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# Marine Energy and the Pacific Northwest Value Proposition

PACIFIC NORTHWEST ECONOMIC REGION CONFERENCE

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# Why Marine Energy in the Northwest?

- ▶ Resource availability
- ▶ Innovation and economic development
- ▶ Demand for clean energy
- ▶ Research leadership
- ▶ **System benefits**



# Emerging Models: System Benefits

## ▶ What are system benefits?

Power system benefits are benefits to the function of the power system beyond energy (megawatt-hour).



# Emerging Models: System Benefits

- ▶ **What generally are the system benefits of marine energy?**
- ▶ **Strong locational value.** Marine energy can be placed in proximity to large load sinks with no existing or potential transmission access, providing energy but also direct reliability services such as reactive power and voltage support, or avoided or deferred system investments.
- ▶ **Predictability.** Marine energy's relative predictability reduces integration, forecasting and balancing costs.
- ▶ **Generating profile.** At scale, marine energy's peaking production matches Northwest winter peaking loads and its curve offsets with wind and solar over a year.

# Locational Benefits for Marine Energy: National

## ► **Nationally – coastal populations and constrained systems**

In 2010, nearly 40% of the U.S. population lived in U.S. coastal counties. Population density in these counties is over four times greater than the national average, and trends project increasing density in the decades ahead.

Delivering and maintaining essential electric services for these growing demands presents a unique challenge. Coastal power systems are

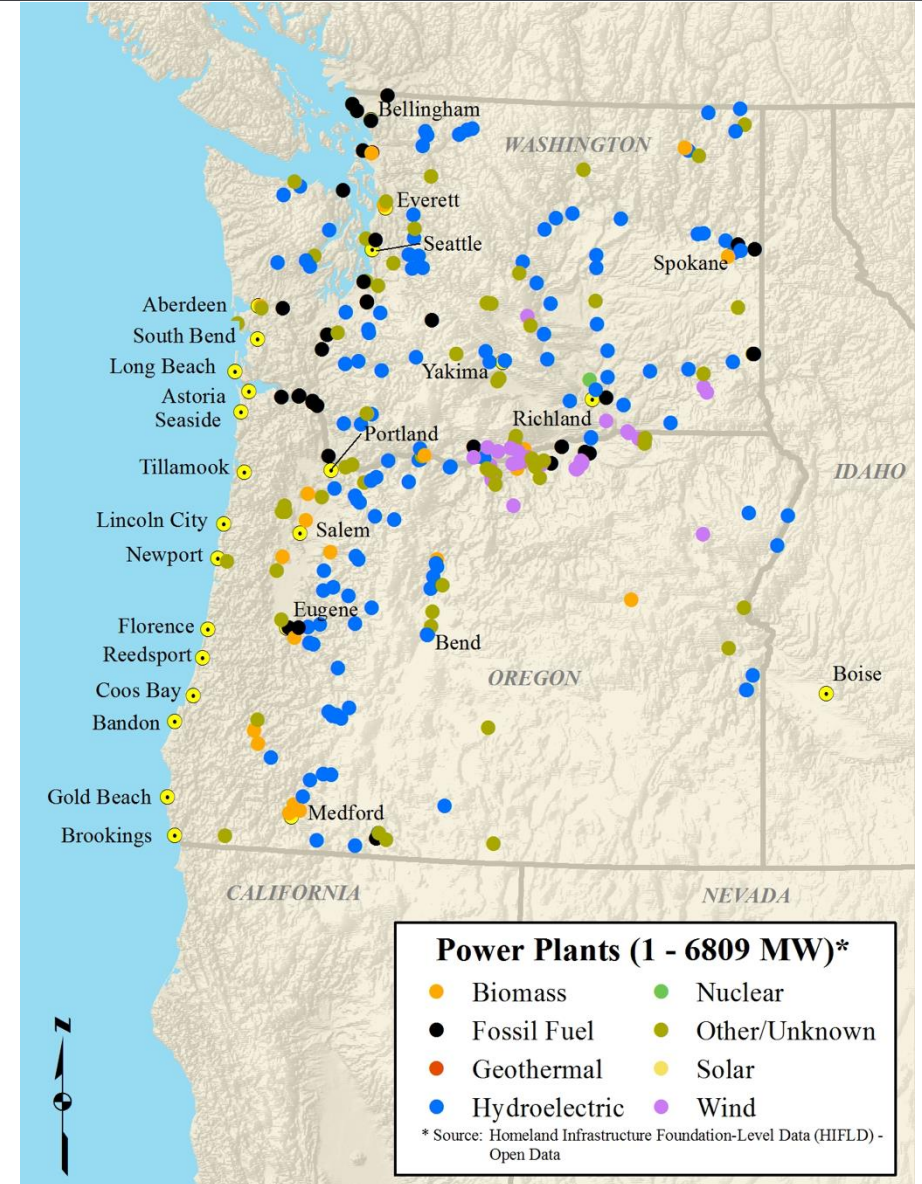
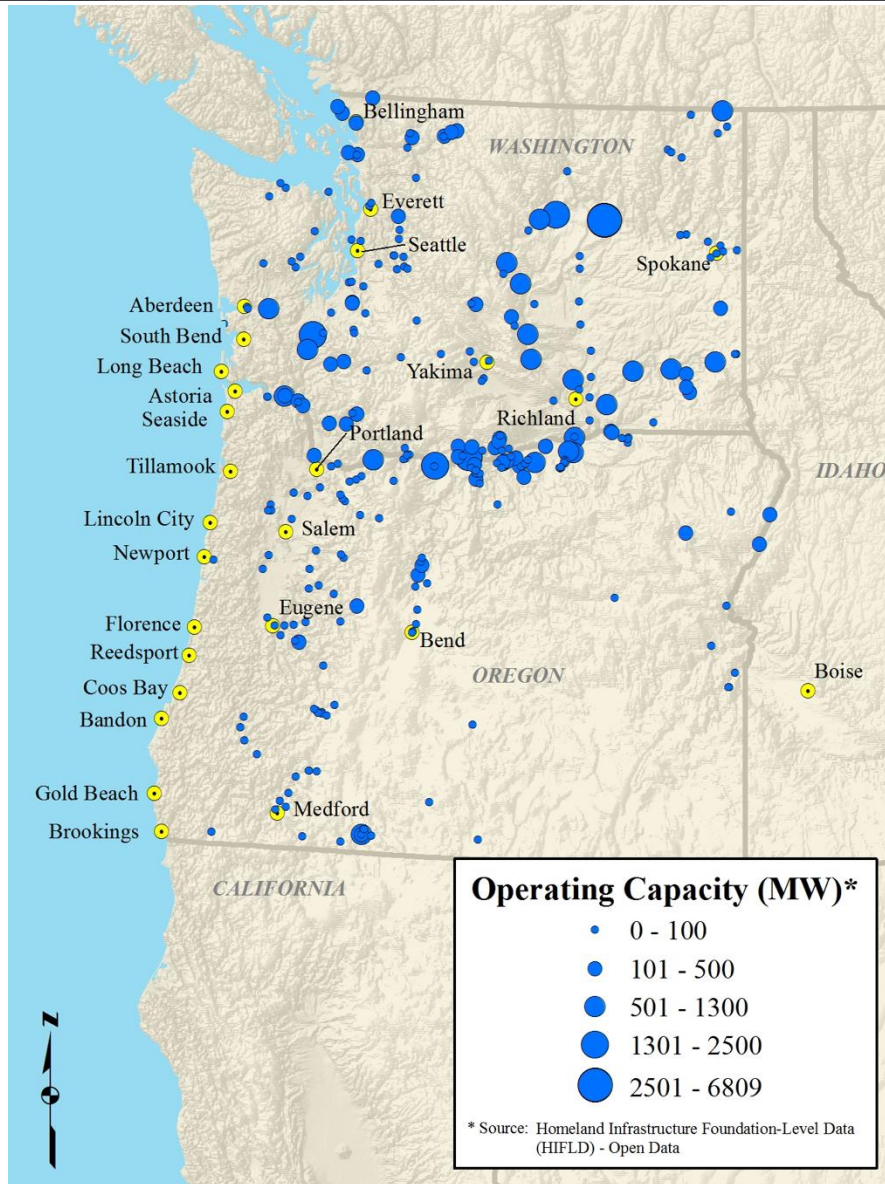
- Not proximate to large generating resources and their benefits (e.g. VAR)
- Dependent on electric delivery over long-distance high-voltage transmission lines to provide electric service
- Spatially limited in solutions

# Locational Benefits of Marine Energy: Generation Location



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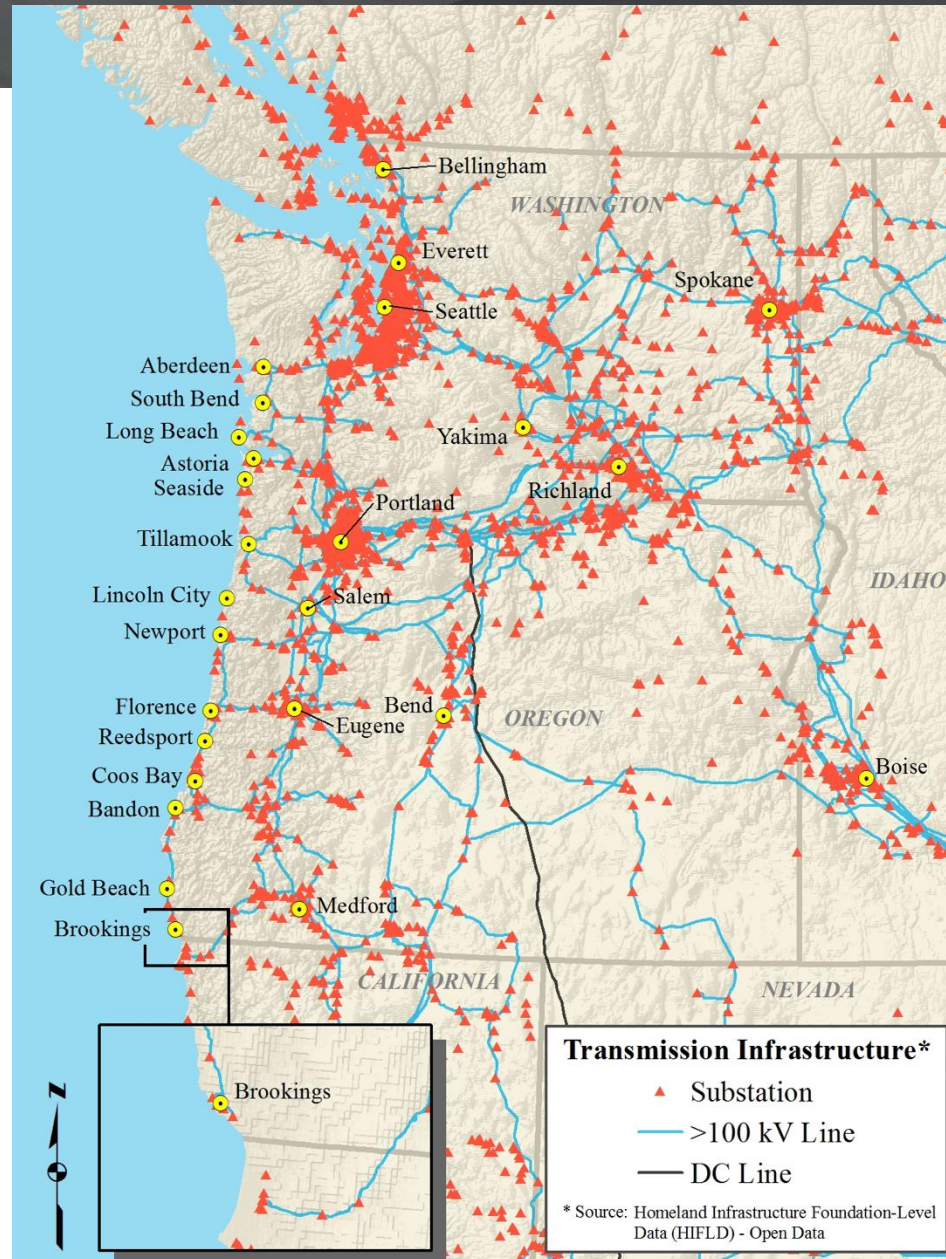
# Locational Benefits of Marine Energy: Transmission



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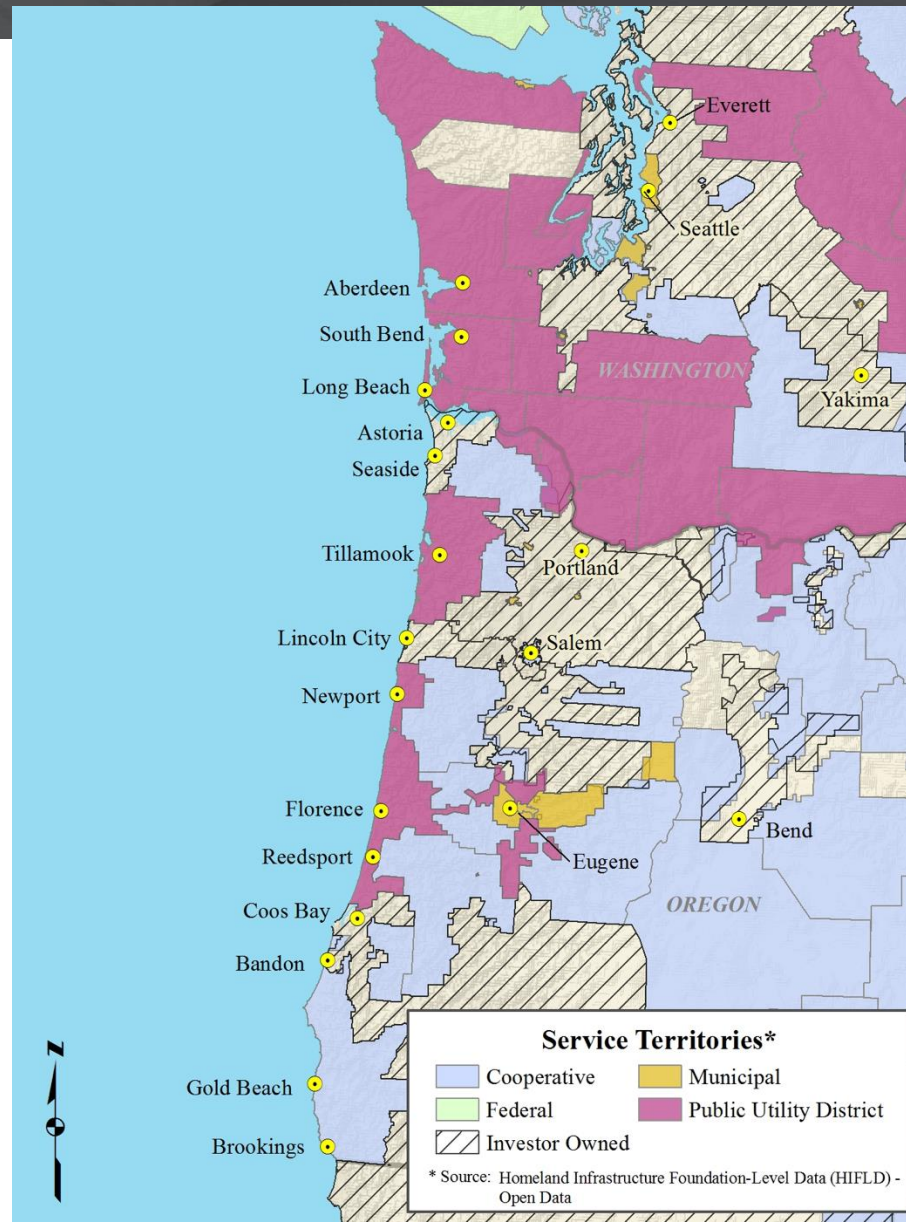
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► Northwest transmission carrying east-side generation



# Locational Benefits of Marine Energy: Service Territories

## ► Many coastal utilities





# Marine Energy is (Probably) Relatively Predictable Generation

## ► Predictable generation costs less to integrate.

Like most renewable energy, marine energy will be variable and not dispatchable. But with marine energy, we can anticipate in advance when the generation occurs.

Predictable generation reduces system costs for balancing, reserves, and integration. One study estimated the integration costs for 500 MW of wave energy to be 10% of the cost of integrating a comparable amount of wind.

While marine energy is predictable, it still requires forecasting. The longer the lead time, the better. Technology and modeling investments support improved forecasting across renewable technologies.

# Marine Energy's Winter Generating Profile Has Northwest Advantages

- ▶ **At scale, Northwest marine energy production will be higher in the winter months.**

Pacific Ocean winter sea states are dramatically more energetic than summer sea states.

- ▶ **This is advantageous for several reasons.**

System-wide, Northwest electric loads peak in winter.

Winter generation complements other renewable generating profiles.

# Marine Energy's Generating Profile is Complementary to Wind and Solar

- ▶ Winter generating marine energy can fill gaps, especially under high renewable penetration scenarios.

Oregon Wind and California Solar (Divided by 3) - Monthly Generating Profiles





# Coastal Resilience for the Electric System

- ▶ **Marine energy could fill a challenging niche demand for electric resiliency for coastal communities.**

Weather is the dominant cause of grid disruptions. Coastal utilities already face unique physical challenges.

Past frequency of disruptive events is not a prediction for future frequency. Studies show that 100 year floods may be 10-year to 1-year events by 2050.

During Superstorm Sandy, one New Jersey utility reported widespread outages due to storm surge, with 4 to 8 feet of water inundating substations that had never previously experienced flooding.



# Role for MHK in resiliency sector?

## ► Resiliency

National Academies report, July 19, 2017: *Enhancing the Resilience of the Nation's Electricity System*. <https://www.nap.edu/catalog/24836/enhancing-the-resilience-of-the-nations-electricity-system>

Related recommendations:

- US DOE should expand its research program for resiliency of the electric grid; and take a leadership role in long-term vision and interdependencies and multiple jurisdictions
- Distributed energy resources could provide benefits, particularly in reducing acute vulnerabilities, but are not developed properly and can exacerbate outages
- Fuel diversity as a resiliency measure



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# Thank you

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