Oregon Renewable Energy Siting Assessment (ORESA) Overview

October 2020

OREGON DEPARTMENT OF ENERGY

OREGON Department of Land Conservation & Development

Institute for Natural Resources

NAS WHIDBEY ISLAND

ORESA Project

The ORESA project is funded through a $1.1 million **U.S. Department of Defense Office of Economic Adjustment** (DOD-OEA) grant awarded to the Oregon Department of Energy, working with the Department of Land Conservation & Development and Oregon State University's Institute for Natural Resources.

ORESA Project Goals and Objectives

DOD-OEA's overarching goal is to support military compatibility through coordination with local, regional, and state agencies and raise awareness about the military through the ORESA project.

Key project goals are to create relevant educational tools for stakeholders, agencies, local governments, and policy makers about renewable energy development, military training and operational areas, economic/community benefits, land use considerations, natural, cultural, and environmental resources, and other regulatory requirements.

Key project objectives are baselining data, information, and perspectives to create a transparent, consistent collection of trusted, accurate information in Oregon, without recommendations or endorsements, and noting where information may be imprecise or uncertain.

ORESA Project: 5 Components

- - - PHASE 1 - - -

1. Renewable Energy Market & Industry Assessment (Led by ODOE and supported by Consulting Firm – E3: Energy and Environmental Economics) – Collect data and model the future opportunity for development of renewable energy generation and transmission infrastructure in Oregon. Develop cost-optimized, renewable energy build-out scenarios for Oregon over the next 15 years. Build an understanding of the challenges and opportunities that exist in the renewable development community in Oregon and identify gaps that could be addressed for Oregon to meet its long-term energy goals.

ORESA Project: 5 Components

- - - PHASE 1 - - -

2. Military Needs & Interests Assessment (Co-led by ODOE and DLCD and supported by Consulting Firm – Epsilon System Services) – Collect data and information about current and future military assets, uses, needs, and case studies. Analyze data, protocols, and policies regarding military training and operating areas, including current and anticipated future uses. Note any constraints and opportunities between renewable energy development and military uses.

ORESA Project: 5 Components

- - - PHASE 2 - - -

3. Natural Resources, Environment, and Development: Opportunities & Constraints Assessment (Led by DLCD and supported by Consulting Firm – CBI: Conservation Biology Institute) – Collect data and information regarding the presence of natural, cultural, and environmental resources, as well as, jurisdictional protections, development constraints, and commercial interests. Collect data and information regarding community and economic opportunities with renewable energy development. Build an understanding of renewable energy opportunities and constraints, including regulatory structures and protections vested with Tribal governments and local, state, and federal agencies.

ORESA Project: 5 Components

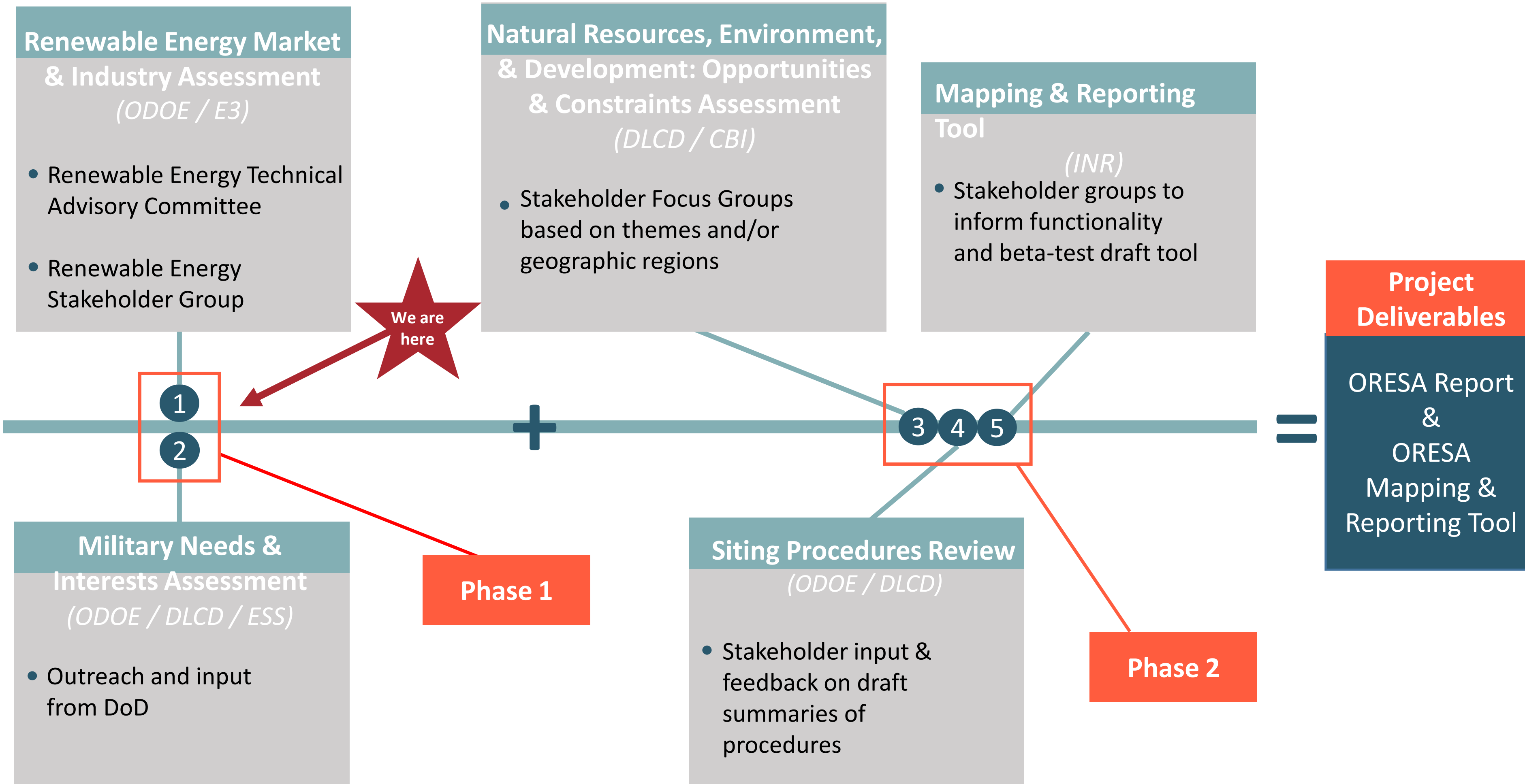
- - - PHASE 2 - - -

4. Siting Procedures Review (co-led by ODOE and DLCD) – Review and analysis of siting regulations, permitting, and project review processes as they relate to notification, identification, and evaluation of potential impacts. Develop summary of siting regulations and process review with feedback from stakeholders. Identify best practices in tools and strategies for engagement and improved coordination.

ORESA Project: 5 Components

- - - PHASE 2 - - -

5. Mapping and Reporting Tool (led by INR) - Develop a mapping and reporting tool, housed on Oregon Explorer, with data and information about renewable energy; military training and operational areas; economic development opportunities; land use considerations; natural, cultural, and environmental resources; and other regulatory requirements. The tool should build a more comprehensive understanding of renewable energy and transmission development and support proactive coordination with stakeholders, agencies, local governments, and policymakers in the state. Development of the tool will involve stakeholders to help define use cases and reporting functionality.


Renewable Energy Market & Industry Assessment
(ODOE / E3)
Renewable Energy Technical Advisory Committee
Renewable Energy Stakeholder Group
We are here
Natural Resources, Environment, & Development: Opportunities & Constraints Assessment
(DLCD / CBI)
Stakeholder Focus Groups based on themes and/or geographic regions
Mapping & Reporting Tool
(INR)
Stakeholder groups to inform functionality and beta-test draft tool
Project Deliverables
ORESA Report & ORESA Mapping & Reporting Tool
1
2
+
3
4
5
=
Military Needs & Interests Assessment
(ODOE / DLCD / ESS)
Outreach and input from DoD
Phase 1
Siting Procedures Review
(ODOE / DLCD)
Stakeholder input & feedback on draft summaries of procedures
Phase 2

Stay in touch!

Learn more about the ORESA project:

https://www.oregon.gov/energy/energy-oregon/Pages/ORESA.aspx

Sign up for email updates on the ORESA project:

http://web.energy.oregon.gov/cn/a6n53/subscribe

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Renewable Energy Market Assessment Project Update

Stakeholder Meeting

Wednesday October 14th, 2020

Nick Schlag, Director
Femi Sawyerr, Consultant
Charles Gulian, Consultant
Emily Leslie (Energy Reflections)

Agenda

- **Introduction and background**
  - Assessments key elements
  - Status updates
- **Scenario design**
  - Framework for scenario analysis
  - Proposed scenarios
- **Methods & assumptions**
  - Modeling overview
  - Demand for renewable energy
  - Renewable resource potential & cost
  - Transmission considerations
  - Analysis outputs overview
- **Wrap up & next steps**

Meeting protocol

- **Participants are encouraged to ask clarifying questions during the presentation**
  - We'll keep an active eye on the "Chat" window, so feel free to drop questions there
- **We'll reserve open discussion for specific points in the presentation between sections**
- **The webinar is being recorded so attendees are encouraged to state their name and organization when asking questions**
- **Attendees are encouraged to mute their devices when not asking questions**

Introduction and Background

Renewable Energy Assessment key elements

+ **ODOE has engaged E3 to conduct renewable energy assessments to achieve three objectives:**
  1. Quantify the future opportunity for development of renewable energy generation and transmission infrastructure in Oregon
  2. Develop cost-optimized, renewable energy build-out scenarios for Oregon over the next 15 years, and
  3. Develop an understanding of the constraints and opportunities that exist in the renewable energy development industry

Renewable Energy Market Assessment

- Characterize renewable resource development potential in Oregon
- Create a range of plausible scenarios for renewable buildout within the state of Oregon over the next fifteen years

Renewable Energy Industry Assessment

- Collaborate with industry stakeholders and representatives to identify and characterize barriers and opportunities for renewable development within the state

REMA highlights

- **The primary purpose of the REMA is to provide plausible projections of how much renewable energy and infrastructure might be built in Oregon over the next 15 years**
- **To achieve this purpose E3 is conducting an analysis using a custom spreadsheet model that will utilize a scenario analysis approach to project multiple futures of renewable energy development**
  - Will consider several variables including resource economics, energy policy, commercial interest, and land use impacts
- **There are three main goals of this assessment**
  - Identify the type, quantity, and quality of resources available for Oregon to meet its long-term clean energy goals
  - Understand the existing and future transmission needs for development of these resources
  - Understand the tradeoffs that exist with different geographic resource constraints
- **This presentation presents the proposed scenarios and will highlight some key inputs and assumptions for the modeling**

Status update

+ Renewable Energy Industry Assessment

- Industry survey soliciting input on development landscape sent to about 23 organizations
- Once all surveys are collected and reviewed, we'll reach out on an individual basis for follow up

+ Renewable Energy Market Assessment

- Draft renewable supply curve is mostly completed
  - Will incorporate input from other ORESA partners to finalize inputs
- Data gathering for additional inputs and assumptions is mostly completed
  - Will incorporate feedback from stakeholders to finalize inputs
- Development of scenario analysis tool in progress - finalizing initial version
  - Will incorporate input and assumptions feedback from TAC and other stakeholders

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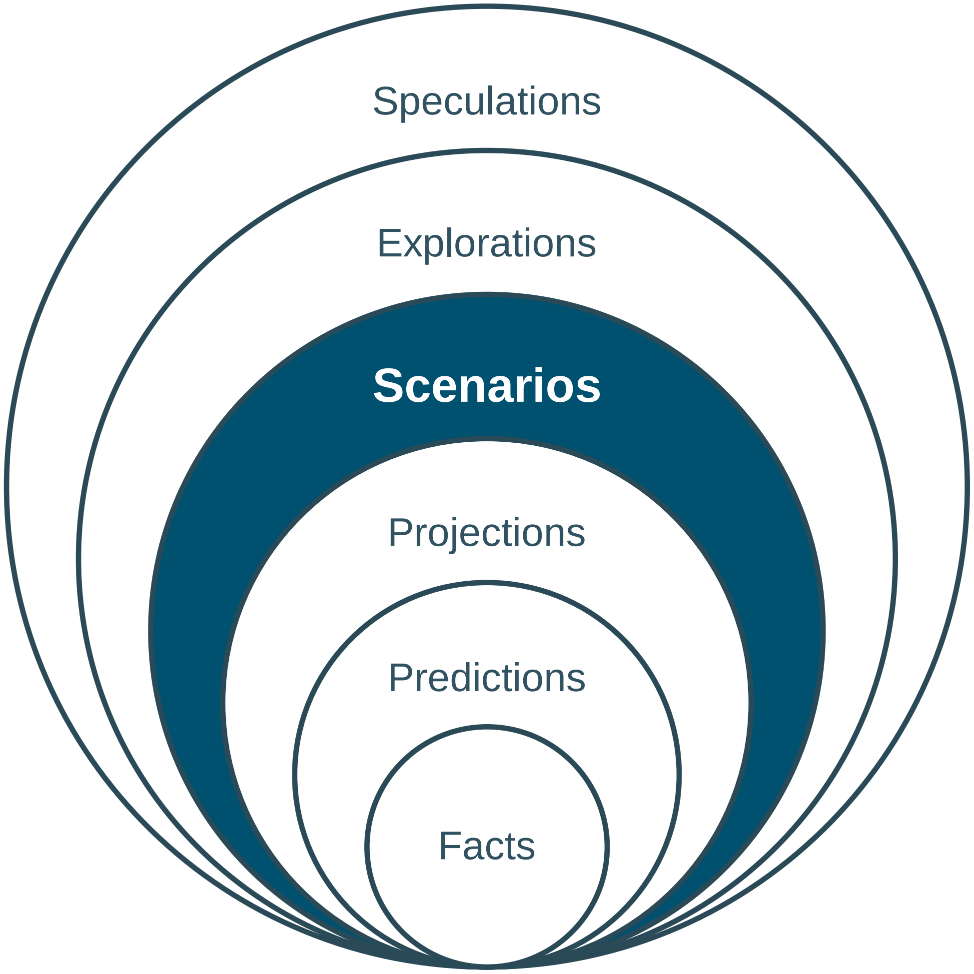
Scenario Design

Scenario analysis framework

- This study uses scenario analysis to identify and analyze plausible outcomes for renewable development within the state of Oregon over the next fifteen years

- Goal of scenario analysis is not to predict an outcome—but to highlight key drivers of and differences between scenarios to inform future decision making



Issues & questions to consider in choosing scenarios

+ **REMA will use scenario analysis to identify multiple plausible portfolios that capture plausible outcomes for renewable development in Oregon in the next 15 years**
+ **Many factors could affect development patterns in the state:**
  - Commercial viability & scalability of technology options
  - Limitations of existing transmission system and challenges of building new
  - Future load growth, including efficiency and electrification
  - Competing land uses
  - Voluntary commitments for additional procurement
  - Increased deployment of distributed energy resources (DER)
  - Increased/accelerated state policy targets
  - Focus on in-state vs. out-of-state procurement to meet Oregon's needs
  - Procurement of resources in Oregon to meet needs of other states

Scenario analysis approach will provide a range of portfolios

+ **List of planned scenarios chosen to examine a range of potential outcomes that highlight key challenges and implications of achieving development at scale within the state**
  - Key themes chosen in scenario design are **geography**, **technology**, and **transmission**

Scenarios Identified for Analysis

1 — Columbia Gorge Focus

Emphasis on continued development of renewables within the Columbia River Gorge

Low renewable demand (1a) and High renewable demand (1b)

2 — Central/Eastern Oregon Focus

Emphasis on development of remote resources in southeast Oregon

High renewable demand

3 — Distributed Resource Focus

Emphasis on development of distributed resources near loads that limit need for new transmission

High renewable demand

4 — Offshore Wind Focus

Emphasis of development of offshore wind resources to meet Oregon's needs

High renewable demand

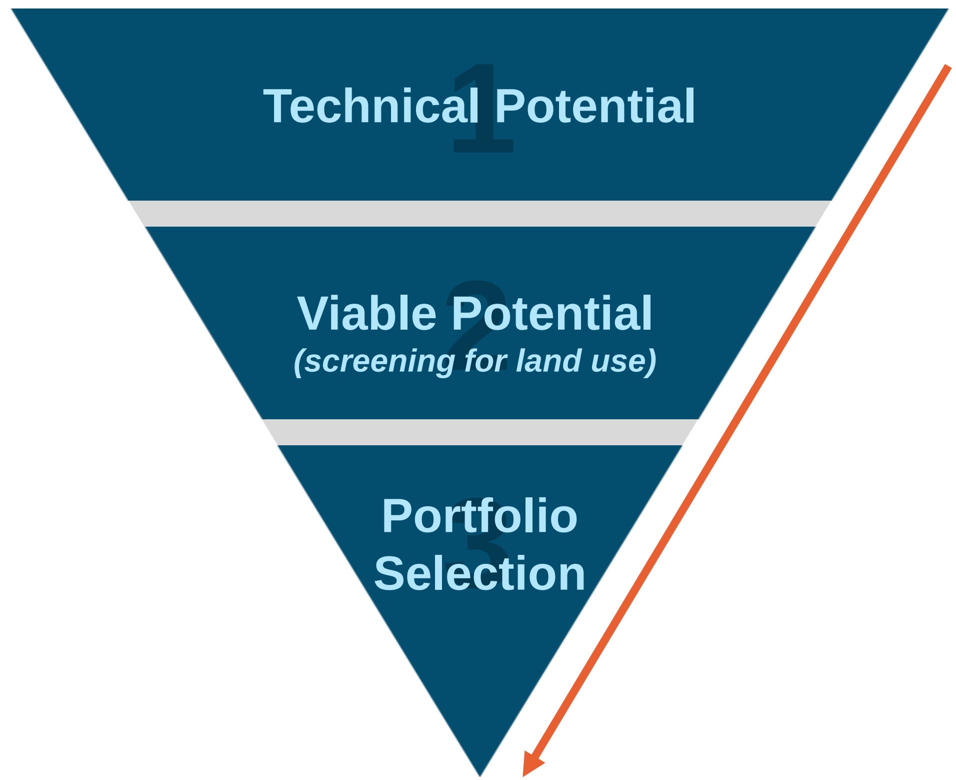
Each scenario's focus indicates the primary – but not the only – source for new renewables in that scenario (i.e. each scenario will include some geographic and technological diversity)

Modeling Assumptions & Methodology

Overview of data collection and modeling

- REMA effort will focus on developing plausible portfolios of resources informed by detailed technical assessment of resource options to meet future state goals and other drivers of renewable development
- Three phases of analysis will provide a continuous opportunity to narrow and refine focus on potential resources
- Inputs & assumptions presented today are draft and subject to further review and revision
- Final results will illustrate a range of potential outcomes, incorporating multiple scenarios

Developing Renewable Portfolios



Overview of portfolio development

INPUTS

- Demand Forecast
- Policy Goals
- RE Procurement

- Resource Potential *(including land use data)*
- Resource Cost
- Transmission Impact
- Energy Value
- Capacity Value
- Commercial Interest

MODEL LOGIC

Renewable Demand

Calculate demand for renewables to meet scenario defined goal

Renewable Supply Curve

Identify and rank resources to meet future policy needs based on:

(1) resource economics,
(2) commercial interest,
(3) land use implications

Renewable Resource Selection

Select resources to fill renewable net short according to the definitions of the specified scenario

OUTPUTS

Renewable Portfolios

Report out specific resources in each portfolio and provide associated GIS data

Overview of portfolio development

INPUTS	MODEL LOGIC	OUTPUTS

Inputs:
- Demand Forecast
- Policy Goals
- RE Procurement
- Resource Potential *(including land use data)*
- Resource Cost
- Transmission Impact
- Energy Value
- Capacity Value
- Commercial Interest

Model Logic:

Calculate demand for renewables to meet scenario defined goal

Renewable Resource Selection

definitions of the specified

Identify and rank resources to

(2) commercial interest,
(3) land use implications

Outputs:

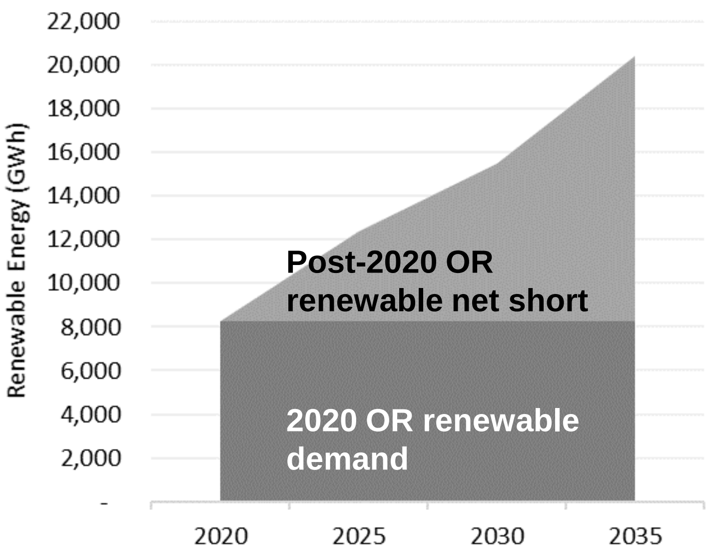
Renewable Portfolios

Report out specific resources ...tfolio and provide ...ted GIS data

Callouts:
- NWPCC Eighth Power Plan (draft)
- GIS analysis incorporating data from NREL, state agencies, and other ORESA study contributors
- NREL 2020 Annual Technologies Baseline, NWPCC Eighth Power Plan (draft), NREL 2019 Offshore Wind Study
- Discussions with BPA and NorthernGrid
- NWPCC Resource Adequacy Analysis

Multiple factors will affect demand for renewable development in Oregon

- **Oregon's RPS policy will require utilities to procure significant amounts of new renewable resources**
  - 50% by 2040 for large IOUs
  - 25% by 2025 and thereafter for large COUs (>3% of retail sales)
  - 10% by 2025 and thereafter for small COUs (1.5% - 3% of retail sales)
  - 5% by 2025 and thereafter for smallest COUs (<1.5% of retail sales)



To meet 2035 RPS goals under current policy, OR utilities will have to procure a total of 12 TWh of new generation (based on NWPCC Seventh Power Plan draft demand forecast)

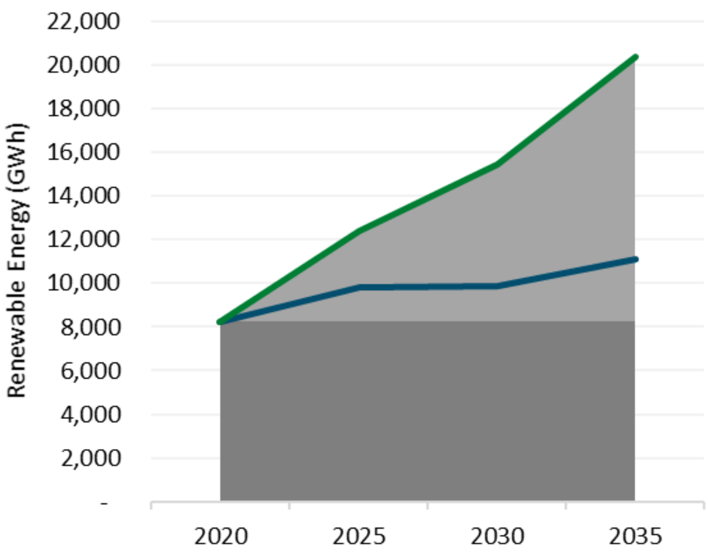
The amount of new generation built in the state of Oregon over this period could be substantially lower due to procurement of resources outside Oregon to meet Oregon's RPS goals

Other factors could cause this "net short" to increase and could lead to more development within Oregon:

- *Voluntary commitments by utilities and corporate entities*
- *Increased policy goals*
- *Higher load growth due to electrification*

Multiple factors will affect demand for renewable development in Oregon

+ **Recognizing the uncertainties that will affect the amount of development in the state, our analysis considers two levels of "demand" for renewable development <u>within the state of Oregon</u>:**
  1. **"Low Renewable Demand"** based on current RPS targets and utility plans as filed in IRPs
  2. **"High Renewable Demand"** that could reflect any combination of:
     – Increased reliance on Oregon resources to meet current policy goals;
     – Future increases in Oregon's clean energy policies; or
     – Increased demand due to higher loads driven by electrification



B ***<u>High Renewable Demand Scenario</u>***

- *Calculated as all utilities meeting current policy needs with in-state resources but could also reflect increased demand from "Low Demand" scenario due to increase in policies or loads*
- *Not intended to be predictive but to test impacts of higher levels of in-state development*
- *Modeled in Scenarios 1-4*

A ***<u>Low Renewable Demand Scenario</u>***

- *COUs meet renewable needs with in-state resources*
- *Pacificorp & PGE procure resources within OR consistent with most recent IRPs (and rely heavily on out-of-state resources)*
- *Modeled only in Scenario 1*

Renewable supply curve development

- To develop a "supply curve" for renewable resources in Oregon, we evaluate the potential, performance, and cost for new renewables in the state
- Technical potential and performance for renewable development in Oregon evaluated through detailed geospatial analysis
  - Data sources include NREL, RETI, EPRI, Geothermex
  - Geographic screening data was used to refine the technical potential data
- Cost projections for renewable development developed from publicly available data and studies:
  - **2020 NREL Annual Technology Baseline (ATB)**
  - 2019 NREL study of Oregon offshore wind resources
- The result of these efforts is a data library of renewable resources in Oregon that are available for development

Details of geospatial resource analysis

- **For onshore resources, a 20-mile area was identified in proximity to transmission lines with ratings of 115 kV and above**
  - Raw resource potential was obtained from NREL and RETI (NSRDB2 + SAM, Wind Toolkit 2020, Geothermex "Potential Geothermal Resource Areas of Oregon")
- **For offshore wind:**
  - Raw resource potential was obtained from NREL (Wind toolkit metadata, 50 TB dataset released 2020)
- **For wave energy**
  - Raw resource potential was obtained from EPRI (Mapping and Assessment of the United States Ocean Wave Energy Resource and from NREL Marine and Hydrokinetic Atlas))
- **Three geographic screens have been developed to explore a range of different land-use constraints upon renewable energy potential in Oregon**
  - Siting Level 1: Legally protected areas
  - Siting Level 2: Administratively protected areas
  - Siting Level 3: High conservation value areas
- **The geographic screen analysis is not intended to predetermine site suitability for renewable development, but does help illustrate tradeoffs among competing priorities**

Geographic screen definitions

Siting Level 1: Legally Protected Areas

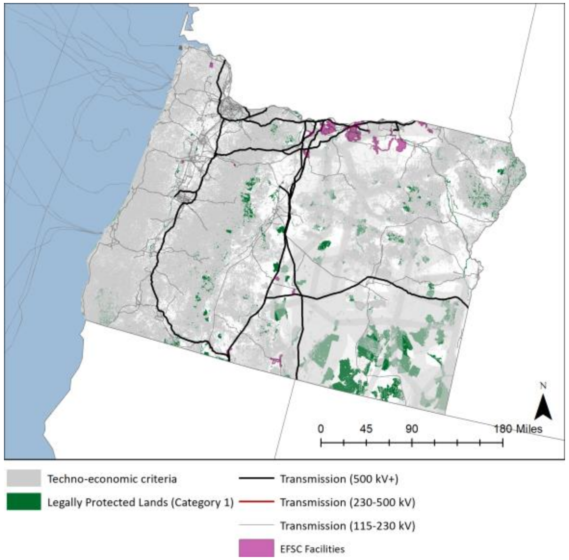
- Areas where existing legal restrictions prohibiting energy development
- Examples: Military areas, National Wildlife Refuge, National Parks

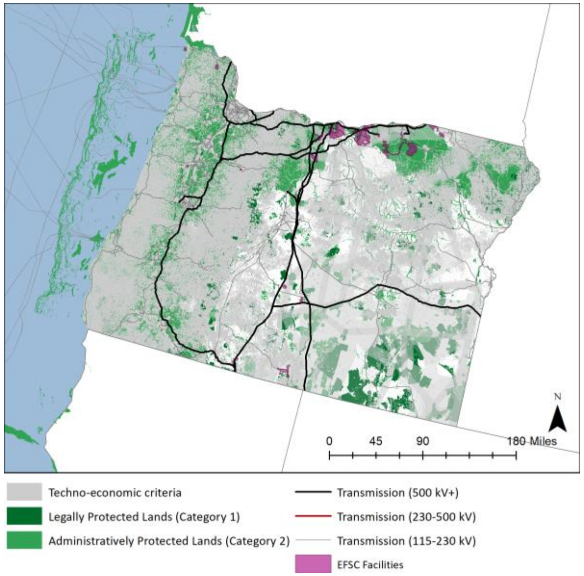
Siting Level 2: Administratively Protected Areas

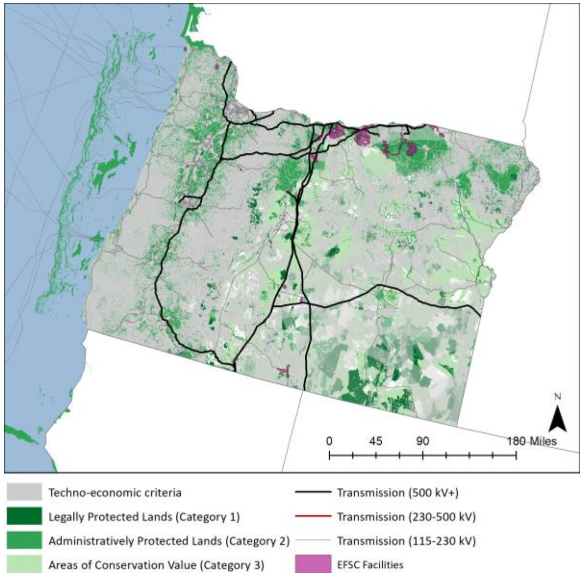
- Areas where the siting of energy requires consultation or triggers a review process to protect ecological or cultural values or natural characteristics
- Examples: Critical Habitat for Threatened or Endangered Species, wetlands

Siting Level 3: High Conservation Value Areas

- Areas with high conservation value Despite their conservation value, these lands typically do not have formal conservation protections
- Examples: Important Bird Areas, big game priority habitat, The Nature Conservancy Ecologically Core Areas)





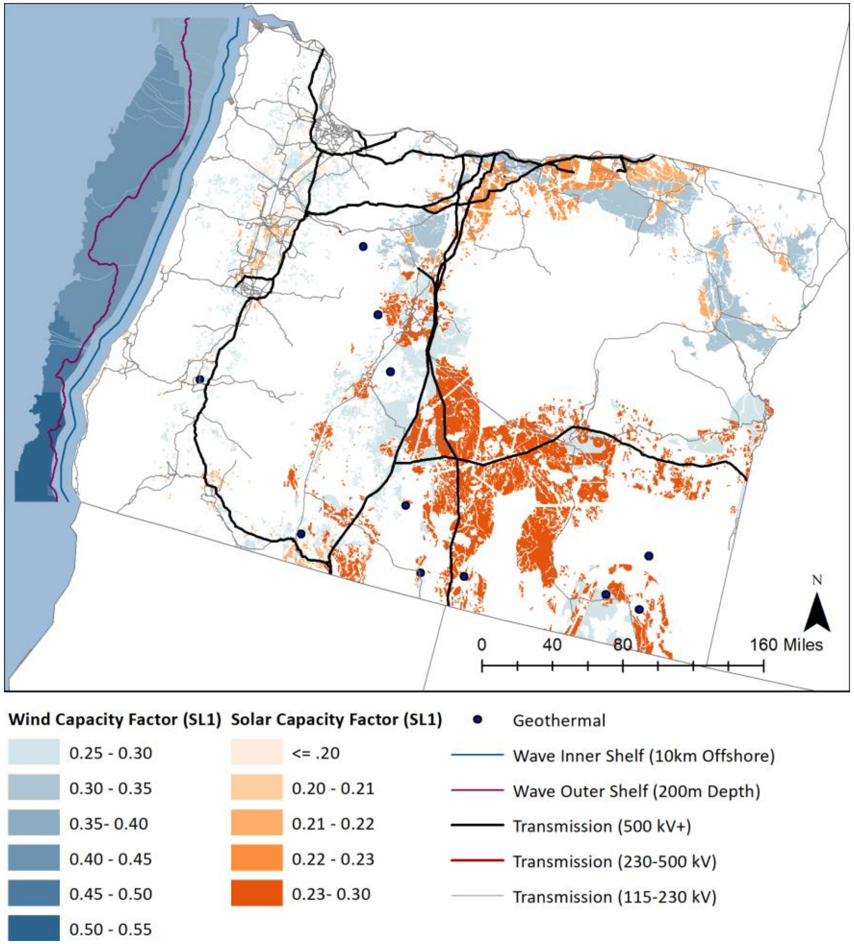


Goal of exploring multiple geographic screens is to illustrate tradeoffs between competing priorities but is not intended to predetermine site-specific suitability for renewable development

Legally protected geographic screen allows vast amounts of RE potential

Resource	Cap. Factor (%)	SL 1 Potential (GW)
Solar	<20%	74.6
	20-21%	-
	21%-22%	198.5
	22%-23%	191.7
	23%-30%	1,065.4
Wind	25-30%	31.8
	30%-35%	23.1
	35%-40%	-
Offshore Wind	35%-40%	29.4
	40%-45%	110.5
	45%-50%	13.2
	50%-55%	22.0
Geothermal	80%	0.4
Wave	25%-45%	9.0
Bioenergy		Pending

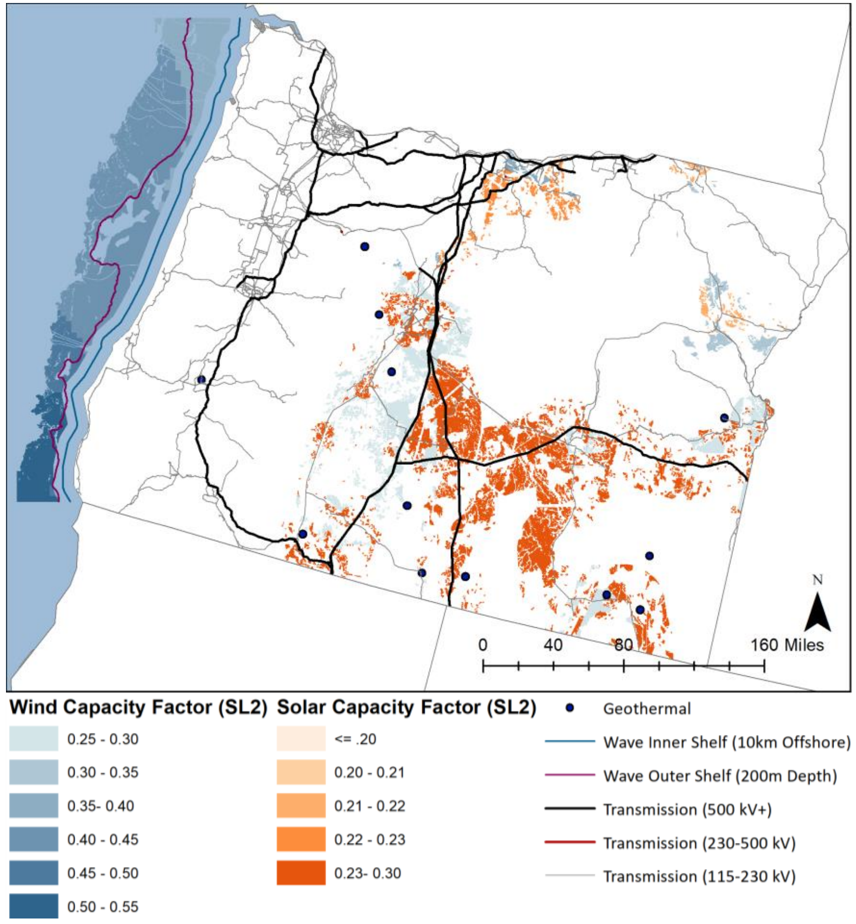
Resource Potential, Siting Level 1



Administratively protected geographic screen allows significant amounts of RE potential

Resource	Cap. Factor (%)	SL 2 Potential (GW)
Solar	<20%	-
	20-21%	-
	21%-22%	27.8
	22%-23%	64.1
	23%-30%	840
Wind	25-30%	20.6
	30%-35%	2.6
	35%-40%	0.9
Offshore Wind	35%-40%	27.9
	40%-45%	97.0
	45%-50%	11.4
	50%-55%	20.8
Geothermal	80%	0.4
Wave	25%-45%	9.0
Bioenergy		Pending

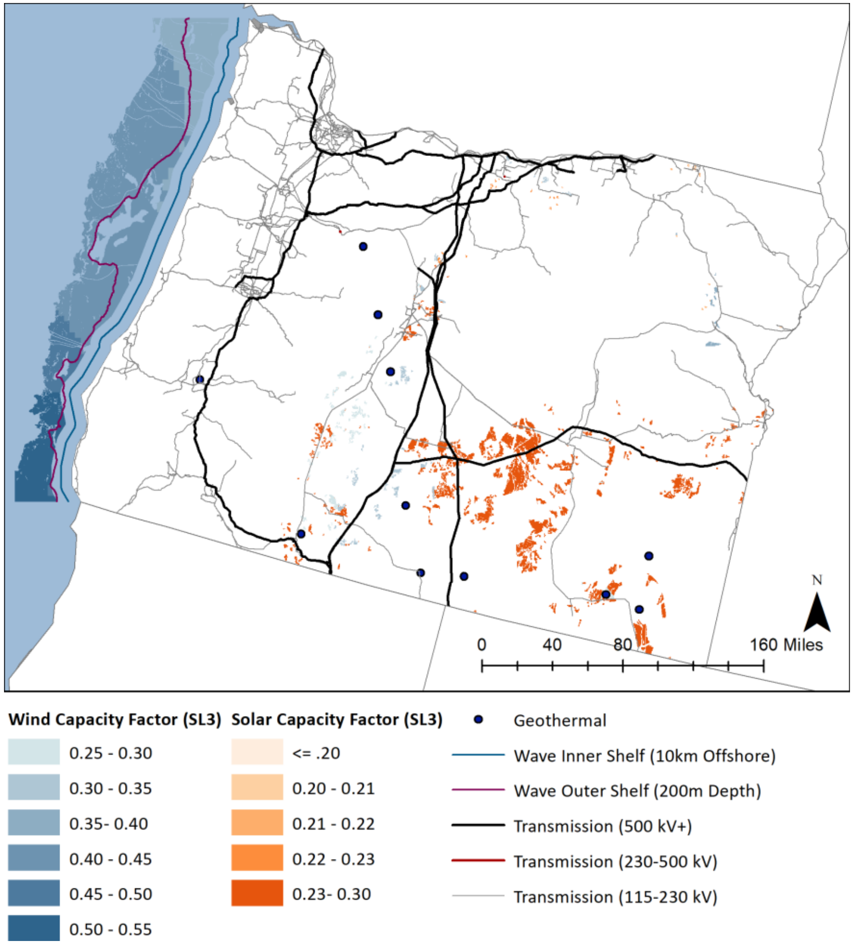
Resource Potential, Siting Level 2



High conservation value geographic screen greatly reduces the RE potential

Resource	Cap. Factor (%)	SL 3 Potential (GW)
Solar	<20%	-
	20-21%	-
	21%-22%	1.8
	22%-23%	2.7
	23%-30%	227.2
Wind	25-30%	1.1
	30%-35%	1.2
	35%-40%	0.2
Offshore Wind	35%-40%	27.9
	40%-45%	97.0
	45%-50%	11.4
	50%-55%	20.8
Geothermal	80%	0.4
Wave	25%-45%	9.0
Bioenergy		Pending

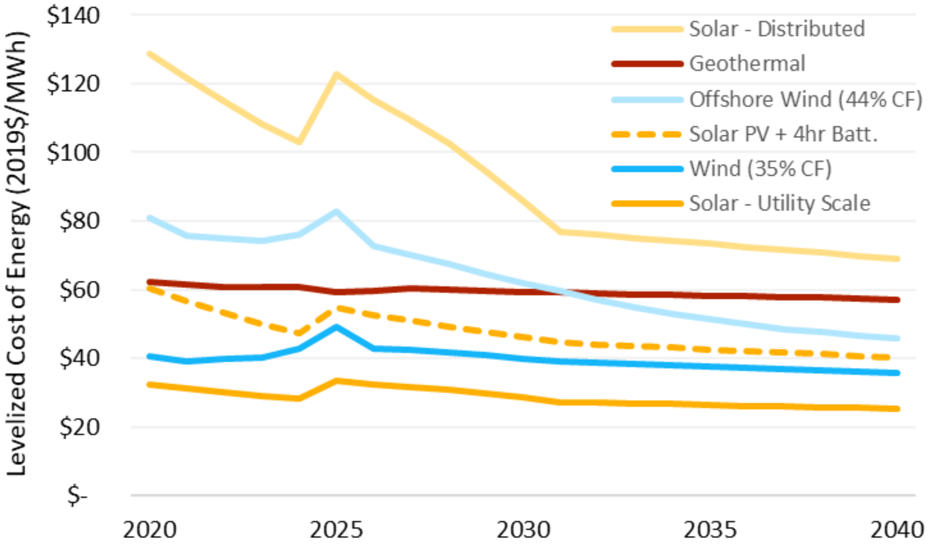
Resource Potential, Siting Level 3



Resource costs based on public data sources

+ Capital costs, and O&M costs are analyzed using a proforma model developed by E3 to obtain levelized cost of energy (LCOE) values for each technology
+ Geothermal, solar, and onshore wind resource costs are based on the 2020 NREL Annual Technology Baseline (ATB)
+ Offshore wind resource costs are based on the 2019 NREL Oregon study
+ Wave/Tidal energy costs are based on the 2015 Ocean Energy Systems study

LCOE Trajectory for RE Resource (2019$/MWh)



Average LCOE estimates for Biomass and Wave Energy are $127/MWh and $113/MWh respectively

LCOE values exclude cost of bulk transmission system upgrades

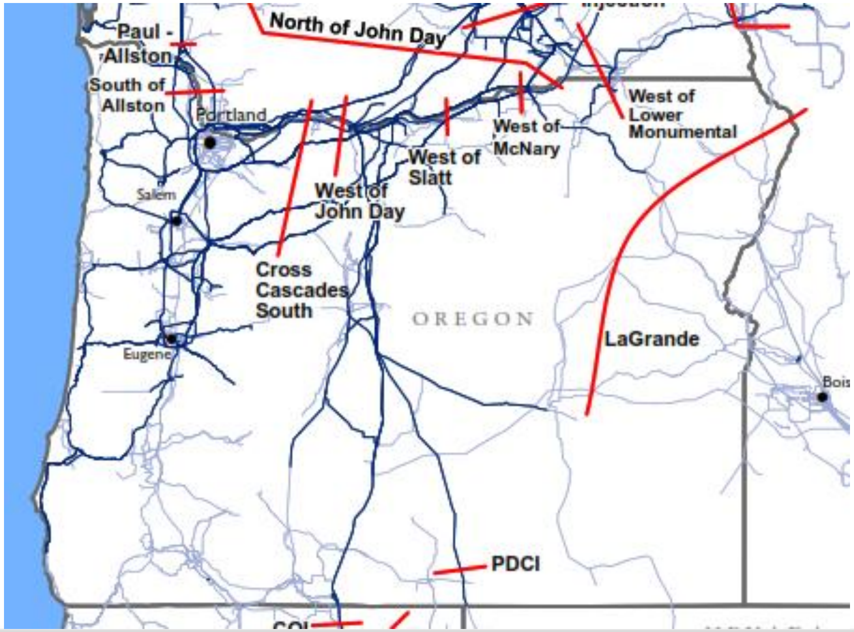
Approach to considering transmission

- **Joint planning of transmission and generation is complicated!**
- **To understand implications of renewable development on transmission needs, we ask three questions:**
  - Where are key transmission constraints within Oregon?
  - How much new capacity can be developed within limits of existing system?
  - How much will investments to expand capacity cost?
- **Discussions with BPA and NorthernGrid have informed development of a zonal approach to transmission needs and costing in REMA scenario tool**
  - Available "headroom" based on Available Transmission Capacity (ATC) combined with estimates of system's ability to serve local needs
  - Costs of transmission upgrades based on BPA 2019 Cluster Studies and NorthernGrid estimates

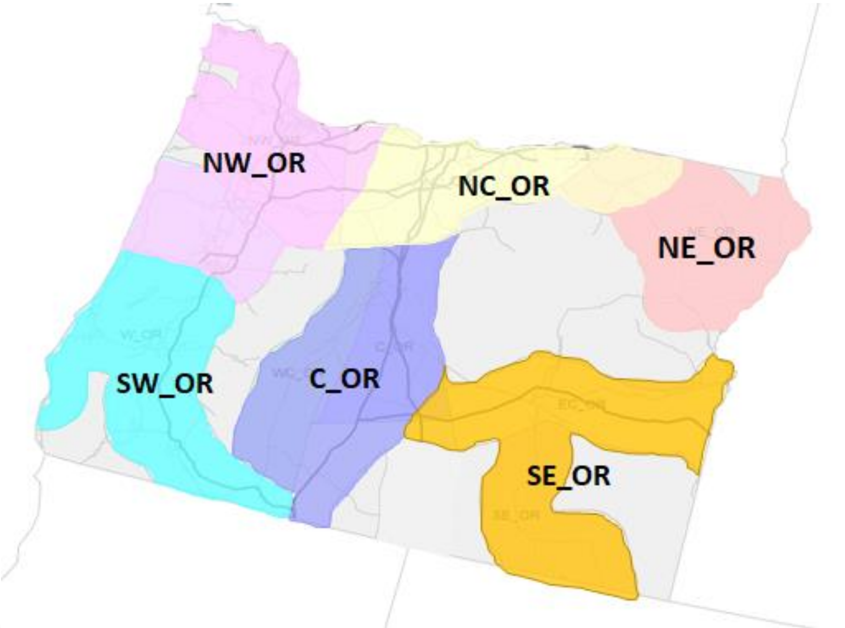
Developing transmission zones for Oregon

- **Based on discussions with BPA and NorthernGrid, renewable supply curve is divided into regions to reflect transmission constraints**
  - NW and NC zones are separated by the Cross Cascades South flow gate
  - Central zone is constrained by Pacific AC Intertie to the North
  - NE zone is constrained by La Grande flow gate on the West
  - SE zone will require new transmission development to connect to the Central zone

Key BPA Flowgates in Oregon

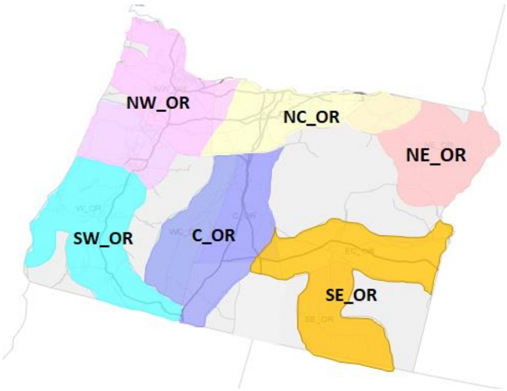


REMA Transmission Zones



Transmission capability values for key Oregon related flowgates

- **The flowgate constraint values were obtained from 2020 BPA long-term available transfer capability (ATC) data**
  - This will be used to represent the transmission headroom for interconnection of new renewable resources within the zones; primarily to deliver to loads in the NW zone



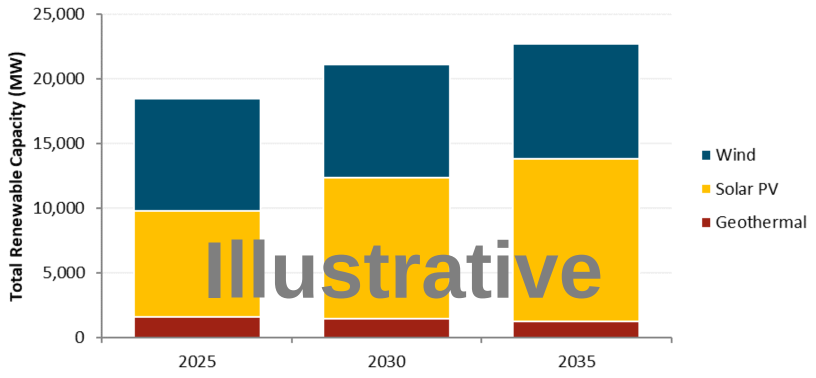
Zone	Headroom: Bulk System (MW)[1]	Headroom: Local Needs (MW)[2]	Tx Upgrade[3]: Capital Cost ($MM)	Tx Upgrade[3]: Size (MW)
NW_OR	–	572	**Currently working with BPA and NorthernGrid to develop estimates of transmission costs to deliver new resources to load centers**	
SW_OR	–	122		
NC_OR	1,031[4]	22		
C_OR	1,391[5]	104		
NE_OR	126	65		
SE_OR	–	18		

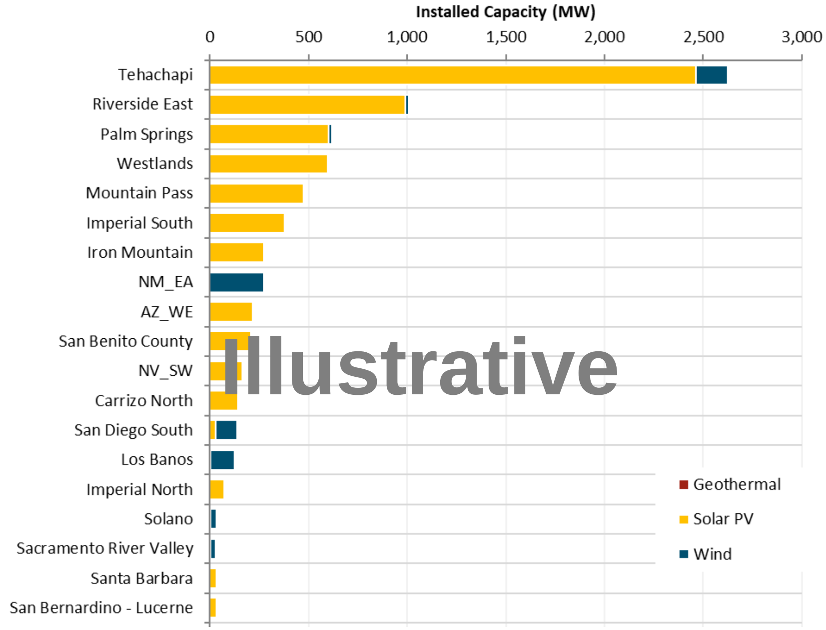
1 Based on Available Transmission Capacity (ATC) as reported by BPA
2 Assuming 5% of annual load within the zone can be served with renewables without major transmission upgrades (10% in "Distributed Focus" scenario)
3 Transmission upgrade characteristics assume delivery to NW Oregon load center
4 Available in all scenarios except "Southeast Oregon Focus" scenario
5 Available only in "Southeast Oregon Focus" scenario, and requires a lower voltage collector system to access 500 kV network

Overview of Analysis Outputs

+ The primary outputs of the analysis will be presented in charts, at a state level and at a zonal level, showing the amount of resources in MW and MWh aggregated by technology for each scenario
+ The results will also be presented in maps illustrating the selected build-out at a zonal granularity

Example Scenario Results





Wrap up and next steps

On the horizon

+ Stakeholder feedback collection

- Stakeholders can provide feedback within the next week that will be considered for incorporation into modeling
- Additional feedback not considered for the modeling but within the scope of the analysis will be considered for the project report

+ Scenario analysis

- After incorporating feedback E3 will begin scenario analysis work
- Coordination for preliminary results webinar will be communicated with stakeholders

+ Stakeholder interviews

- Over the next couple weeks, E3 will follow-up with some stakeholders on responses from the industry assessment survey that might require deeper conversation

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Thank You

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Appendix

Resource Value

+ **Future value of renewable assets depends on:**
  - Resource type
  - Level of renewable penetration in PNW market
  - Policies driving regional planned additions and retirements

+ **Modeling two monetizable value streams for renewable energy:**
  1. **Energy value** from the PNW market
  2. **Capacity value** from net-CONE (cost of new entry) of a natural gas combustion turbine (CT) plant

Monetizable Values Examined

Energy value

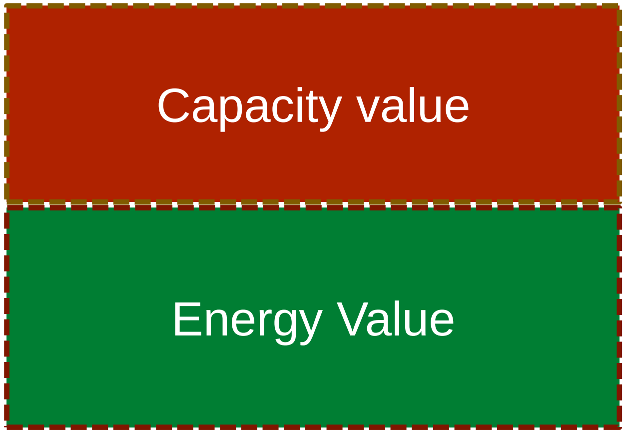
- Value of energy depends on daily wholesale market price trends and renewable output, which evolve under greater renewable penetration

Capacity value

- Renewable qualifying capacity is lower than for gas assets and depends on complex interactions between a plant's generation profile and timing of system peak load

Energy, capacity, and REC values will evolve significantly over time

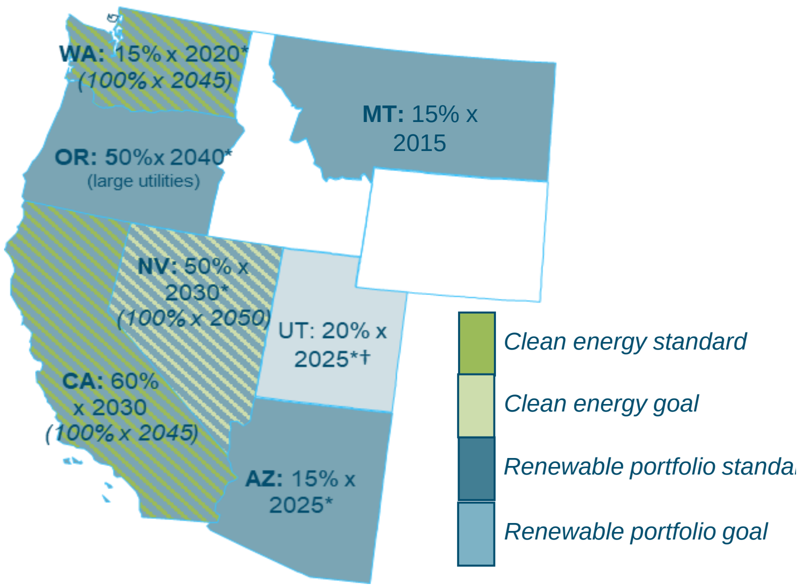
Value Stack



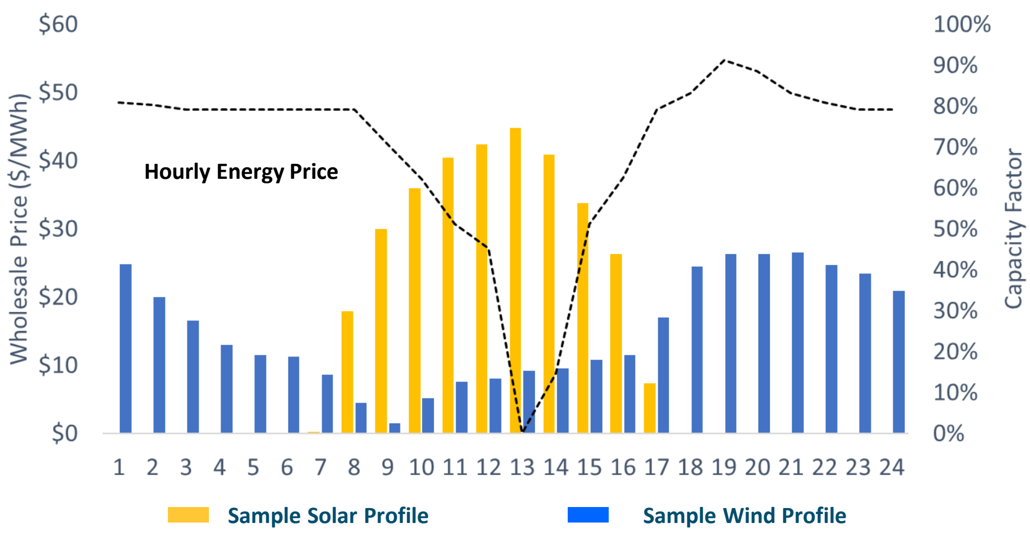
Energy Value

+ **Future energy value for renewable assets heavily depends on their generation profiles and future buildout**
+ **Annual energy value is calculated as the hourly generation-weighted average of wholesale prices from the zone containing the Mid-C**

State Policies Modeled in Prices



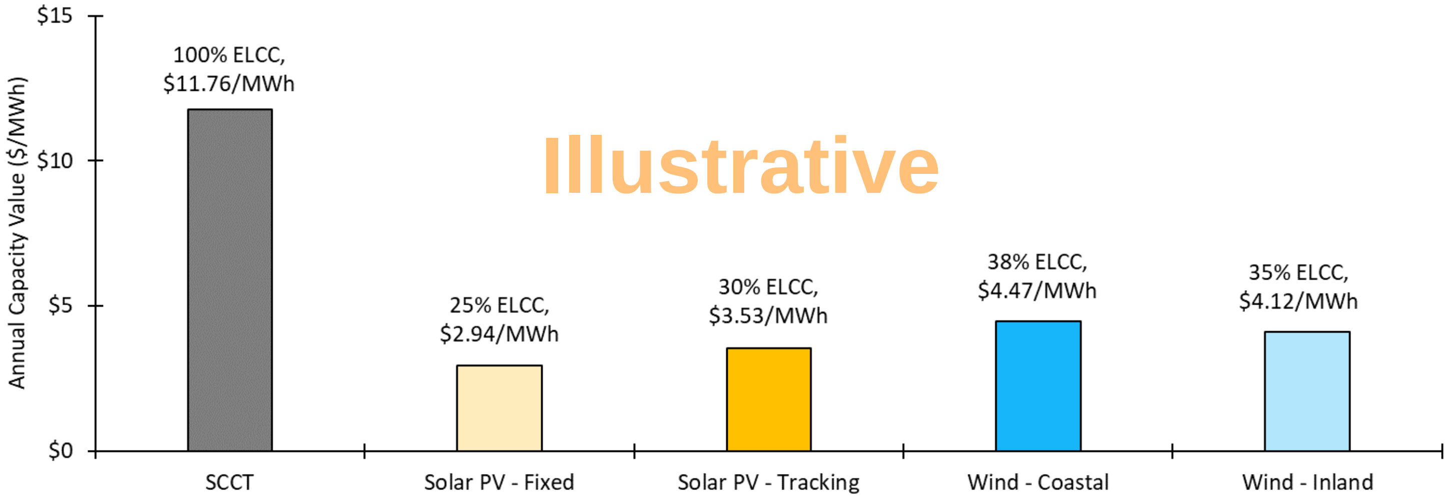
Illustrative Future Day in E3 Model



Capacity Value

- **Capacity value is calculated based on resource ELCCs and the avoided cost of procuring firm capacity**
  - Effective Load Carrying Capability (ELCC) is the attributed capacity a resource's ability to provide firm capacity to the system peak
- **Avoided cost is set to net cost of new entry of a SCCT**
  - Assumption is that SCCT provide 100% of its capacity to the system peak

Illustrative Example of Resource Capacity Value as a Function of ELCC



Source Data for Resource Potential

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