement by California OSW imports in the reference scenario.

The reference scenario should include a full spectrum of renewable, clean energy deployments available within Oregon including:

Rooftop Solar: 5 – 10 kW

Commercial Solar: 10 kW – 1 MW

Community Solar: 1 – 3 MW

PURPA Solar, Hydro and Wind: 3 – 50 MW

Utility Scale Solar and Wind: 50 – 500 MW

Oregon Offshore Wind: 3 GW

Section 3 Alternate Scenario: Extract Maximum Value of Oregon Infrastructure (EMVOI)

This pathway should be restricted only by physical, technical and Oregon Energy policy constraints.

As stated by the US Department of Energy in the recently released Innovative Grid Deployment Liftoff Report " Multiple advanced grid solutions are commercially available today to help grid operators and regulators address near-term capacity and reliability priorities and modernize the grid – without increasing costs for ratepayers. **Most solutions could be deployed on the existing grid in under 3-5 years and at lower cost and greater value than conventional approaches**." This pathway should assume the rapid and regularly phased deployment of dynamic line ratings, Advanced Distribution Management Systems, substation automation and digitization, topology optimization, advanced power flow control, energy storage, virtual power plants and communications. All of these rapidly deployable technologies unlock near term Oregon energy development while vastly enhancing our understanding and transparent access to the full potential of existing and future investments in Oregon's energy infrastructure.

This scenario should not presume that the historically undervalued avoided costs assigned to PURPA, Community Solar or micro-grid projects prevail in future procurement rounds but that the intent of HB2021 Sec 2(2) is reflected in resource valuation and Clean Energy Planning. Projects built in Oregon support improved power quality, grid resilience and economic development.

Small-scale renewables have proven resilient, more easily comply with land-use constraints and offer community benefits in the form of property tax revenues, health benefits, and other benefits that communities define.

The Local Solar Roadmap Whitepaper (..Dec, 2020) modeled the implications of optimized deployment of local solar and storage nationwide and found that the cleanest, lowest cost grid builds upon 223 GW of new local solar by 2050 at a cost savings of $473B while creating over two million more jobs and unlocking synergistic value add from utility scale solar and wind projects.

This scenario should not be inhibited by the potential for contractual inhibitions on development of renewables within Oregon's COU service territories. As Bonneville Power Administration (BPA) and the Consumer-Owned Utilities (COUs) they serve deliberate the terms of future power supply contracts amidst a backdrop of dynamic market transformation through both the Western Resource Adequacy Program (WRAP) and regional day ahead markets, procurement constraints on Oregon's off takers should not define this Scenario. Rather, this scenario should assume full usage of Oregon's existing and emerging transmission and distribution capacity through the strategic placement of renewable generation and energy storage. This will give our state and federal legislators and Governor Kotek a full understanding of the possible and allow them to make informed policy decisions.

Oregon's offshore wind boasts one of the highest capacity value renewables on earth and is located adjacent to the state's most energy islanded and underserved communities. In addition to providing unparalleled grid and economic diversification, the potential for Oregon's OSW infusions from the west to deliver seasonal power flow relief to the state's congested central and eastern transmission system resulting in greater flexibility to accommodate flexible loads, distributed resources and storage and should be included as a tool for significantly strengthening the diversity and balance of Oregon's energy ecosystem.

Oregon's natural resources and waste streams can make meaningful contributions toward meeting our own needs for clean fuels and industrial decarbonization. Commercially deployed electrolysis, gasification and digestion technologies responsibly integrated into the state's communities and working landscapes should be modeled and evaluated as an essential tool to reduce reliance on imports, strengthen and diversify the state economy and simultaneously mitigate and adapt to climate change. This scenario should investigate the implications of reduced reliance on imported fuels with specific consideration given to environmentally responsible biomass gasification of forestry residuals, wildfire ladder fuels and fire breaks, forestry product wastes and biproducts and captured digestion of agricultural and municipal waste streams.   ODOE should consult with Oregon Departments of Forestry and Agriculture regarding resource availability and status of energy related studies.

September 4, 2024

Edith Bayer
Oregon Department of Energy
550 Capitol St., NE
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Edith.m.bayer@energy.oregon.gov

Dear Edith,

Thank you for the opportunity to comment on the development of the Oregon State Energy Strategy. We recognize that is a comprehensive initiative led by the Oregon Department of Energy (ODOE) to outline the state's energy policy objectives and pathways to achieve them. Knowing that the final report is expected in November 2025, it is an aggressive timeline to establish the modeling protocols to inform the policies that align with Oregon's goals for emissions reductions, energy efficiency, and the transition to clean energy.

We appreciate the efforts dedicated for cross-agency collaboration and consultation with stakeholders to inform the approach. However, DEQ is concerned with including any potential programs or assumptions in the reference scenario for the model. Specifically, in establishing the reference scenario for medium and heavy-duty vehicles, including only policies currently in place ensures that the projections are grounded in the current regulatory environment. This approach avoids the uncertainties and assumptions associated with potential policies like Advanced Clean Fleets, which may not be implemented as anticipated or could undergo significant changes during the rulemaking process. Rather, we recommend utilizing fleet turnover rates beyond 2036 to estimate MHD ZEV vehicles to 2050. Modeling information from the Clean Fuels Program or the Climate Protection Program could help inform this work. We see that other sectors in the reference scenario also include yet to be established policies that would have similar impact. By limiting the reference scenario to existing policies, the model provides a stable and reliable reference point, allowing any impacts of new or proposed policies to be clearly observed and analyzed in alternative scenarios. This clarity is crucial for developing effective and realistic policy recommendations.

Additionally, if these assumptions are baked into the model, it potentially sets the precedent the state will be adopting or moving forward on these policies. As the regulatory agency responsible for proposing and implementing these policies, if adopted, it gives the appearance of bypassing the typical procedures of stakeholder involvement and consideration we engage in by assuming we are moving forward with these provisions.

Our hope was also the strategy could serve as a reference for other agencies to support development of other policies. We're concerned that the model and choices in the reference scenario will not be supported for future policy for other state agencies. In designing the scenarios we feel it would have been better to bring agencies in when the decision making process for the model design was occurring so that we were not surprised and raising these concerns late in the process.

Thanks for your consideration of our comments in this process. We look forward to continued collaboration between our agencies.

Sincerely,

Rachel Sakata

Rachel Sakata
Transportation Strategies Section Manager
Oregon DEQ

cc: Colin McConnaha, DEQ
Jessica Reichers, ODOE
Alan Zelenka, ODOE

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Oregon Energy Strategy
Draft Reference Scenario
Key Data and Assumptions

Introduction

This document provides the draft inputs for the Reference Scenario of the Oregon Energy Strategy model. The modeling phase of the Oregon Energy Strategy involves development of a Reference Scenario and five alternative scenarios. The modeled scenarios produce different pathways to meeting Oregon's energy and climate objectives. They provide information on the effects of different energy choices and will serve as foundational information for policy discussions in Phase 2 of the Oregon Energy Strategy process. These discussions are where policy recommendations will be developed. The final Oregon Energy Strategy will be submitted to the Governor and Legislature by November 1, 2025.

The model must solve to meet Oregon's anchor climate and clean energy goals: Executive Order 20-04 (80 percent economy-wide reduction in greenhouse gas emissions by 2050); HB 2021 (100 percent clean electricity for the state's largest investor-owned electric utilities and Electricity Service Suppliers), and the Climate Protection Program (90 percent reduction in greenhouse gas emissions from fuels by 2050). This is a requirement of HB 3630, which directs ODOE to develop the energy strategy and identify pathways to achieving the state's energy policy objectives.

These goals are ambitious, and there are many uncertainties surrounding what combination of technologies and measures will allow Oregon to meet its clean energy and climate goals over time and out to 2050. What is relatively clear based on a range of studies ODOE has evaluated is that: (1) aggressive energy efficiency and electrification are key pillars of cost-effective decarbonization; (2) we have a suite of diverse technologies to choose from to decarbonize the electricity sector; and (3) clean fuels will play a key role.[i]

The modeling exercise requires well-informed, data-driven judgment calls on many of the assumptions relating to energy efficiency and electrification. This is because the transition to economy-wide decarbonization by mid-century requires a pace and scale that is much greater than past trends. And we are still working to understand the combination of consumer behaviors, market forces, and policy supports necessary to accomplish our goals. In order to ensure the Reference Scenario is built on the best available data and aggressive but achievable assumptions, ODOE has collaborated with industry and community experts to inform the modeling inputs. Using that feedback, ODOE and its technical contractor CETI developed a draft Reference Scenario inputs list. The table below represents key data and assumptions that inform how the model will create the Reference Scenario.

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[i] 2022 Biennial Energy Report. *Charting a Course for Oregon's Energy Future*.

How the Model Works

At the highest level, the model uses data on the existing state of energy production and consumption and combines this with forecasts on population growth, load growth, technology evolution, and weather patterns to assess future statewide energy demand. The model then determines the supply of energy resources across the entire energy sector to meet that future demand, considering reliability and cost.[ii]

For the Oregon Energy Strategy, the Reference Scenario is informed by Oregon's energy consumption across its state-wide economy (residential, commercial, industrial, agricultural, fuel, and transportation sectors). To determine energy demand, it looks at energy-consuming technologies across 80 different sub-sectors (space heating, cooking, cars and trucks, and many others), and makes assumptions about how these technologies change over time, including improvements in energy efficiency, when these technologies are expected to turn over, and what they will be replaced with when they reach the end of their useful life.

The Reference Scenario also considers factors like weather, population growth, and industrial load growth (including from industrial data centers and chip manufacturing) to account for how energy demand is changing over time. Through this process, the model comes up with a picture of Oregon's energy needs every 5 years, from now to 2050.

Once we have a picture of how much energy we will need over time, the model searches for the most affordable mix of resources to meet demand across all energy consuming sectors while meeting our key climate and energy goals and maintaining reliability.[iii] It draws on everything from utility-scale resources to smaller-scale and distributed energy resources to do this. The model also considers the availability of energy supply infrastructure (i.e., gas pipes and electricity wires) to deliver that energy to customers.

How Model Results are Used

Model scenarios do not predict the future, rather they provide insights into pathways that meet our clean energy goals by considering differences in costs, energy efficiency, feasibility, and availability. The Reference Scenario will be compared against alternative scenarios that produce different energy pathways that are used to explore "What if?" questions. For example: What if transmission development is further delayed? What if we do not achieve as much electrification as in the Reference Scenario and instead rely more on clean fuels? What does this mean for overall system costs? What does it mean for the mix of resources we'd need to meet our clean energy goals? And most importantly: what do we learn from this exercise on the technologies and measures that are most likely to deliver a lowest-cost, highest-benefits energy transition for our state? The information we gather will provide a basis for analysis and discussion around

[ii] 294abc_c5f79e16ca7a470b8168e1bbe7d98c7f.pdf (evolved.energy)

[iii] The model can incorporate some non-energy constraints, such as land use protections. However, much of the analysis on non-energy costs and benefits will happen when we are evaluating the results of the modeling. ODOE will be working with our consultant to evaluate the effects of different scenarios on equity, environmental justice, air quality and public health, and employment.

what policies are needed to achieve our energy objectives while maintaining a resilient and affordable energy system — and create a more equitable energy future for Oregon.

The following are key data and assumptions for the Reference Scenario of the Oregon Energy Strategy. ODOE is accepting comments on these inputs until **5 p.m. on September 4, 2024.**

Note: **Bolded text** indicates points of discussion in working group meetings.

Key Assumptions for the Reference Scenario

Key Demand-Side Assumptions (Buildings, Industry, Transportation)

1. Buildings

1.1 Buildings: Data sources for stocks

Residential Space Heating	Northeast Energy Efficiency Alliance (NEEA) Residential Building Stock Assessment & Home Energy Score Data*
Commercial Space Heating	NEEA Commercial Building Stock Assessment
Residential Water Heating	NEEA Residential Building Stock Assessment & Home Energy Score Data*
Commercial Water Heating	NEEA Commercial Building Stock Assessment
Residential Building Shells	NEEA Residential Building Stock Assessment & Home Energy Score Data*
Commercial Building Shells	NEEA Commercial Building Stock Assessment
Residential Technology Stock Replacement	Energy Information Administration (EIA) Residential Energy Consumption Survey, potentially supplemented by local/regional data (still in discovery)
Commercial Technology Stock Replacement	EIA Annual Energy Outlook, potentially supplemented by local/regional data (still in discovery)
Residential Cooking & Other Appliances	NEEA Residential Building Stock Assessment
Commercial Cooking & Other Appliances	NEEA Commercial Building Stock Assessment
Residential Lighting	NEEA Residential Building Stock Assessment
Commercial Lighting	NEEA Commercial Building Stock Assessment

**Oregon's Home Energy Score data comes from Earth Advantage*

1.2 Buildings: Key Assumptions

Residential Space Heating	Assume existing policies play out for all space heating technologies **Electric heat pump sales 95% of overall sales by 2040**
Commercial Space Heating	**Weighted average of large and small commercial space heating loads, with the following framing:** - **Small commercial: follow residential** - **Large commercial: electric heat pumps 75% of overall sales by 2045**
Residential Water Heating	**Incorporate Federal Energy Conservation Standards for Consumer Water Heaters (from May 6, 2029)** **Electric heat pump sales rising to 95% of overall sales by 2045**
Commercial Water Heating	**Weighted average of large and small commercial water heating loads, with the following framing:** - **Small commercial: follow residential** - **Large commercial: 25% of all new sales are electric heat pumps by 2035 and 90% by 2045**
Cooking	**95% sales of new appliances are electric by 2035**
Technology stock replacement	**Dual gas/electric heat pump systems, differentiated by climate zone, compete with other electric technologies in line with sales shares above**
Building shells	**Weatherize 80% of existing commercial and residential home envelopes by 2040 and 95% by 2050.** **Weatherization measures assumed to achieve a 10% reduction in overall building energy use on average.**
Lighting	100% LED sales by 2025 (HB2531)
Hybrid Boilers	Model can invest in dual fuel electric and gas boilers as well as hydrogen boilers

2. Industry – Key Assumptions

Industrial Processes	1% process efficiency improvements per year in all sectors Fuel switching measures from fuels to electricity
Electrification	**100% of machine drives by 2035** **100% of heat by 2050, including in Oregon's largest industrials such as computer and electronics products** **50% of integrated steam production, and 80% of integrated steam production in food manufacturing, by 2045** **100% of refrigeration by 2040** **90% of industrial HVAC loads across industrial subsectors** **80% of industrial vehicles including in agriculture by 2050**

Switch to Hydrogen	**50% of heat in bulk chemicals (not a large industry in OR)** **20% of construction energy demand** **20% of industrial vehicles by 2050**
Cement	Cement process is optimized in the model, including retrofits and new build rotary kilns to include direct separation, oxy-combustion, biomass fuel, and CCS (not a large sector in Oregon)
Thermal Energy Storage	Economic adoption modeled in industrial sector

3. Transportation

3.1 Transportation: Data sources for stocks

Light duty vehicle (LDV)current stocks	OR Dept. of Transportation – Driver & Motor Vehicle division (DMV) Data
Medium- and heavy-duty vehicle (MHDV) current stocks	OR Dept. of Transportation – Combination of Commerce and Compliance Division (CCD) and DMV data (depending on vehicle weight) *Note: propose to use Environmental Protection Agency's (EPA's) Motor Vehicle Emission Simulator (MOVES) model if cannot obtain CCD data
Transit Buses current stocks	National Transit Database / EPA MOVES
School Buses current stocks	OR Dept. of Transportation – DMV Data
Fuels current	OR Dept. of Environmental Quality Clean Fuels Program Data
Vehicle Miles Traveled (VMT) current	Dept. of Environmental Quality / EPA MOVES (data comes from Highway Performance Monitoring System)
Fuel Economy current	EPA MOVES, Historical average fuel economy by vintage and vehicle type
LDV sales shares MHDV sales shares	Advanced Clean Cars I / Advanced Clean Cars II Internation Council on Clean Transportation (ICCT) forecasts based on IRA incentives Advanced Clean Trucks through 2035 ICCT forecasts based on IRA incentives

3.2 Transportation: Key Assumptions

MDV and HDV sales shares – post 2035	**Post 2035: 100% zero emission vehicle (ZEV) sales by 2040 for Class 2b-8 vehicles (excluding buses)** **For long haul: 75% battery electric vehicles (BEVs)/25% hydrogen fuel cell vehicles (FCEVs)** **All other classes 100% electric**

Transit Buses future	**100% ZEV sales by 2036 (75% BEV / 25% FCEV by 2040)**
School Buses future	**100%BEV sales by 2036 (100% electric)**
Rail future	**20% electric, 70% hydrogen by 2050 (logistic growth starting in 2030)**
Maritime Shipping future	**Domestic: 10% electric, 20% H2, 50% ammonia by 2050** **International: 20% H2, 60% ammonia by 2050**
Vehicle Fuels future	Clean Fuels Program + Portland's Renewable Fuel Standard
Vehicle Lifetimes	15 years
Fuel economy: Light duty cars and trucks	EPA SAFE 2022-2026, constant after 2026
Fuel economy: Medium duty & heavy-duty vehicles	EPA Phase 3 standards through MY 2032; Annual Energy Outlook (AEO) projection after 2032
Fuel economy: Buses	Buses: AEO projection of fuel economy
Fuel economy: Aviation	15-20% efficiency gain through 2050, to reflect International Air Transport Association (IATA) Net Zero Roadmap
VMT Assumption	**20% reduction in VMT per capita by 2050**
Vehicle costs	Light, Medium, and Heavy-Duty Vehicles: International Council on Clean Transportation Report: Analyzing the Impact of the IRA on EV Uptake in the U.S. Transit / School Buses: International Council on Clean Transportation Rail / Aviation / Maritime: Costs assumed to be same as fossil alternatives due to lack of data
Fuel costs	Annual Energy Outlook 2023 Oil and Gas Forecasts
Infrastructure costs	EV Charging: NREL Electrification Futures Study Hydrogen: U.S. Dept. of Energy Technical Targets for H2 Delivery Looking into using NREL's EVI Pro
EV Charging Estimates	NREL Electrification Futures Study Looking into using NREL's EVI Pro

Key Supply-Side Assumptions (Electricity, Fuels, Pipes & Wires)

4. Direct Use Fuels

Demand Side Assumptions	Modeled residential, commercial, and industrial demand end use using assumptions about sales shares in EnergyPATHWAYS
Supply Side Assumptions	Existing natural gas utility Integrated Resource Plans (IRPs) for near-term investments and operations Survey of peer reviewed and government agency sources of capital

	and operating costs and performance (ADP Technical Documentation 2023, p. 61)
Fuel supply and price forecasting	Energy Information Administration (EIA) Annual Energy Outlook NW Power and Conservation Council’s Fuels Advisory Committee natural gas price forecast **Department of Energy Billion Ton Study**
Alternative Clean Fuel Investment	DEQ's Climate Protection Program
Alternative Clean Fuels	Biomass-derived fuels, hydrogen, and hydrogen-derived fuels qualify as clean (if green hydrogen used). Imported fuels are counted as zero emissions (credit for negative emissions from processes like BECCS are retained by producing state). Clean Fuel Standard incorporated

5. Energy Efficiency and Load Flexibility

Behind the Meter Photovoltaic (BTM PV)	Northwest Power and Conservation Council March 2024 rooftop solar projections
BTM Storage Adoption	**Energy Information Administration's (EIA) June 2024 Survey: 10 MW assumed today** **(Note: ODOE is also calculating data from the Oregon Solar and Storage Rebate Program (OSSRP) to compare to EIA data. Please share if there is another data source ODOE should consider.)** ***What should be assumed for the total amount of BTM storage by 2050?***
Flexible Load Parameters	**Space heating loads can be delayed or advanced by 1 hour** **Water heating loads can be delayed or advanced by up to 2 hours** **Air conditioning can be delayed or advanced by 1 hour** **Residential vehicle charging can be delayed by up to 8 hours and commercial vehicle charging up to 3 hours**
V2G	**No V2G assumed**
Data Center Load Growth	Northwest Power and Conservation Council Pacific Northwest Power Supply Adequacy Assessment for 2029 base case, with load differentiated across modeling zones
Demand Response – Households participation	**50% of electric appliance installations by 2050 (linear growth from 2025)** ***Note: ODOE is still calculating the starting point in 2025 and welcomes any data related to existing household participation in demand response programs***

	Residential EVs: Start at 0, ramp up to 2/3 of residential EVs participate in managed charging by 2030
Demand Response - Commercial	**50% of electric appliance installations by 2050 (linear growth from 2025)** ***Note: ODOE is still calculating the starting point in 2025 and welcomes any data related to existing household participation in demand response programs*** **Commercial EVs: Start at 0, ramp up to 1/3 of commercial EVs participate in managed charging by 2030**
Demand Response - Industrial	**Includes dual fuel boilers, thermal energy storage, process flexibility, heating, cooling** ***ODOE is still reviewing what figure to include, and would welcome feedback on current levels of industrial participation in demand response programs as well as future projections***
Emissions constraint target accounting	Emissions reduction on anthropogenic emissions, natural climate solutions, and sequestration not eligible
Carbon Capture and Storage (CCS)	No CCS in Oregon permitted
Non-CO2, non-energy	EPA developed supply curves of measures to reduce non-CO2 and non-energy emissions, e.g. reducing methane (CH4) leakage, reducing f-gasses in industrial processes and products, reducing nitrous oxide (N2O) from soil management. Optimized by the model against energy emissions reduction measures.

6. Electricity Generation Technologies

Energy Demand	Results from EnergyPATHWAYS model informs Regional Investment and Operations Model (RIO) (both Evolved Energy Research models) Data center and chip fabrication load growth trajectory (see above) Rooftop solar scheduled additions (see above)
Electric Supply	Existing supply minus announced coal/gas retirements Siting restrictions apply to new generation, interconnection, transmission Out-of-state generation requires transmission
Generation Options	Hydropower Solar (photovoltaic and thermal) Wind (onshore, offshore)

	Biomass (woody, manure, biogas) Biogas, hydrogen, renewable natural gas Geothermal Coal, gas, nuclear (siting restrictions – no new natural gas or nuclear sited in Oregon)
Transmission Availability	The Nature Conservancy Power of Place West (inter-zonal) Bonneville Power Administration (BPA) (for Oregon East-West zones) No new inter-zonal transmission is built until 2035
Inflation Reduction Act Incentives	Supply-side incentives include for hydrogen production, renewable electricity generation, battery storage, carbon capture, clean fuels, out-of-state nuclear

7. Land Use and Natural Resources

7.1 Land Use Screens

The Reference Scenario will restrict the use of legally protected (Level 1) and administratively protected areas (Level 2) in Oregon for energy development using The Nature Conservancy's Power of Place West study as a framework to select land use screens.

Categories of Exclusion	Definition of Category	Examples	Biomass
Level 1	Legally protected: Areas with existing legal restrictions	National Wildlife Refuges, National Parks, Marine Sanctuaries, Military Training Areas	All feedstocks included, exclude potential supply from conservation reserve program land
Level 2	Administratively protected: Level 1 + areas with existing administrative and legal designations where state or federal law requires consultation or review and lands owned by non-governmental organizations (NGOs) on which there are conservation restrictions.	Critical Habitat for Threatened or Endangered Species, Sage Grouse Priority Habitat Management Areas, vernal pools and wetlands, tribal lands	No net expansion of land for purpose-grown herbaceous biomass crops. Specifically, land available for herbaceous biomass crops (miscanthus and switchgrass) is limited to the share of land currently cultivated for corn that is eventually consumed as corn ethanol, which is phased out in all net zero scenarios by 2050.
Level 3	High conservation value: Level 1 + Level 2 + areas with high conservation	Prime Farmland, Important Bird Areas, big game	Same as Level 2

	value as determined through multi-state or ecoregional analysis (e.g., state, federal, academic, NGO) and lands with social, economic, or cultural value.	priority habitat and corridors, TNC Ecologically Core Areas, "Resilient and Connected Network"	

7.2 Land Use Key Assumptions

Emissions constraint target accounting	Emissions reduction on anthropogenic emissions, natural climate solutions, and sequestration not eligible
Carbon Capture and Storage (CCS)	No CCS in Oregon permitted
Non-CO2, non-energy	EPA developed supply curves of measures to reduce non-CO2 and non-energy emissions, e.g. reducing methane (CH4) leakage, reducing f-gasses in industrial processes and products, reducing nitrous oxide (N2O) from soil management. Optimized by the model against energy emissions reduction measures.

8. Transmission and Distribution

The Transmission and Distribution working group had insufficient time to address all the data and assumptions that will be incorporated into the model. ODOE is posing the following questions for consideration.

Timing of Electricity Transmission Development	**No new transmission until 2035**, except for certain priority transmission projects that are currently planned and/or under development – examples include: **New Lines** – IPC's Boardman to Hemingway (B2H) project online in 2030 and PAC's Gateway project online in 2035 **Reconductoring/Rebuilding Existing Lines** - BPA's Big Eddy to Chemawa project and PGE's Round Butte to Bethel project, both expanding East to West transfer capacity from 230 kV to 500 kV and both online in 2035 (conservative assumption) or 2030 (liberal assumption) ***Are there other "in-flight" projects (new lines/reconductoring/rebuilding) that should be considered?***
Electricity Distribution System Cost Assumption	Proxy value based on historic costs from Energy Information Administration (EIA) ***Should the proxy value be increased to account for higher costs needed to support electrification and adaptation to extreme weather***

	events, including wildfires? If yes, what data source would support forecasted costs?
Pipeline Infrastructure Assumptions	No new infrastructure development beyond operations and maintenance. ***Should we be considering any other future costs? Including costs of repurposing pipelines for alternative fuels?***
Electricity transfer capacity between East and West Oregon	Publicly available Bonneville Power Administration (BPA) data on historical path flows. Account for East to West transmission expansion projects noted above (B2H, Big Eddy to Chemawa, and Round Butte to Bethel) ***How/when do we account for BPA and PGE's planned rebuild projects across the Cascades? Such as: Big Eddy to Chemawa and Round Butte to Bethel?***

DLCD OSE Comments

Acknowledge land use planning system's role in reference case, available land, more compact communities, energy siting

Please include a 20% reduction of vmt per capita in the reference case for the following reasons:

- Vmt per capita has not grown for many years
- The Statewide Transportation Strategy and the Oregon Transportation Plan include a 20% reduction of vmt per capita for light duty household travel. This is refined and being implemented through DLCD's administrative rules for cities within the state's 8 metropolitan areas which in which over 60% of Oregonians live in and over 70% work in.
- DLCD has adopted several administrative rules requiring cities to plan for and meet reductions in vmt per capita:
    - OAR 660-044 Metropolitan Greenhouse Gas Reduction Targets set the overall targets.
    - OAR 660-012 Transportation Planning Rules implement the GHG targets requiring a range of land use and transportation actions to be planned and implemented over the next 25 years to achieve the GHG targets
- The Portland metropolitan area has been planning for vmt reductions for several decades and has demonstrated several times that their plans can achieve a 35% reduction in vmt per capita
- Recent changes in housing policy for cities over 10,000 legalize duplex through quadplex development on land previously zoned for single family development. These changes, along with requirements in the CFEC rules to require more upzoning and mixed-use development will help to reduce overall levels of driving.

PUBLIC POWER OMEU
OREGON MUNICIPAL ELECTRIC UTILITIES ASSOCIATION

Submitted electronically.

September 4, 2024

Ms. Edith Bayer
Energy Policy Team Lead
Oregon Department of Energy
550 Capitol Street NE, 1st Floor
Salem, Oregon 97301

Dear Ms. Bayer:

Thank you for accepting comments on the Draft Reference Scenario, which will be the "base case" for developing State Energy Strategy recommendations.

Process Concerns

First, a few process observations. While we appreciate that ODOE extended the deadline for comments by a few days, the working group process has been extremely abbreviated given its importance. Beyond the presentation slides from the August 22nd meeting, a written description of the draft reference scenario with key data and assumptions was not even written until August 27th. The description does not include any links to or copies of the data sources that ODOE proposes to use for the assumptions. In the short timeframe available for comment, it was not possible to track down many of the listed sources. For example, where can we find the March 2024 Rooftop Solar projections from the NWPCC?

The deliberations of all eight working groups were completed in less than a month. Many of the work groups only met virtually once and the bulk of the time in those meetings was spent listening to briefings from ODOE staff or consultants. OMEU had the impression that there would be a lot more robust stakeholder engagement in this work. While it was democratic to allow anyone interested to have a seat at the working group tables, we are not convinced that the resulting composition of the working groups was balanced. Hopefully, ODOE will account for that by not giving undue weight to overrepresented groups, and by factoring in viewpoints that may not have been represented in this process.

It is frustrating to have such an important foundational element of the strategy—with multiple inputs—presented in this way. In promoting the Oregon Energy Strategy Director Benner and the ODOE staff have always conditioned the value of the strategy by saying "if done right." So far, this process has us questioning whether this is being "done right."

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While we would have liked to have followed all the working groups and to have dug into the data sources and assumptions more closely, that was not possible in the abbreviated timeframe. Nonetheless, we will continue our engagement and offer these preliminary comments on some select aspects of the draft reference scenario. As we learn more and have an opportunity to understand the reference scenario more fully, we may have other thoughts to share.

Reference Scenario Should Be Feasible

As an overarching comment, our view is that the reference scenario should be more feasible than aggressive. High reliability should be the top consideration and is required by law. The scenarios can test more aggressive GHG reduction approaches, but the reference should be as realistic as possible. The problem with pumping up the reference scenario with overly aggressive GHG assumptions is that it becomes the basis for policy recommendations and decisions. Appreciating the legislative direction to achieve the state's policy objectives around GHG reductions, we must also make sure that the model factors in affordability, reliability, equity, and the promotion of economic growth. As presented, it is unclear how the model does that.

The State of California, which has too much intermittent solar, provides a cautionary tale for how unrealistic policies can play out. Despite battery storage deployment, California remains designated as having an "elevated risk" of blackouts in above-normal peak summer conditions by the North American Electric Reliability Corporation (NERC). Increased consumer demand appears to be blunting the positive impact of battery storage deployment. To ensure reliability the state has been paying to develop new small (20-30 MW) *gas plants* around the state for evening peaks. They have also had to keep the aging Diablo Canyon nuclear plant open to safeguard their energy supply.

Reference Case Assumptions

GHG Targets for Electricity.

- How does the 26% of the state served by Oregon consumer-owned utilities (COUs) factor into the statewide model for electricity? While COUs are not subject to HB 2021 because of our existing clean energy mix, what assumptions are made in out years regarding the necessity of additional generation to meet COU load growth from electrification and economic development using the "back casting approach"?

- With respect to 100% clean electricity by 2040 for PacifiCorp, PGE, and electricity service suppliers, it is unclear how the reference case will also incorporate the statutorily authorized "reliability pauses" and required cost caps. If the reference case is to align with state policy and be "feasible" we think that it should. While OMEU is not in the best position to suggest what a reasonable adjustment downward might be, we do believe one is necessary. The scenarios, rather than the reference case, seem to be the best place to model an unimpeded ability to reach the 100% target by 2040.

GHG Targets for Fuels.

- Similarly, the Climate Protection Plan (CPP) assumption of a 90% reduction of GHG emissions from direct use fuels by 2050 does not appear to be tempered by direction in the rules for DEQ to inform the PUC of changes to customer rates that may be attributable to compliance with these rules. The rule provides that if "retail customer rates have increased or are projected to change significantly due to local distribution companies' cost to comply with this rule, DEQ will consider recommending changes." Additionally, to ensure reliability in the near term, natural gas should be assumed as "bridge fuel" until more transmission and proven commercial battery storage comes online to complement renewables. Of course, the current statutory regulatory environment makes siting and expansion of transmission lengthy and problematic. These hurdles will impede CPP targets.

Electricity Generation Technologies.

- While it makes sense to include only established renewable technologies in the reference case, small modular reactors (SMRs) should be modeled in one of the scenarios. As a carbon free resource that is not affected by environmental conditions, SMRs can be relied on to provide reliable base load power when intermittent resources like wind and solar are not available. SMRs may be a key to future economic growth without massive transmission builds. We recognize that siting SMRs in Oregon would require a constitutional amendment but nonetheless feel it would be appropriate to model in a scenario.

- While we understand that HB 2021 prohibits the siting of new natural gas plants, threats to reliability—particularly due to more frequent extreme weather events— and affordability require that model assumptions be conservative about the near-term phase out of existing natural gas plants in Oregon. It may be good to look at natural gas peaker plants in one of the scenarios.

- In looking at solar generation, it is important to consider the impact of climate change. For example, as many areas of Oregon are blanketed by smoke from summer wildfire events, solar productivity is impaired. Solar power can also be impacted by extreme heat as most panels are designed for peak capacity around 77°F and begin to lose capacity at higher temperatures. Power output can decrease ~0.5% for every degree above 77°F. Considering peak temperatures around 104°F, solar panels can experience capacity losses up to approximately 7.5%. Regarding energy storage, lithium-ion batteries have an ideal operating temperature range of 59–95°F. Exposure to temperatures above that range can damage the battery and significantly reduce the amount of energy it can be stored over time. An Electric Power Research Institute (EPRI) project observed an outdoor residential system in Arizona exposed to extreme high temperatures in 2020. After exposure to daily high temperatures at or above 110°F for 50 days (nonconsecutive) during July and August, the battery cells swelled, presumably from the heat, impacting their efficiency, which reduces available energy capacity." ("Extreme Heat Events and Impacts to the Electric System" September 2022 Electric Power Research Institute READi Insights.)

- Wind power can also be negatively impacted by extreme weather. For example, during a recent Texas heat wave, wind turbines were generating less than a tenth of what they are capable of as power demand surged from air conditioning. During the heat event, wind speeds fell to extremely low levels, which meant that the state's fleet of turbines were at just 8% of their potential output. (Bloomberg, July 11, 2022)

Data Center Load Growth.

- In their report to the Northwest Power & Conservation Council (NWPCC) regarding the Northwest Power Supply Adequacy Assessment for 2029, NWPCC staff indicated that the assumptions in their "base case" are not more probable than the "mid case" scenario, which is informed by utility forecasts. Given the uncertainty of data center load growth, NWPCC's datacenter range spans from a floor of 1,800 aMW to a ceiling of 6,500 aMW. Given this range, the lack of certainty in this area, and the loads we are seeing in the BPA the interconnection queue, it makes more sense to look to the middle of the uncertainty band—3,976 aMW, rather than the NWPCC base case of 2,400 aMW. We don't recall any discussion of why this base case was assumed instead of the mid case in the reference scenario.

  The PNUCC 2024 Northwest Regional Forecast projects "an increase in demand of over 30% in the next 10 years," which is driven by the rapid expansion of data centers. See Table 1 on page 19 of PNUCC's forecast which shows load growth of over 5,000 aMW in the next five years. https://www.pnucc.org/wp-content/uploads/2024-PNUCC-Northwest-Regional-Forecast-final.pdf According to a Cushman & Wakefield report that evaluates data centers by their electricity usage, the Oregon data center market ranks as the fifth largest in the nation.

  While we appreciate that there will need to be a lot of cooperation in building resources and transmission that is adequate to meet these datacenter loads, a mid-point assumption is more reasonable for the reference scenario even though it will show that the energy system is inadequate without other assumptions around building resources and transmission. With the recent CHIPS Act investments in our state, we must also be "feasible, but aggressive" with our economic development assumptions, not just GHG emissions. Please adjust the reference case to the NWPCC mid case assumptions; the NWPCC "base case" could be used in a scenario, however.

Buildings: Residential Electrification.

- Given the price point of electric heat pumps, the assumption of 95% of overall sales by 2040 seems too aggressive. The BPA incentives for low-income customers cover nearly 100% of heat pump costs, however we need to understand assumptions out to 2040 for customers that are not low income. The slides do not provide any information about existing heat pump sales in Oregon in order to evaluate whether 65% by 2030 and 90% by 2040 is realistic given the high initial price point. In any event, 90% by 2040 as in the DEQ MOU seems more feasible than the suggested change of 95%. Again, the reference scenario should be feasible. More aggressive assumptions should be saved for the scenarios.

Buildings: Commercial Electrification.

- The assumptions in this area seem highly dependent on the availability of incentives. Do these assumptions factor in BPA and Energy Trust incentives?

Transportation: Light-Duty.

- What are today's statistics for car purchases in Oregon? What percentage of customers are choosing EVs in Oregon today? How much of an annual increase would need to be achieved to reach 100% by 2035?

Transportation: Medium and Heavy-Duty Vehicles.

- 100% of new Class 2b-8 vehicle sales are ZEVs by 2040 seems overly aggressive for this class of vehicles. We do not support a 100% assumption of ZEVs for this class of vehicles, nor do we support an assumption of the California Advanced Clean Fleets (ACF) policy as part of the reference scenario as was proposed in the working group. The ACF has not been adopted in Oregon. The absolutist approach taken in California in the implementation of that rule will result in absurd, costly, and harmful outcomes. For example, there are no exemptions for utility vehicles. While it may make sense to have some electric utility vehicles, realistically our fleets cannot be 100% electric. If we are working to restore electric service during an outage or providing mutual aid to another more distant community after a storm, we need to be able to power our trucks with non-electric sources. The ACF could be modeled in a scenario but should not be assumed in the reference case. The reference scenario needs to have achievable modeling inputs.

  100% BEV sales by for school buses by 2036 does not seem realistic as part of the reference scenario. Below is a recent article on electric school buses in Oregon, which highlights that they are currently significantly more costly than existing options, and due to student safety concerns may not work in snowy mountainous areas. https://www.oregonlive.com/environment/2024/03/beaverton-takes-the-lead-in-oregon-school-districts-drive-to-electrify-school-buses.html

  An important consideration for modeling aggressive transportation electrification scenarios is charging infrastructure and the impacts of increased loads on local distribution grids and substation transformers. Has ODOE factored into the model the availability of power transformers? Currently, manufacture of these types of transformers are out five years. As demand increases, the timelines for utilities to purchase and install these expensive assets will increase.

Please know that OMEU appreciates the dedication and hard work that ODOE staff and its consultants are putting into this strategy but know a better strategy would result from more realistic timelines for engagement. We definitely have an interest in shaping the state's energy strategy but must balance our participation with our primary mission of providing reliable electric service at least cost. As this work progresses, we hope you will keep this in mind.

We would be happy to discuss any of these suggestions, (971) 600-6976, jenniferjoly@omeu.org.

Sincerely,

/s/ Jennifer Joly
Jennifer Joly, Director
Oregon Municipal Electric Utilities Association

Attn: The Oregon Department of Energy

Re: Oregon Energy Strategy Advisory Group – Draft Reference Scenario

From: Tucker Billman, Director of Government Relations for the Oregon Rural Electric Cooperative Association, and member of the Oregon Energy Strategy Advisory Group

To ODOE Staff for the Oregon Energy Strategy Advisory Group,

As a member of the Oregon Energy Strategy Advisory Group, I appreciate the opportunity to submit comments on the Draft Reference Scenario.

I appreciate the acknowledgement of hydropower playing a key role in meeting the state's clean energy objectives. This is a critical acknowledgement, especially for consumer-owned utilities who are already nearly 100% free of greenhouse gas (GHG) emissions and who serve a geographic majority of the state. We are already doing our part to help the state achieve its GHG goals. However, I do have some process related concerns.

While I appreciate the effort to include a broad array of stakeholders in the various subcommittees that served as feedstock into the Draft Reference Scenario, I believe the subcommittee meetings were hastily performed with too little input from industry experts in their respective fields. ODOE and CETI utilized the overwhelming majority of meeting time to explain the modeling process rather than soliciting meaningful feedback from experts in the various topic areas being discussed.

It is my hope that as the process moves forward and ODOE develops an actual energy strategy that will be shared with policymakers, the input from experts is solicited more intentionally and more thoroughly. The Energy Strategy is extremely important, and it is critical that it be done correctly. Let's slow down and take the time necessary to get this right.

Thank you for the opportunity to comment.

Tucker Billman
Advisory Group Member
Director of Government Relations
Oregon Rural Electric Cooperative Association

OREGON SOLAR + STORAGE INDUSTRIES ASSOCIATION

Oregon has a unique opportunity to take advantage of federal incentives for clean energy development. We are well-poised to attract outside investment that will bring economic benefits, jobs and property tax revenue to our state. However, all 50 states are competing for this investment and without a strategy, Oregon might lose out.

Oregon clean energy scenario development is critical to explore Oregon's options becoming energy resilient and clean. Currently, Oregon largely depends on out-of-state coal and gas to keep our lights on, which does not bring economic benefits to Oregonians. With a statewide energy strategy we will have the ability to consider different options and maximize federal dollars to support our state's goals.

However, in order to reach our goals, the scenarios need to have the right components. They need to accurately reflect Oregon's climate and energy goals and laws as well as on the ground conditions and the increased power outages we are experiencing in Oregon. In addition, Oregon policymakers can only be fully informed if there is a scenario included that only reflects physical and technical restraints to achieving Oregon's climate and energy goals. This scenario should not include other current policies, which can be changed by the legislature. The legislature needs to know the full realm of the possible and not have current policies constrain innovative thinking about how we reach our energy goals.

Executive Summary

The presented policy framework, modeling approach and proposed reference scenario all fail to meet the statutory objective of HB3630 of identifying optimized pathways to achieving the state's climate and energy policies and policy objectives.

· The policy framework omits critical components of HB2021 (80% decarbonization by 2030 and direction of benefits to communities) and Oregon's Renewable Portfolio Standard.

· The modeling framework does not support a comparison of built in Oregon renewables, storage and grid enhancing technologies with distant resources reliant on long-range transmission.

· The proposed Reference Scenario does not recognize HB2021's 80% by 2030 milestone, draws from Integrated Renewable Portfolios that are neither acknowledged by Oregon's Public Utility Commission nor demonstrate grid reliability and assumes that other states and provinces will achieve their energy policy goals while accommodating Oregon's growing loads.

Achieving our most immediate milestones while delivering reliability and other benefits Oregonians must frame all modeled scenarios. The resulting outcomes should identify actionable pathways to Oregon's safety and success where Integrated Resource and Clean Energy Plans submitted by our largest investor-owned electric utilities and rejected by Oregon's Public Utility Commission have failed to do so.

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The grid, economic and resilience values of rooftop, community, commercial (PURPA) and utility scale renewables, storage and advanced grid technologies should be able to be reflected by the modeling framework and evaluated in Reference and Alternate scenarios.

Policy Constructs

As stated in HB 3630, The state Department of Energy shall develop a comprehensive state energy strategy that identifies optimized pathways to achieving the state's energy policy objectives. ODOE has not comprehensively defined those energy policy objectives. The Draft Reference Scenario Key Data and Assumptions proposes to adhere only to "anchor policies":

- Executive Order 20-04 (80 percent economy-wide reduction in greenhouse gas emissions by 2050);

- HB 2021 (100 percent clean electricity for the state's largest investor-owned electric utilities and Electricity Service Suppliers), and

- Climate Protection Program (90 percent reduction in greenhouse gas emissions from fuels by 2050)

Most notably absent from those descriptions are

- HB2021's 80% retail electricity decarbonization by 2030

- HB2021 provisions regarding direct benefits to communities…in the forms of creating and sustaining meaningful living wage jobs, promoting workforce equity and increasing energy security and resiliency

- ORS 469A (Renewable Portfolio Standards)

Modeling Approach

The modeling approach presented by CETI does not support a comparison of energy made in Oregon, sized and located to meet our load demands and grid constraints vs large new distant generation requiring new transmission. Instead, the approach presented is to aggregate reliability and loads across the entire state and only capture high level transmission conditions across two regions. This does not provide the level of locational resolution necessary to recognize or effectively weigh the significant implications of resource, storage and load locations on grid reliability, community energy security or economic harm or benefit. As such, this approach does not comply with the statutory direction to "identify optimized pathways to achieving the state's energy policy objectives."

The modeling must support an evaluation of the impacts of wildfires, earthquakes, heavy snow and other weather events that impact Oregonians access to energy and fuels Reference and Alternate scenarios but does not appear to do so.

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The modeling process described will not reflect any of the locational values of clean energy resources. It will not, for example, differentiate resources located near communities from those located farther away or out of state and transmitted through catastrophe prone routes. Neither will it capture the reductions in energy losses inherent to transmission or the reductions in wildfire risks and planned safety outages.

Reference Scenario

In order for the Clean Energy Transition Institute's (CETI) modeling to be useful, the modeled scenarios must have comprehensive and specific inputs and constraints that reflect a realistic portrait of Oregon's energy policy objectives, renewable resources, development timelines and energy infrastructure. CETI's reference model should focus on physical and technical constraints of the infrastructure and natural resource availability to and in Oregon.

The reference scenario should not rely on predicting the success of our neighboring states in accomplishing their energy, climate and technology deployment goals in a manner that can and will accommodate the needs of Oregonians.

The proposed reference scenario should not acknowledge the most recently filed Integrated Resource Plans or Clean Energy Plans from PGE or PacifiCorp as neither has been acknowledged by Oregon Public Utility Commission and neither achieves 80% carbon reductions by 2030.

The proposed reference scenario does not appear to acknowledge the rapidly approaching 2030 goal of 80% investor-owned utility decarbonization.

Physical upgrades to Oregon's energy structure must be assumed under a realistic timeline. The draft Reference Scenario presumes that neighboring states will achieve their technology deployment and clean energy generation goals and that these resources will necessarily be available in time to meet Oregon's needs through transmission routes that have not been constructed. As a result, the Reference categorically omits or delays consideration of significant renewable resources available within Oregon and off of state shores to strengthen our grid and economy.

Clean energy generation and storage assets can be strategically located within Oregon to reduce line loss distances between generation and load, complement legacy and evolving power flows, insert firm generating resources into energy island pockets, increase community energy security, improve power and air quality, reduce wildfire risks and make meaningful contributions of geographic and resource diversity to a robust WECC. The reference scenario should reflect near term in-Oregon, technically feasible infrastructure potential as well as the existing policies, planning and funding streams available to support from rooftop to large scale solar and other non-emitting generation and energy storage within Oregon including:

- PURPA
- Solar For All
- Building Resilience Infrastructure and Communities

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- County Energy Resilience Plans
- Tribal Climate Adaptation and Mitigation Plans
- Western Resource Adequacy Program
- Community Renewable Energy Program
- Community Solar
- Net metering

Additionally, the Reference scenario should not presume that the historically undervalued avoided costs assigned to PURPA projects prevail in future procurement rounds. Oregon PUC's Capacity docket, UM2000, is poised to embark on a re-evaluation of avoided cost models. Staff's proposal is framed with the goal of "sending more precise signals about what provides value to the utility system and its users, which includes:

o Reflecting the importance of reliability under a changing system.

o Recognizing the transmission expansion required to acquire the resources identified in the utilities' resource strategies.

And Aligning with changing resource procurement drivers and approaches, which includes:

o Providing more realistic avoided resource characteristics.

o Recognizing the shift to more frequent and nimbler, all source procurements.

o Reflecting the ability of small QFs to contribute to Portland General Electric and Pacific Power's small-scale resource (SSR) requirements.

o Recognizing that RPS compliance is not likely to drive procurement for Portland General Electric and Pacific Power.

While COU development of renewables to serve internal loads may currently be restricted by BPAs preference customer program, renewable development within COU preference customer networks remains an open right under PURPA and open access transmission and provides a timely and valuable pathway toward meaningful contributions to achieving state energy, reliability and climate objectives.

The reference scenario should include a full spectrum of renewable, clean energy deployments available within Oregon including:

Rooftop Solar: 5 – 10 kW

Commercial Solar: 10 kW – 1 MW

Community Solar: 1 – 3 MW

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PURPA Solar, Hydro and Wind: 3 – 50 MW

Utility Scale Solar and Wind: 50 – 500 MW

Oregon Offshore Wind: 3 GW

Section 3 Alternate Scenario: Extract Maximum Value of Oregon Infrastructure (EMVOI)

This pathway should be restricted only by physical, technical and Oregon Energy policy constraints.

As stated by the US Department of Energy in the recently released Innovative Grid Deployment Liftoff Report " Multiple advanced grid solutions are commercially available today to help grid operators and regulators address near-term capacity and reliability priorities and modernize the grid – without increasing costs for ratepayers. **Most solutions could be deployed on the existing grid in under 3-5 years and at lower cost and greater value than conventional approaches**." This pathway should assume the rapid and regularly phased deployment of dynamic line ratings, Advanced Distribution Management Systems, substation automation and digitization, topology optimization, advanced power flow control, energy storage, virtual power plants and communications. All of these rapidly deployable technologies unlock near term Oregon energy development while vastly enhancing our understanding and transparent access to the full potential of existing and future investments in Oregon's energy infrastructure.

This scenario should assume full usage of Oregon's existing and emerging transmission and distribution capacity through the strategic placement of renewable generation and energy storage. This will give legislators and Governor Kotek a full understanding of the possible and allow them to make informed policy decisions.

This scenario should not presume that the historically undervalued avoided costs assigned to PURPA, Community Solar or micro-grid projects prevail in future procurement rounds but that the intent of HB2021 Sec 2(2) is reflected in resource valuation and Clean Energy Planning. Projects built in Oregon support improved power quality, grid resilience and economic development.

Small-scale renewables have proven resilient, more easily comply with land-use constraints and offer community benefits in the form of property tax revenues, health benefits, and other benefits that communities define.

Furthermore, net energy metering (NEM) contributes many economic and social benefits to many Oregonians. The majority of net metered solar in Oregon is installed for those under the state median income level, allowing NEM benefits to reach those who need it most. As a reference, The Local Solar Roadmap Whitepaper (Dec, 2020) modeled the implications of optimized deployment of local solar and storage nationwide and found that the cleanest, lowest cost grid builds upon 223 GW of new local solar by 2050 at a cost savings of $473B while creating over two million more jobs and unlocking synergistic value add from utility scale solar and wind projects.

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This scenario should not be inhibited by the potential for contractual inhibitions on development of renewables within Oregon's COU service territories. As Bonneville Power Administration (BPA) and the Consumer-Owned Utilities (COUs) they serve deliberate the terms of future power supply contracts amidst a backdrop of dynamic market transformation through both the Western Resource Adequacy Program (WRAP) and regional day ahead markets, procurement constraints on Oregon's off takers should not define the Reference Scenario.

This scenario should contemplate a less restrictive land use policy landscape. Integrated agrivoltaics, renewable energy development of non-irrigated fallow farmlands and other responsible policy adaptations available to Oregon's lawmakers should be evaluated for a comprehensive understanding of the implications of land-use restrictions and possible future changes to those restrictions. This is essential information for our lawmakers to make informed decisions to best meet Oregon's energy, resilience and climate goals.

Conclusion

OSSIA is excited to continue to be engaged in this process. Creating an energy strategy, informed by scenario planning, will help policymakers understand the levers to pull to get Oregon to our climate and clean energy goals. We appreciate the work of ODOE and CETI and are committed to working with stakeholders to develop the best possible scenarios for Oregonians.

Additional References and Data Sources

Oregon Energy and Climate Policies

ORS 469 – Energy, Conservation Programs, Energy Facilities

ORS 469A – Oregon's Renewable Portfolio Standards, Small Scale Renewable Standard, Oregon's Greenhouse Gas Emissions Standard

ORS 469 – Energy, Conservation Programs, Energy Facilities

ORS 469B – Energy Incentives, Tax Credits, Grants

ORS 470 – Small Scale Local Energy Projects

ORS 756 – Oregon Public Utility Commission

ORS 757 – Utility Regulation (Includes Net Metering, Transportation Electrification, Solar, Greenhouse Gas Standards, Direct Access, among others)

ORS 758 – Additional provisions related to utility regulation (includes PURPA)

OAR 340-215 (Oregon Greenhouse Gas reporting program) (ORS 468A – Air Quality)

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Executive Order 20-04

Comprehensive Interconnection Feasibility Studies

G0728, G0838, G0839, G0865, G0866, G0867, and G0874

G0673, G0674, G0675, G0693, G0694, G0695, G0696, G0697, G0698, G0699, G0700, G0701, G0702

G0758 G0825 G0826 G0841 G0849 G0850 G0861 G0870 G0871

PACIFIC POWER.
A DIVISION OF PACIFICORP

825 NE Multnomah
Portland, Oregon 97232

September 4, 2024

Oregon Department of Energy

550 Capitol St. NE, 1st Floor

Salem, OR 97301

Re: Oregon Energy Strategy Public Comments

Pacific Power appreciates the initial opportunity to submit feedback on the proposed modeling assumptions for the Oregon Energy Strategy led by the Oregon Department of Energy. The Company has engaged in meaningful discussions in several Oregon Energy Strategy working groups and has outlined its feedback consistent with input from internal subject matter experts. Pacific Power looks forward to learning more about these modeling assumptions as we continue collaborating with the Oregon Department of Energy and other relevant stakeholders on the Oregon Energy Strategy.

I. Direct Use Fuels

2024-Draft-Reference-Scenario.pdf - *Under Supply Side Assumptions, the document states, "Existing natural gas utility Integrated Resource Plans (IRPs) for near-term investments and operations" will be used as the source for near-term assumptions.*

Questions:

- Does the use of utility near-term investments and operations include proxy resources identified in its IRP preferred portfolio?
- Does the use of utility near-term investments and operations include transmission selected in its IRP (even if that transmission is expected to be online before 2035)?

PacifiCorp Assumptions:

- Transmission and resources selected anywhere on the system are eligible for Oregon participation

II. Energy Efficiency and Load Flexibility

2024-Draft-Reference-Scenario.pdf - *Regarding datacenter load growth, "Northwest Power and Conservation Council Pacific Northwest Power Supply Adequacy Assessment for 2029 base case, with load differentiated across modeling zones"*

Questions:

- Will this assumption be updated with data from utilities' expected data center load growth based on IRP data?
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III. Electricity Generation Technologies, and Transmission and Distribution:

2024-Draft-Reference-Scenario.pdf - *The document states, "No new transmission until 2035" and includes several exceptions, such* as, "IPC's Boardman to Hemingway (B2H) project online in 2030 and PAC's Gateway project online in 2035"

Questions:

- Is the reference to PAC's Gateway project referring to Gateway South or to the entire Energy Gateway set of projects?
- Why are the B2H and Gateway assumptions significantly different from PacifiCorp's near-term planning assumptions?
- Will the model consider multijurisdictional transmission options that are outside of Oregon but that will enable Oregon-assigned resources?

PacifiCorp Assumptions (from the 2023 IRP Update):

- Gateway South commercial online date online in 2025
- Energy Gateway Segment H Boardman to Hemingway online in 2026
- Approximately two gigawatts of additional interconnection capacity are added through 2032, in addition to the amounts directly associated with Energy Gateway South, Energy Gateway West Sub-Segment D1, and B2H.

IV. Timing of Electricity Transmission Development:

- Pacific Power has a planned project to construct a new 500 kV transmission line between southern, central and northeastern Oregon with a planned in-service date of 2032. The need for this new line has been identified in the Company's Local Transmission System Plan, Generation Interconnection Cluster studies and new customer load request studies. Pacific Power requests inclusion of the "Blueprint" project in the topology for the 2035 and later study scenarios. Model information and data is available and will be provided to ODOE and its technical contractor.

V. Transportation Electrification:

- PacifiCorp notes that sales trends are slowing, and Original Equipment Manufacturers have changed their long-term visions. PacifiCorp recommends considering a scenario that reflects these current trends for EV adoption.

VI. HB 2021, Renewable Portfolio Standards, and Community-Based Renewable Energy Projects:

- The reference scenario assumptions states that HB 2021 sets a portfolio standard that requires "100% clean electricity." PacifiCorp recommends clarifying that the law requires an *emissions reduction* standard of 100% by 2040. In addition, PacifiCorp recommends the reference scenario assumptions acknowledge that the law establishes interim emission reduction targets for 2030 and 2035. ORS 469A.410.
- It is a bit unclear in the material that has been shared, how the Renewable Portfolio Standard and other supply side requirements will be reflected in the model.

VII. Additional Considerations

- Slide 28 (electrification/transportation)
  - Because ZEVs include both BEVs and PHEVs, it's going to be important to include assumptions for the share of each of these rather than just stating a percentage for ZEVs. BEVs and PHEVs will have different direct emissions (BEVs don't have any, but PHEVs do).
  - How are stakeholders supposed to interpret the two different Medium-duty rows?

We thank the Oregon Department of Energy for the opportunity to provide feedback during this initial public comment period of the Oregon Energy Strategy modeling process. Pacific Power looks forward to continued engagement.

825 NE Multnomah
Portland, Oregon 97232

September 4, 2024

Oregon Department of Energy
Attn: Edith Bayer
550 Capitol St. NE, 1st Floor
Salem, OR 97301

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We thank the Oregon Department of Energy for the opportunity to provide feedback during this initial public comment period of the Oregon Energy Strategy modeling process. Pacific Power looks forward to continued engagement.

Subject: T&D Working Group meeting Aug. 14

Thank you for this opportunity to provide inputs to the Oregon Energy Strategy development.

On August 14 I listened intently to the online meeting of the Oregon Energy Strategy Transmission and Distribution (T&D) Working Group, because I think T&D infrastructure costs and siting are central to an Oregon Energy Strategy.

I was quite disappointed with this meeting. Instead of an open discussion of various options, the discussion was immediately and persistently dominated by a solar farm developer pushing his business model with sophisticated but only partially relevant data and talking points. His agenda aligns with the business model of other developers of large solar and wind farms and with the obsolete business model by which the state regulates investor-owned utilities (IOUs): we must fund large energy farms east of the Cascades (where the wind and solar resources are best); and we must significantly expand transmission capacity over the Cascades to the I-5 corridor where the large loads are. Such transmission line planning is complex and must be coordinated with multiple other entities, and how can ODOE's modeling possibly be useful? Along with planting subtle sound bites like *we must get power to Portland!*

Um, how clothed is this emperor? Is this another discussion dominated by large corporations, at least partially against the will of the people?

During the meeting there was not one comment or question about just how much more power Portland and the I-5 corridor will need (outside of "It's very difficult to forecast the power needs of future data centers.") Does anyone care about the numbers? Yes, the load increase through 2050 is significant, but a child watching this parade would ask why we don't generate more of our power in the I-5 corridor, especially locally where generation and storage provide the most value for energy resilience? In the meeting ODOE appropriately pointed out that the objective is an energy strategy, not a transmission plan.

Here's an illustration of some options for energy resilience:

New energy generation and storage technologies are only beginning to disrupt the century-old grid architecture of central power plants with electricity transmitted and distributed to consumers. Rooftop solar has made net-zero homes common. In-home batteries provide energy resilience options. Electric vehicles (EVs) already have ~10X as much storage as utility batteries. Before 2050, houses and neighborhoods will have microgrids with solar roofs and EVs bidirectionally charging and supporting grid-scale virtual (distributed) power plants (VPPs). The microgrids will island to provide energy reliability and resilience.

"Microgrid" or "VPP" or "vehicle-grid integration" were not even mentioned in the August 14 meeting. "Energy resilience" is in the topic lists, but I haven't heard any discussion of the value of energy resilience or energy reliability. These omissions also play into supporting our obsolete utility business model. Tellingly, the costs of T&D expansion were simply said to be modeled by historical T&D costs of IOUs. When Rob Del Mar of ODOE asked whether the modeling should address new trends, there were no responses. Apparently storage additions are not available in the modeling.

Obviously the modeling should address new trends! Any energy strategy discussion must consider the cost trajectories of the various technology options. For example, over the past decade,

- LED lighting has become the norm;
- EVs have become the urgent focus of every automaker, now reaching price parity for electric cars;
- solar and wind are now clearly the lowest LCOE for utility-scale electricity generation;
- lithium-ion battery costs have dropped about 80% and have demonstrated a 19%-29% production learning rate;
- T&D construction costs have arguably become more expensive, with some exceptions;
- etc.

On the demand side, the need for energy resilience continues to exponentiate as the frequency and severity of extreme weather events increase. The load increases from electrification of transportation and buildings are relatively predictable, although the pace of electrification will be modulated by policies, supply chains, and other factors.

How much can a few back-of-the-envelope numbers inform energy strategy? T&D costs are high and growing. Macro data for average US T&D costs shown by FERC were each about two cents/kWh in 2021, nearly double the T&D costs in 2011. These apparently include both O&M costs as well as new construction, and 2021 is before most of the current exponential growth in the interconnection queue. These simple trends would indicate T&D costs of at least three cents each by 2030.

Such T&D costs do not compare well with today's residential- or commercial-scale PV costs of about 3 or 1.5 cents per kWh respectively, which will continue to drop for the next decade at least. When homeowners can generate power at 3 cents/kWh and store it in their EV batteries for a tiny extra cost, then major grid investments in T&D at 5 cents or more become highly questionable. What is the expected useful lifetime of new transmission lines? 40 years? How low will battery costs be in 2050? Why would ratepayers think that new transmission lines will not be obsolete within 20 years? And if companies want data centers that add large loads, why don't we let those companies figure out how to plan and implement their own power? Many large corporate power users have already defected from the grid.

But of course, the actual O&M or new construction costs of T&D projects are extremely complex—so complex that transmission authorities are trying to figure out some first-order costs and benefits to create some logic and fairness in interconnection costs for new renewable solar or wind farms. How should costs/benefits of a given new connection be assessed when the power supplied may be transmitted to a variety of places in a variety of situations with an unknown number of other additions to the transmission networks? There are far more variables than equations in this problem, so some general guidelines are being proposed.

I'm not proposing that distributed energy resources (DERs) can displace all of the new utility-scale farms and new T&D necessary. It seems likely that Oregon will need all of the above and then some—but an energy strategy should certainly investigate what could be an optimal level for DERs vs central generation plus the added T&D, especially when DERs are necessary for energy resilience. Presumably the costs of both added T&D and added DERs will increase with quantity—what do those curves look like? And how does the value of energy resilience vary with the size of DER capacity? Does five times as much DER result in five times as much energy resilience value? And how do each of these vary over decades, as costs evolve? Along with externalities like the social costs of greenhouse gases, the value of energy resilience, local job creation, local toxic emission reductions, etc. should be part of EER's total cost optimization. Or ODOE should triangulate some means of including the "non-economic" costs. Pathfinding will be difficult if our only reference data is from five scenarios optimized for minimum economic costs.

I hope these topics will help to broaden the strategy discussion. I'm not working for any for-profit entity—I'm only working for our descendants now, trying to steer this ship away from 4C of warming.

Thank you,
Eric Strid

Cofounder and retired CEO, Cascade Microtech (now FormFactor), Beaverton
Director, Power Oregon
Director, npArbor, Inc.
Co-Chair, Hood River County Energy Council
Co-convener, Columbia Gorge Climate Action Network
Advisory Boards: Electrify Oregon; Food and Water Watch; The Green Energy Institute at Lewis and Clark College

September 4, 2024

Oregon Department of Energy
550 Capitol Street NE
Salem, OR 97304
Attention: Edith Bayer

RE: Public Comment on Draft Reference Case for the Oregon Energy Strategy

Dear Ms. Bayer,

The Renewable Hydrogen Alliance (RHA) thanks the Oregon Department of Energy (ODOE) for the opportunity to respond to its request for public comment on the draft reference case for the Oregon Energy Strategy (OES).

RHA is a non-profit 501(c)(6) trade association with over 80 members, including manufacturers of hydrogen production and fuel cell technologies, labor organizations, utilities, and project developers. RHA aims to promote renewable hydrogen and other clean fuels to replace fossil fuel consumption by engaging in education and outreach to environmental and clean energy advocates, utilities, legislators, regulators, communities, and others.

RHA offers these recommended adjustments to the proposed modeling scope with the goal of improving accurate representation of hydrogen and the future hydrogen industry, bolstering transparency and information availability for stakeholders, and building an informational foundation that can support informed policymaking for the state's energy transition.

Geographic Scope

According to the materials presented in the Working Group kick-off meeting, the model geography includes eleven western states.[1] RHA supports the approach of modeling Oregon's energy production and consumption as part of a larger energy system but is concerned that by omitting Canada, the model will not reflect today's significant flows of natural gas and hydrogen and future imports from renewable natural gas (RNG) from the provinces of British Columbia and Alberta. If it is not possible to include these non-electricity energy market flows from Canada, RHA requests more detailed information on whether and how the model will account for natural gas, RNG, and hydrogen imports from British Columbia and Alberta.

There are no major natural gas basins in Oregon, so much of the gas consumed in the state must be imported. The natural gas consumed in Oregon comes from basins in the U.S. Rockies, British Columbia, and Alberta, with as much as two-thirds of it coming from Canada.[2] For the 2021 Power Plan, the Northwest Power and Conservation Council forecasted future RNG demand for Oregon to be more than 15 trillion Btu by 2044.[3] However, this figure only considers RNG blended into the natural gas pipeline and does not include demand for RNG for transportation fuels or for production of renewable hydrogen.

For hydrogen, both British Columbia and Alberta have published ambitious hydrogen strategies and, depending on costs and demand, could export renewable or low-carbon hydrogen to end users in the Pacific Northwest. Indeed, the Washington Department of Commerce is working with the British Columbian government on a cross-border study to identify opportunities across the Pacific Northwest to collaborate on addressing challenges to hydrogen adoption and opportunities to create a cross-border hydrogen market.[4]

Supply-Side Assumptions

Electricity Generation and Transmission

For electricity generation options, RHA recommends that ODOE include hydrogen combustion as a resource, both as a blend with natural gas and with turbines that can operate on 100 percent hydrogen. It is also essential to note that the new 100 percent hydrogen turbines being designed and tested today will still require some natural gas blending for a startup phase. Additionally, it is possible that thermal plants using 100 percent hydrogen turbines would still retain natural gas as a backup fuel when hydrogen is in short supply.

Given the model's assumption of no new interzonal transmission until 2035, RHA strongly recommends that the model be permitted to consider dedicated hydrogen pipelines as an alternative or a complement to transmission upgrades to alleviate pressure on the transmission system and support timely development and delivery of renewable hydrogen, in alignment with state climate objectives.

The Price of Hydrogen

The expected levelized cost of hydrogen (LCOH) modeled will significantly impact the modeled cost-effectiveness of hydrogen end uses and overall costs for hydrogen customers. Accordingly, it is critical that ODOE creates transparency around the assumptions used to derive any LCOH estimates used in this modeling exercise.

One of the biggest factors in LCOH is the expected implementation of incentives, including the 45V tax credit. For the Inflation Reduction Act incentives, RHA requests that the OES team provide more information on how the model will address hydrogen production tax credits, i.e., 45V. Specifically, RHA believes that it is essential to understand the following:

- Are there considerations in place for updating the model if final implementation of 45V is announced during the development of the OES?
- What assumptions are being made for the percentage of hydrogen producers receiving the full tax credit versus a partial credit?

Additionally, RHA requests more detail on assumptions around other components of the LCOH, including production method, storage, delivery, and other logistical factors. Some of the specific questions RHA has in relation to this include:

- What flexibility is ODOE creating for regional cost variations in the price of hydrogen?
- How is the carbon impact of the transportation of hydrogen included in the analysis?
- What assumptions are being made about hydrogen transportation and production point (at customer site versus remote)?

Additional Assumptions

Following are other important additions for accurate modeling of likely supply-side resources that will be commercially available during the study window:

- For hydrogen production, the model should include methane pyrolysis and solid oxide electrolysis.
- For hydrogen storage, underground silo storage and underground hard rock caverns should be added.
- For geologic sequestration, include onshore rock formations.
- Long-duration energy storage options should include hydrogen and compressed air energy storage.
- Electrolyzers and synthetic fuel production plants should be included as flexible loads.

Demand-Side Assumptions

In economy-wide decarbonization scenarios, hydrogen is expected to be used in producing chemicals, industrial heating, generating electricity, energy storage, as a precursor for producing fuels for marine and aviation use, and as a transportation fuel for medium- and heavy-duty vehicles, and off-road vehicles.[5] Washington state's 2023 hydrogen study found that hydrogen will play a significant role in the state for replacing current use of fossil hydrogen in refining and chemical production; production of renewable liquid fuels for on-road, marine, and aviation vehicles; production of ammonia; direct use as a fuel for fuel cell vehicles, specifically heavy-duty vehicles, freight rail, and marine fuel cells; and direct use for electricity production, industrial heat, and natural gas pipeline blending.[6]

While there are material differences between the economies of Washington and Oregon, it is critical that ODOE allows for the model to select hydrogen and hydrogen-derived fuels for industrial and transportation end uses, consistent with the end-use applications considered in the Washington study.

Industry Assumptions

Hydrogen could play a significant role in providing energy for industrial boilers and furnaces, especially for applications that require high heat, like production of glass, steel, and cement. Many manufacturers currently use natural gas or other fossil fuels to produce heat and while some processes may benefit from electrification, a switch to hydrogen will be preferable for others. Accurate representation of industrial decarbonization pathways will be critical to support a managed transition for Oregon's industrial energy users, and accordingly, RHA would encourage the OES team to provide additional transparency around its key assumptions for the industrial sector, namely:

- 50% of integrated steam production electrified
- 80% of integrated steam production electrified in food manufacturing

Transportation

Bus Fleet

RHA does not object to the portfolio-wide assumption of a 75/25 split for BEV and FCEV transit buses but does want to note member feedback that cost considerations and operational profiles will drive the split for any given fleet and will continue to evolve over time.

BEVs currently have a lower per-unit cost, but have operational limits created by milage range and charging times; while FCEV buses are currently more expensive, they are better suited to longer distances, cold weather operations, and higher up-time requirements. Some RHA members with bus fleets have indicated they are anticipating a 75/25 split of their fleet; others are anticipating a full FCEV fleet due to operational requirements.

RHA members with fleet operations have further indicated that hydrogen is much more consistent with current operational and maintenance practices, such that an FCEV fleet would be least disruptive to current operations. Accordingly, the industry may see increased adoption of FCEV buses as vehicle and fuel costs decline with scale and availability.

Truck Fleet

These trade-offs between cost and operational profiles come into play for other heavy-duty vehicles, like long-haul trucking, and RHA does not believe that a 75/25 BEV/FCEV split is realistic for long-haul trucks. Many studies forecasting the adoption of ZEVs rightly point out that there is currently very little hydrogen fueling infrastructure compared to electric and that this only serves to make FCEV adoption more expensive and less likely in the near term. However, there is recent scholarship on the costs of creating a fuel system to supply FCEVs in California that could have relevance for Oregon and the OES, including a 2024 study from UC Davis and UCLA.[7] Looking forward, a majority of the eight planned nodes of the PNW Hydrogen Hub include planning for making hydrogen available for heavy-duty transportation end uses, which would help grow the market and fueling infrastructure network in Washington and Oregon.[8] RHA recommends additional input and engagement from truck fleet operators should be taken into consideration when establishing an appropriate battery and fuel cell portfolio mix for Oregon's future truck fleet.

Finally, RHA requests clarity on how the model will address off-road vehicles, like forklifts, and port ground equipment, like yard tractors or rubber-tired gantry cranes. Amazon and other logistic companies have led the adoption of FCEV forklifts in the U.S., including in Washington and Oregon. Ports are expected to be future consumers of hydrogen and hydrogen-derived fuels, not just for off-road vehicles, but also for shore power, maritime fueling, and other uses.

Scenario Assumptions

While ODOE has not yet provided any details on how it will build the five modeling scenarios beyond the reference case, RHA wants to support ODOE's goal to craft scenarios that will help understand how different market and regulatory conditions, especially those under the purview of Oregon state and municipal authorities, will affect which pathways the model chooses. To ensure that the trade-offs between challenges and opportunities associated with hydrogen are well represented in the scenarios, RHA suggests that ODOE consider adding as many of the scenario elements studied in Washington's hydrogen study to the five scenarios it develops, with a strong preference for the inclusion of:

- **Tighter GHG requirements** – understand the impacts of stringent renewable and/or carbon requirements (e.g., the three pillars in 45V) on local hydrogen supply and market adoption in the near term.
- **Flexible GHG requirements** – understand the impacts of more flexible renewable and/or caron requirements (e.g., a glide path implementation of the three pillars in 45V or carve-outs) on local hydrogen supply and market adoption.
- **Low renewable energy deployment** – understand the impacts associated with continued challenges to the deployment of renewables and other clean electricity resources on energy supply and pricing, and associated availability of electrolytic hydrogen.

- **High renewable energy development** – understand the impacts associated with accelerated deployment of renewables and other clean energy resources on energy supply and pricing, and associated availability of electrolytic hydrogen.

In closing, RHA recognizes the benefits that the OES will bring to meeting Oregon's clean energy and climate goals and applauds ODOE's use of working groups to garner feedback. RHA will continue to participate in the development of the OES and suggests that ODOE not hesitate in contacting RHA with any questions about these comments or about hydrogen in general.

Sincerely,

Erin Childs, Executive Director
Renewable Hydrogen Alliance
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Portland, OR 97212
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[1] Clean Energy Transition Institute. (2024, July 30). *Oregon Energy Strategy Technical Consulting Approach.* https://www.oregon.gov/energy/Data-and-Reports/Documents/7-30-2024-OES-Working-Group-Kickoff-Materials.pdf
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[6] Washington Department of Commerce. (2024, January 5). Green Electrolytic Hydrogen and Renewable Fuels: Recommendations for Deployment in Washington State. https://deptofcommerce.app.box.com/s/widfnmxbo8ijt3uozpoq91jzapu4dhae
[7] Fulton, L., Yang, C., Burke, A., Acharya, T. D., Bourne, B., Coffee, D., & Kong, D. (2024). *Fuel-Cell vehicle and hydrogen transitions in California: scenarios, cost analysis, and workforce implications.* University of California Institute of Transportation Studies. https://doi.org/10.7922/G2H70D5K
[8] PNWH2. (n.d.). *Projects*. https://pnwh2.com/projects/

September 4, 2024

To: Oregon Department of Energy

Re: Comments on Draft Reference Scenario of Energy Strategy

General comments

Renewable Northwest appreciates the continued opportunity to contribute to the creation and modeling of Oregon's Energy Strategy. Completion of the Energy Strategy will be integral for Oregonians' to understand how to reach our ambitious clean energy goals. Renewable Northwest works on Policy, Regulation, Markets and Transmission. In this effort, we participate in the Advisory group and three working groups referred to below. In general, Renewable Northwest is pleased with how Phase 1 is proceeding. It is clear that an extensive amount of information and assumptions are required to inform a robust model and we appreciate the opportunity to comment on the assumptions that are being proposed.

We would like to stress the importance of sufficiently capturing dynamic load growth in Oregon. There are many new and future large single load customers in the state and the numbers are projected to increase in all service territories, investor-owned utility (IOU) and consumer-owned utility (COU) territory alike. We note that load increases are noted in the Energy Efficiency and Load Flexibility supply-side assumptions, however we would like to ensure these dynamics are sufficiently captured in the demand side of the model. We also recommend reflecting these load increases in the Transmission and Distribution section, as well, as they will implicate transmission and distribution system capacity.

We support the inclusion of a scenario that meets net-zero emission reduction targets. Including this as an alternate scenario in addition to the others would provide an interesting pathway to compare to. We are *not* advocating for replacing this scenario with the HB2021 target in the reference scenario, but including it among the alternatives. If this is an option, we believe that it would be beneficial to see this pathway illustrated on an achievable timeline following the 2040 HB2021 target, such as 2050.

Electricity Generation Technologies

We appreciate the use of the Evolved Energy Research models to inform Energy Demand and agree with the sentiment that siting restrictions apply to new generation, interconnection, and transmission and out-of-state generation requires transmission. We agree that relying on out-of-state generation too heavily creates a scenario where we rely more heavily on transmission that will likely take too long to develop. This would also not contribute greatly to the goal of maintaining reliability. Resources developed closer to energy load (or demand) increase reliability of the grid for local Oregon communities.

At the last large Advisory Group meeting, the use of biofuels was heavily emphasized as a Generating Option. While biofuels and clean fuels may have a role in the clean energy transition, we would like to ensure that the modeling of these generation options include their associated emissions when implemented. We have heard that the model will choose technologies based on reliability and cost, and therefore, we expect the model to choose wind, solar, geothermal, and hydropower over biofuels in most cases - in addition to the fact that they are non-emitting.

While the benefits of coal, gas, and nuclear were all brought up in the working group, Renewable Northwest strongly opposes any inclusion of these resources as they are not aligned with the states goals and the legislative direction to model the pathways to achieving HB2021 reduction targets. Further, although not a "*generating*" resource, utility-scale Battery Energy Storage Systems (BESS) should also be included in the reference scenario and included in this section. We expect more storage to be added to the grid. Storage will be an integral part of meeting GHG reduction goals and maintaining reliability - one of the characteristics that the model was said to prioritize.

Land use and Natural Resources

Renewable Northwest agrees with restricting the use of Level 1 and 2 areas as described in The Nature Conservancy's Power of Place study. We would like to see more information illustrated for the Land Use and Natural Resources section in the Draft Reference Scenario. Currently, there are not many assumptions included in the model. If the Power of Place Study will be used in more ways than mentioned, that information should be included in the document. One of the questions that has been asked of the Land Use and Natural Resources Workgroup is whether modeling for siting should look at restrictions on siting and whether siting renewable energy projects will get harder or easier. We actively work in the siting space and know that currently, the locations for which renewable energy projects can be sited is narrowing and it will become harder to site projects. It will be important for the Energy Strategy to suggest land usage numbers - based on the latest studies for energy density for solar and current industry standards - for meeting the scenarios analyzed.

Transmission and Distribution

Renewable Northwest understands that the only new transmission lines that will be included in the reference scenario (prior to 2035) are Idaho Power Company's (IPC) Boardman to Hemmingway project and PacifiCorp's (PAC) Gateway project. There are several efforts, mentioned below, that are working to model where additional transmission capacity will be needed in future scenarios. Additionally, as much as it is possible to model the cost impacts and benefits of implementation of grid enhancing technologies or use of existing right of ways would be welcome analyses. Equally, it is our understanding that the model assumes a single market and/or RTO. It would be helpful to clarify this as arriving at this scenario in the West may take time to realize.

Some additional studies we are aware of that could offer inputs and insights into transmission needs include the Connected West study by GridLab, Gridworks, and Energy Strategies - expected to be completed in the coming months. While this study is taking a west-wide approach, this is still applicable to the Oregon context as the state is increasingly connected to other states and markets, which offers the potential for efficiencies in electricity trading, but also in the need for transmission builds and connectivity. We strongly support using Bonneville Power Administration data on transmission builds. We also see IOU plans (PGE, PAC, and IPC Integrated Resource Plans, for example) as an important reference for understanding their future plans and strategies around transmission and distribution. These plans would also provide potential insight into the needs for east-west transfers to meet the demand in load centers. The Western Transmission Expansion Coalition (WestTEC) effort is generating regional transmission planning scenarios. This effort is still in process and may take some time for arriving at scenarios. However, following its work, assumptions, and efforts would benefit the Energy Strategy, if even to coordinate and deconflict.

The Distribution system cost assumption should include evolving costs such as those presented by wildfire risks. Given the history of dealing with wildfire, we suggest looking at what the California Independent System Operator and Pacific Gas & Electric use as proxy values with regard to wildfire costs.

We appreciate the opportunity to provide comments on the Draft Reference Scenario and look forward to continuing to collaborate on the Energy Strategy.

Sincerely,

Emily Griffith
Oregon Policy Manager
Renewable Northwest

Diane Brandt
Policy and Legislative Affairs Director
Renewable Northwest

The Nature Conservancy
Protecting nature. Preserving life.™

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September 4, 2024

Oregon Department of Energy

Public Comment: State Energy Strategy – Modeling Scenario Development

Submitted by Laura Tabor, Climate Action Director

Thank you for the opportunity to provide comments on Oregon Department of Energy (ODOE)'s State Energy Strategy modeling scenario development.

The Nature Conservancy in Oregon (TNC) is a science-based, non-partisan organization with 80,000 supporters and members in every county. Addressing the climate change crisis is a core component of TNC's work to create a world where people and nature can thrive. Investing in developing a clear, actionable State Energy Strategy is critical for Oregon to meet its clean energy goals, streamline the transition and deployment of clean energy infrastructure, and deliver positive outcomes to Oregonians.

We offer the following comments on the development of the State Energy Strategy modeling scenarios, including the reference scenario.

Reference Scenario

Considerations for Use of Power of Place – West Data. We are glad to see that ODOE plans to use the TNC Power of Place analysis to inform the reference scenario. It is important to recognize that Power of Place is not a predictive model with prescriptive solutions, but rather considers helpful scenarios that foster dialogue for how renewable energy in Oregon can be sited to limit environmental impact. We would also like to highlight some specific areas where more recent data are available, and encourage ODOE to use best available data to inform both the reference and alternative scenarios.

In particular, the offshore layers in Power of Place are limited and no longer represent best available science. Significantly more spatial data has been collected by the state, NOAA and BOEM in recent years (e.g. DOD data, updated fisheries data, etc.). We encourage the contractor and state staff to work with the DLCD, specifically Andy Lanier and others, to identify the most current data layers and utilize them. There is also more updated data available concerning big game migration corridors that would better reflect the best available science. ODFW has new big game corridor maps and new sage grouse maps (pending adoption) that would better represent these areas within the reference scenario.

Transmission Reconductoring and Co-location Assumptions. We support the proposal to analyze costs of reconductoring and co-location along with new corridor development. Reconductoring and co-location are critical to meeting new transmission capacity needs quickly and with least environmental impact. (slide 34 of the 8/22 meeting materials)

Transmission and Distribution Costs. It is important to be consistent across fuel types when considering additional cost implications related to how energy systems may evolve. For example, in scenarios assuming some level of both alternative fuel use and electrification, it is important to consider both the cost of using gas pipelines for alternative fuels and any costs (or benefits) of increased electrification and distributed energy resources for electric distribution.
Areas in Need of Clarification. There are a few areas where it is not clear from documentation how assumptions will be modeled. We look forward to continued conversation and explanation of the following:

- How, if at all, will the model consider community solar projects or other smaller scale renewables that are not rooftop installations, but smaller scale/not utility-scale development?
- What does the supply-side assumption for alternative clean fuel investment for the Climate Protection Program look like? Will the model be based on the original rules? Draft rules from ongoing rulemaking? Or will there be an opportunity to refine pending DEQ's final rulemaking anticipated later this year?
- How will biomass-derived fuel carbon intensity be reflected? The supply-side assumptions state both, that they "qualify as clean" and that the "Clean Fuel Standard [is] incorporated." We would prefer consistency across sectors in reflecting the actual carbon intensity of biofuel pathways as analyzed in the Clean Fuels Program; while we recognize Oregon statute treats biofuels as net-zero, modeling the actual emissions implications of these fuels is important for understanding the full implications of energy choices.

Alternative Scenarios

We look forward to future opportunities to provide feedback on proposed alternative scenarios. We are particularly interested in the following scenario elements and "what if" questions:

- What if increased east-west transmission capacity occurs sooner or is delayed? How do transmission constraints and siting and permitting speed interact with the relative growth of distributed versus utility-scale renewables development?
- What are the implications of leaning more into reconductoring and co-location as priority approaches to increasing transmission capacity while new corridors develop?
- What if there is greater uptake of agricultural measures, e.g. nitrogen and manure management, that don't fit neatly into energy or sequestration portfolios?
- With regard to offshore wind, we note that a very high development scenario is unlikely. In the Power of Place analysis, offshore wind selection in the model was relatively consistent across scenarios. Our understanding is that the model will not be spatially explicit in identifying potential areas for offshore wind development; this is important so as not to undermine the upcoming offshore wind road map effort which may call for proactive spatial planning for this resource.

What if electrification of transportation happens slower than expected?

Specific to public transit in general the following challenges and unknowns may impact this transition: utility energy capacity for full build-out of TriMet's battery electric bus operating/maintenance facilities, and transit centers. As of today, three (3) out of four (4) bus operating/maintenance facilities are planned for electrification. The average potential total energy demand is around 10 MW per site. It has been noted from Portland's local utility (PGE), that each of these sites will require upgrades to accommodate this grid capacity, as well as cost implications. I've included a preliminary utility assessment for each of these site for reference. In addition, if budget can be met, then the actual timeline to construct the utility upgrades and electric vehicle infrastructure have been expected to have delays as we've seen from other transit agencies that have already begun transitioning to zero emission vehicles (ZEV) at larger scales.

What if hydrogen end-use markets do not develop as quickly as anticipated? What if hydrogen is more expensive than anticipated?

TriMet is planning for its fourth operating/maintenance facility to primarily house hydrogen fuel cell buses (FCEB) that will utilize on-site liquid hydrogen storage for fueling these vehicles, up to 250 potential bus capacity. TriMet is committed to using green hydrogen supply for all potential FCEBs deployed. The challenges include there's currently no green hydrogen supply in the Pacific Northwest, and plans for implementing supply depots are unfortunately having initial process delays, such as with the Pacific Northwest Hydrogen Hub, which is planning funding for multiple locations with a small percentage of this specific to public transit. As of today, to potentially meet our 250 bus demand theirs is no supply locally that would help with cost effectiveness. The closest locations are in California or Canada, which both supplies are currently not green hydrogen.

Other Challenges to Consider:

- Cost per kilogram (Cost/kg) for hydrogen is the most expensive fuel as of today. Current costs some public transit agencies (mostly in California) have experienced is between $9/kg - $30/kg. A competitive fuel cost for hydrogen is closer to $5/kg or less. If costs per kilogram remain high this can potentially delay deployment.
- Reliability of on-site generation hydrogen stations. There has been some concerns with reliability of on-site generating stations such as electrolysis and natural gas reforming. Both Sunline Transit, Palm Springs & Champagne Urbana, Illinois electrolysis stations have had some issues with reliability.
- Redundancy/resiliency and more specifically for electricity as a fueling source. There have been multiple incidents of power outages and/or natural disasters that have taken electric bus fueling offline. This is still major unknown for public transit as they transition to zero emission technologies, even with a micro-grid type solution plan and how to best integrate these solutions with public transit's existing systems for the fueling infrastructure such as charge management systems (CMS).

PGE 2023 ANALYSIS AND ESTIMATES FOR TRIMET EV FLEET

April 8, 2023

Contributors:

Center Garage – Joshua Paulson
Merlo Garage – Aaron Banks
Powell Garage – Justin Graff
Distribution Planning Manager – Jennifer Galaway

TRIMET CENTER GARAGE

SYSTEM EXISTING STATE

The TriMet Center Garage (TCG) located on SE 17th Street between SE Center and SE Holgate Boulevard is currently being served by the Holgate-Gideon and Holgate-Rhone feeders. Holgate-Gideon is fed from the Holgate BR4 substation transformer and Holgate-Rhone is fed from Holgate BR5. TCG has no automatic transfer capability between these two feeders.

The total requested electrical vehicle charger load is 9.18 MW. The Holgate-Rhone and Holgate-Gideon feeders cannot absorb this new load without exceeding feeder planning criteria[1]. Substation capacity is also limited by the station transformers BR4 and BR5, which cannot accommodate the new load without exceeding transformer planning criteria[2]. Summer 2022 loading, planning criteria, and the remaining capacity prior to exceeding planning criteria are shown in the following table.

Feeder and Transformer Loading and Available Capacity Serving TriMet Center Garage				
Asset Name	Summer Rating (MVA)	Planning Criteria (MVA)	Summer '22 Peak Load (MVA)	Available Capacity (MVA)
Holgate-Rhone	13.5	9.0	3.9	5.1
Holgate-Gideon	14.3	9.6	4.9	4.7
Holgate BR4	19.8	15.8	12.4	3.4
Holgate BR5	22.4	17.9	16.9	1.0

REQUIRED UPGRADES TO SERVE 9.18 MW AT CENTER GARAGE

Holgate Substation Rebuild

PGE currently is working on the development of a capital project that will increase the capacity of the Holgate substation. A portion of this project involves upgrading the existing Holgate substation transformers BR4 and BR5 to 50 MVA transformers, which would provide enough transformer capacity to serve the TriMet Center Garage load addition. This project has not been funded yet so the timeline for completion is still to be determined.

New Dedicated Feeder to Serve 9.18 MW Load (projected cost: $4.14 million):

Building out a new feeder from the Holgate substation is the recommended solution for serving the full 9.18 MW of load at TCG. This feeder would be served by Holgate WR1 (formerly Holgate BR4). Below is a scope of work that would be required to build out a new dedicated feeder to serve TCG at full load.

1. New 2-3x750 KCMIL Al EPR feeder getaway (150')
2. New 1200A cable disconnect switch at transition between feeder getaway and overhead conductor for new feeder

[1] Planning criteria for a feeder is 67% of summer rating of the overhead conductor or underground cable.

[2] Planning criteria for a transformer is 80% of summer rating.

3. New dedicated feeder (0.58 miles) that is primarily underground 2-3X750 KCMIL Al EPR, including a few spans of overhead 795 KCMIL AAC used for crossing a railroad via a bridge. The path of this feeder runs south on 24th Ave, turns west on SE Holgate Blvd running along south side of street, and lastly is routed north on SE 17th terminating near TriMet Lost and Found on SE 17th Ave
4. Dual runs of 6" PVC conduit along entire length of underground feeder

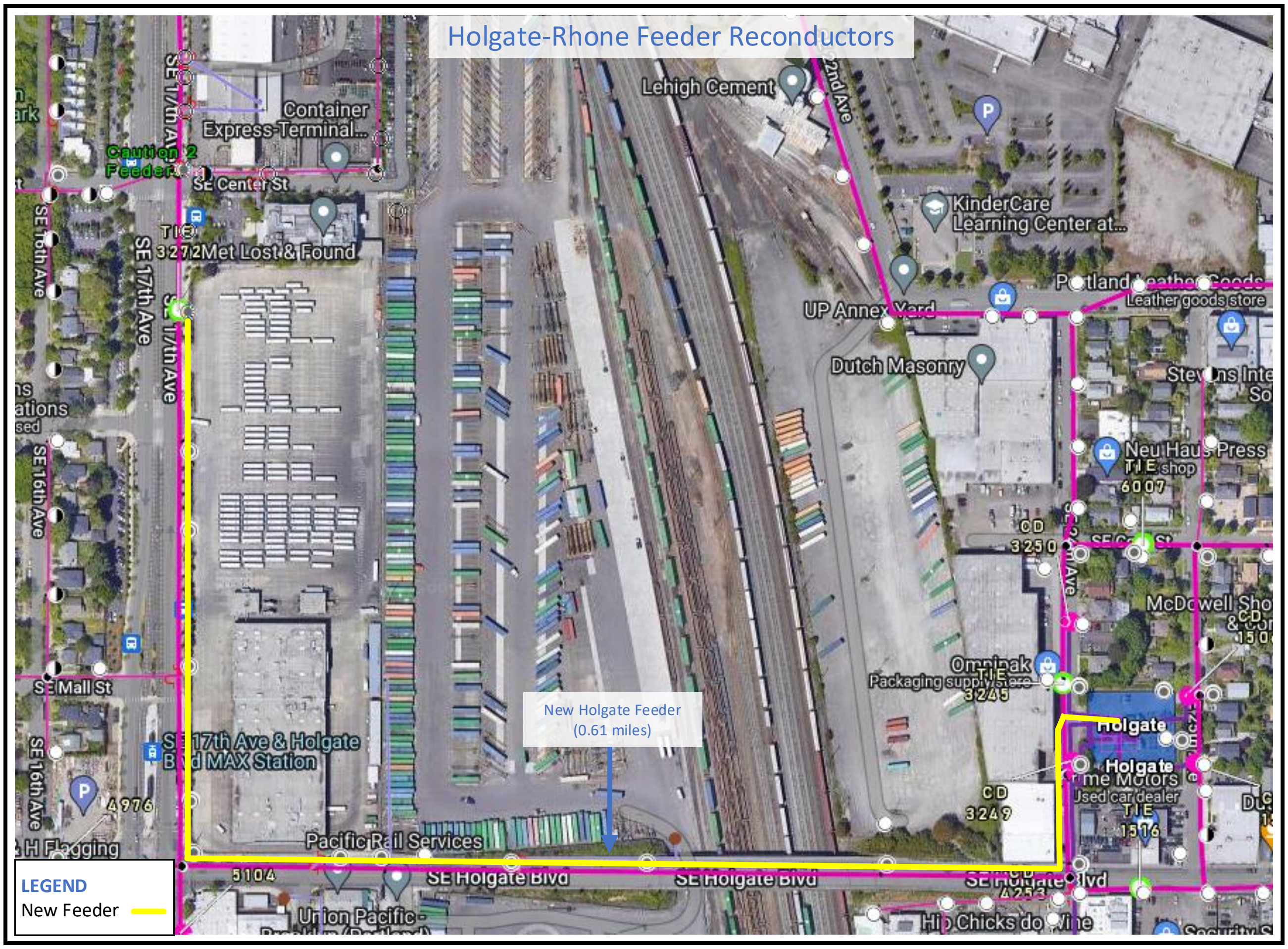

Figure 1 – New dedicated feeder to TriMet Center Garage

REQUIRED UPGRADES TO PROVIDE 9.18 MW OF ALTERNATE SERVICE AT CENTER GARAGE

Holgate-Rhone is the recommended alternate service feeder. Holgate-Rhone is served by a different substation transformer than the new feeder, therefore providing adequate redundancy for N-1 scenarios. In the previous analysis, Temp H-Neptune was proposed to be the alternate service feeder, but this will no longer be an option due to system reconfigurations driven by the Harrison Voltage Conversion Project. A reconductor of 0.24 miles of the Holgate-Rhone feeder will be necessary to provide capacity for alternate service.

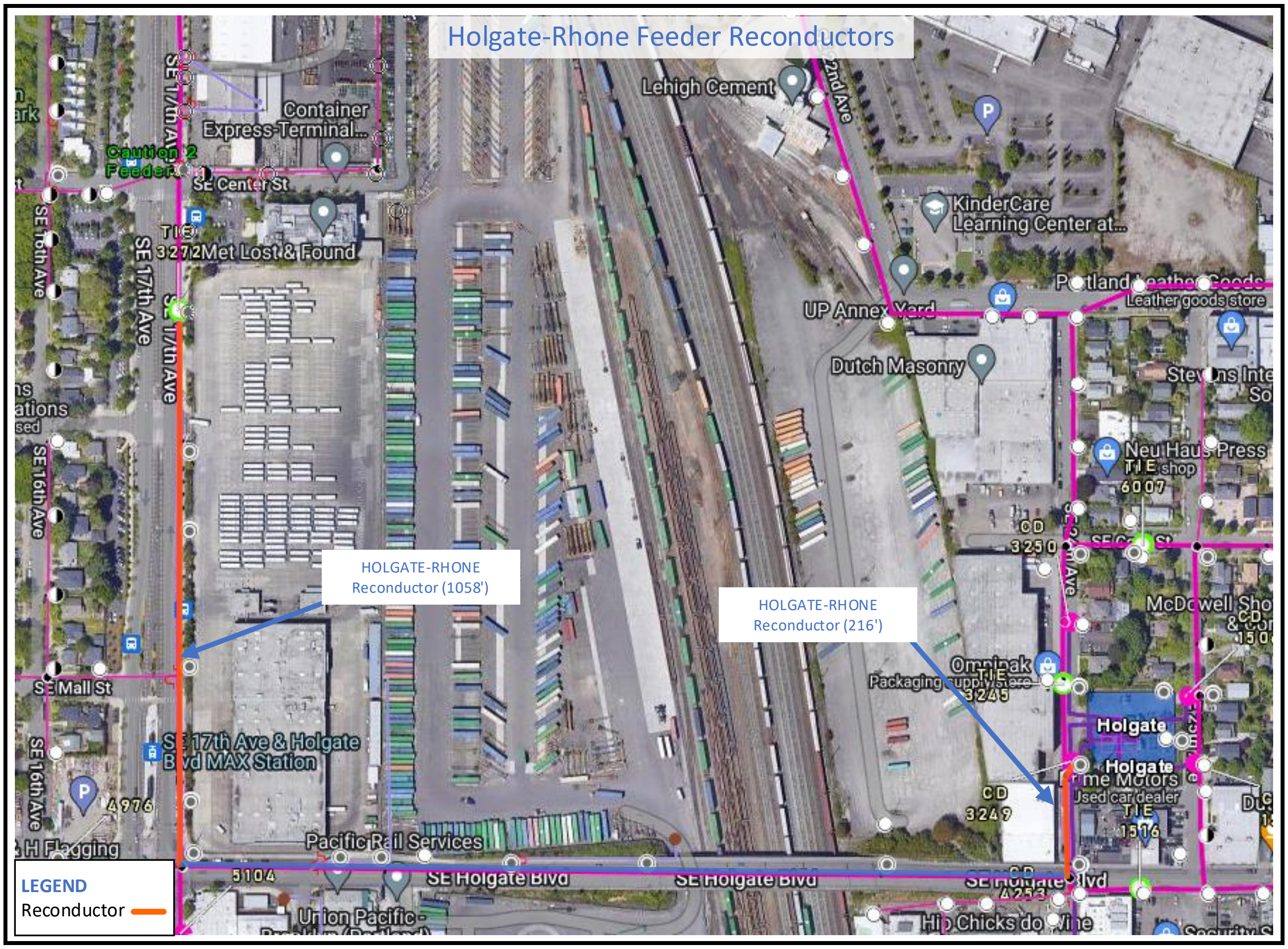

Figure 2 – Reconductors for Holgate-Rhone Alternate Service Feeder

The estimated cost of this feeder reconductor is $586,000.

TRIMET MERLO GARAGE

SYSTEM EXISTING STATE

The TriMet Merlo Garage is served by the St Marys East-Elmonica feeder and the St Marys East-Elmonica feeder is fed from the WR8 transformer in the St Marys East substation. The St Marys East-Elmonica feeder peaked at 10.5 MVA in summer of 2022, which means there is approximately 1.5 MVA (12.0-10.5=1.5) of available capacity on the feeder with no upgrades or changes. St Marys East WR8 peaked at 20.5 MVA in the summer of 2022. This means that WR8 has approximately 4.5 MVA (25.0-20.5=4.5) of available capacity with no upgrades or changes. With no upgrades or changes, there is 1.5 MVA of available capacity to serve the TriMet Merlo Garage.

REQUIRED UPGRADES TO SERVE 11.04 MW AT MERLO GARAGE

Since the previous Merlo Garage capacity analysis provided to TriMet, there has been load growth in the area affecting the St Marys East substation. This new load growth is projected to come online starting in late 2023. The new load growth will change what was previously required for a 11.04 MW load addition at the Merlo Garage.

St Marys East Substation Requirements

To accommodate 11.04 MW of new load at the Merlo Garage site, additional capacity will be required at both the feeder level and the substation transformer level. This will require the St Marys East substation to be upgraded. TriMet will be required to pay for their share of the substation upgrade cost.

- Upgrade both 28 MVA transformers (WR7 and WR8) to 50 MVA transformers
- Upgrade both 13 kV switchgears for WR7 and WR8 to 5 feeder position switchgear

Estimated Cost: (11.04 MVA/100.0 MVA) x ($7,589,062) = **$837,832**

New St Marys East Feeder Requirement

A new feeder from the upgraded St Marys East substation will required for a 11.04 MW load at Merlo Garage. Figure shows the most direct route for this new feeder. This route is along the TriMet max line on TriMet property. The feeder is recommended to be an overhead feeder due to Cedar Mill Creek and other wetlands in the area; however, permitting requirements may dictate that this feeder must be underground. Assuming overhead feeder construction, this new feeder would be approximately 0.45 miles long and would cost an estimated **$1,695,511**.

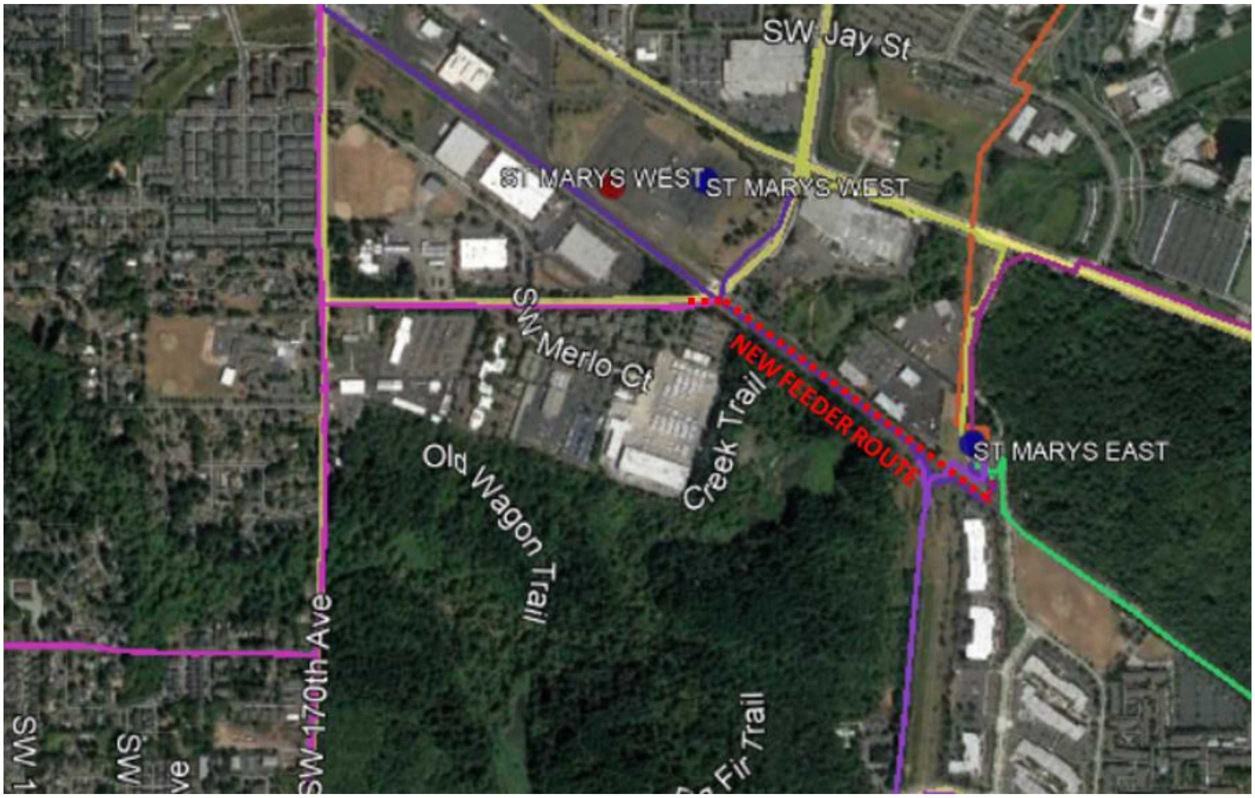

Figure 3 - Conceptual route of new feeder to serve Merlo Garage

REQUIRED UPGRADES TO PROVIDE 11.04 MW OF ALTERNATE SERVICE AT MERLO GARAGE

To provide 11.04 MW of alternate service to the Merlo Garage site, the same substation upgrades will be required. In addition to the new feeder shown in Figure , a second feeder from the St Marys East substation will be required.

St Marys East Substation Requirements

The same substation upgrades as required for the primary 11.04 MW service are required for the addition of the alternate service, with cost sharing being a higher percentage of the substation capacity.

Estimated Cost: (22.08 MVA/100.0 MVA) x ($7,589,062) = **$1,675,665**

New St Marys East Alternate Service Feeder Requirement

To provide alternate service a second feeder from the second 50 MVA substation transformer would be necessary. To be an effective alternate feeder, a separate route will be required. This separate route will not be as direct as the primary feeder shown in Figure . *Figure 4* shows the most direct route for an alternate feeder to serve the Merlo Garage. The feeder is recommended to be underground due to permitting requirements with the City of Beaverton. This new feeder would be approximately 0.85 miles long and would cost an estimated **$3,904,000**.

Figure 4 - Conceptual alternate feeder route for alternate service to Merlo Garage

TRIMET POWELL GARAGE

SYSTEM EXISTING STATE

The Kelly Butte-McGrew feeder currently supplies TriMet's Powell Garage, located on SE Powell Boulevard between I-205 and SE 99th Ave. Kelly Butte-McGrew has approximately 3 MW of available capacity on the feeder before upgrades will be required. While there is some available capacity on Kelly Butte WR2 beyond the 3 MW of the feeder, any upgrades to Kelly Butte-McGrew will be a temporary solution that would see redundant work and money sunk into a pathway from Kelly Butte Substation to Powell Garage that will change based on load projections. Regardless of what the ultimate buildout ends up being, once TriMet moves beyond the initial 3 MW/Phase 1 of the project at Powell Garage there will be a need for significant system upgrades to accommodate the full buildout.

REQUIRED UPGRADES TO SERVE 13.62 MW AT POWELL GARAGE

Kelly Butte Substation Upgrades

Kelly Butte Substation will require the addition of a new 28 MVA transformer and the associated 13 kV switchgear to provide adequate capacity to serve the proposed ultimate buildout at the TriMet Powell Garage.

- *115 kV Gas-Insulated Switchgear (GIS), Complete Demolition and Rebuild:* Remove the entire substation and rebuild with new GIS. No yard expansion required. Reroute all distribution and transmission lines for new locations. (1) new 115kV six-position GIS ring bus, overhead bushings. (3) 115-13kV 28 MVA transformers, (3) 13 kV metalclad switchgear.
    - **TriMet budgetary estimate:** (13.62/84) x ($17,223,036) = **$2,792,592**

Feeder Route from Kelly Butte Substation to Powell Garage:

- Underground option: To install an approximately 2-mile long fully underground feeder from Kelly Butte Substation with dual run 750KCM-AL underground cable. From the substation, the feeder will run east along SE Division Street to SE 112th Avenue, south to SE Powell Boulevard and then west to the Powell Garage.
    - **Budgetary estimate = $5,300,880**

- Overhead option: To install underground getaway from Kelly Butte Substation to getaway pole and install an approximately 2-mile long overhead Hendrix spacer cable by double-circuit on existing poles. From the substation, the feeder will run east along SE Division Street to SE 112th Avenue, south to SE Powell Boulevard and then west to the Powell Garage.
    - **Budgetary estimate = $2,612,127**

REQUIRED UPGRADES TO PROVIDE 13.62 MW OF ALTERNATE SERVICE AT POWELL GARAGE

Eastport Substation Upgrades

Eastport Substation will require the addition of a new 28 MVA transformer and the associated 13 kV switchgear to provide adequate alternate service capacity to serve the proposed ultimate buildout at the TriMet Powell Garage.

- *115 kV Open Air Expansion:* Install (1) 115-13 kV 28 MVA transformer, (1) 13 kV metalclad switchgear, and (2) 13 kV capacitor banks onto the recently expanded substation arrangement. No yard expansion. No modifications to existing equipment other than relay racks.
  - **TriMet budgetary estimate:** (13.62/28) x ($5,185,286) = **$2,522,271**

Feeder Route from Eastport Substation to Powell Garage:

- To reconductor approximately 1.5-miles of existing feeder to 795 AAC overhead conductor. Assume portion of the feeder will be underground to cross under I-205 (approx. 550 feet). From the substation, the feeder will run east along SE Holgate Boulevard to SE 92nd Avenue, north to SE Powell Boulevard and then east to the Powell Garage. Some field switching will be involved that will result in a lightly loaded feeder for the alternate service to Powell Garage.
  - **TriMet Budgetary estimate = $2,322,000**

Figure 5 - Conceptual new and alternate feeder route to Powell Garage

Thank you for the opportunity to comment as you develop Oregon’s Energy Strategy.

As you begin this process, I urge you to conduct a careful, on the ground analysis that identifies areas with the highest values for conservation of wildlife, biodiversity, and ecosystems—and once identified, to eliminate these areas from consideration for energy development right from the start. This will reduce time-consuming conflicts later in the process and help ensure that renewable energy development will not destroy the many essential ecosystem services that make life possible on earth, from providing clean air and water to regulating climate, the growing of crops, and the natural decomposition of wastes.

With this in mind, I also encourage you to consider siting new energy generation in “brownfield” areas that have already been developed for other purposes—or to consider areas where renewable energy can be co-sited with other uses and create co-benefits. This will also reduce conflicts, allowing for more rapid adoption of renewable energy generation.

If you consider a Floating Offshore Wind energy scenario, I urge you to ensure the model you use accurately represents the high conservation values of marine ecosystems. The base model under current consideration is inadequate for credible comparisons to other energy generation options. I’d like to see the least-cost analysis make sure to account for all costs, including loss of habitat.

Please also note that transmission from Southwestern Oregon will be extremely difficult and not just costly but destructive of valuable ecosystems and wildlife habitat.

I urge you to consider energy options that reduce or manage demand and that increase energy efficiency. For example, Oregon may want to consider policy options that provide significant incentives for energy conservation or that encourage development of sustainable industries rather than those that demand high-energy, such as data centers.

Finally, I urge you to consider full life-cycle analysis for different energy sources to ensure that we’ll not be reducing greenhouse gas emissions in energy generation while also increasing greenhouse gas emissions to manufacture the infrastructures needed.

Thank you for your attention.

Sincerely,
Vicki Graham