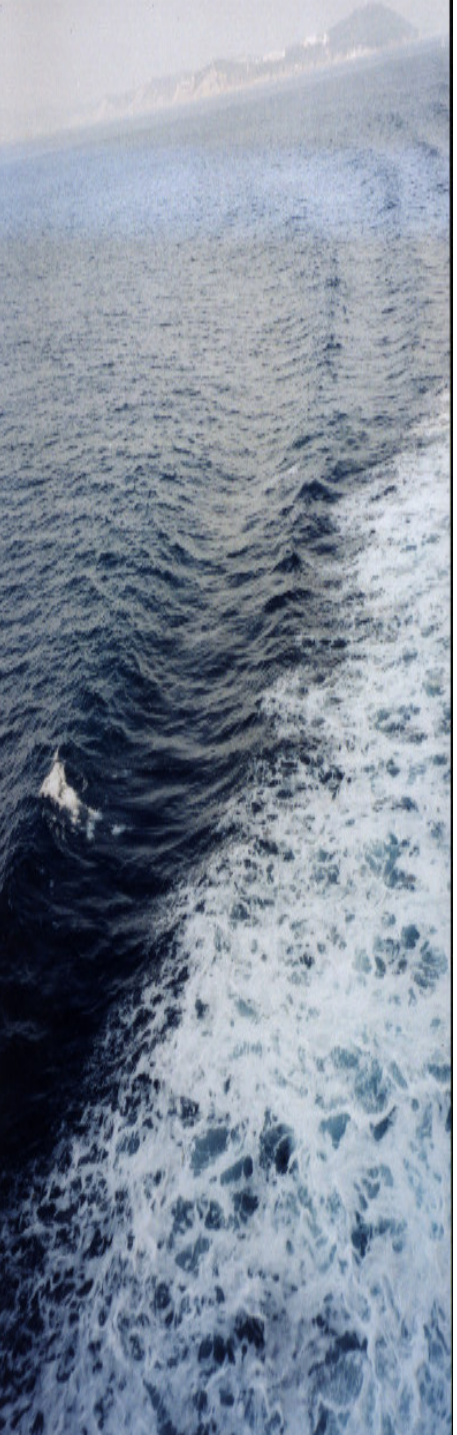
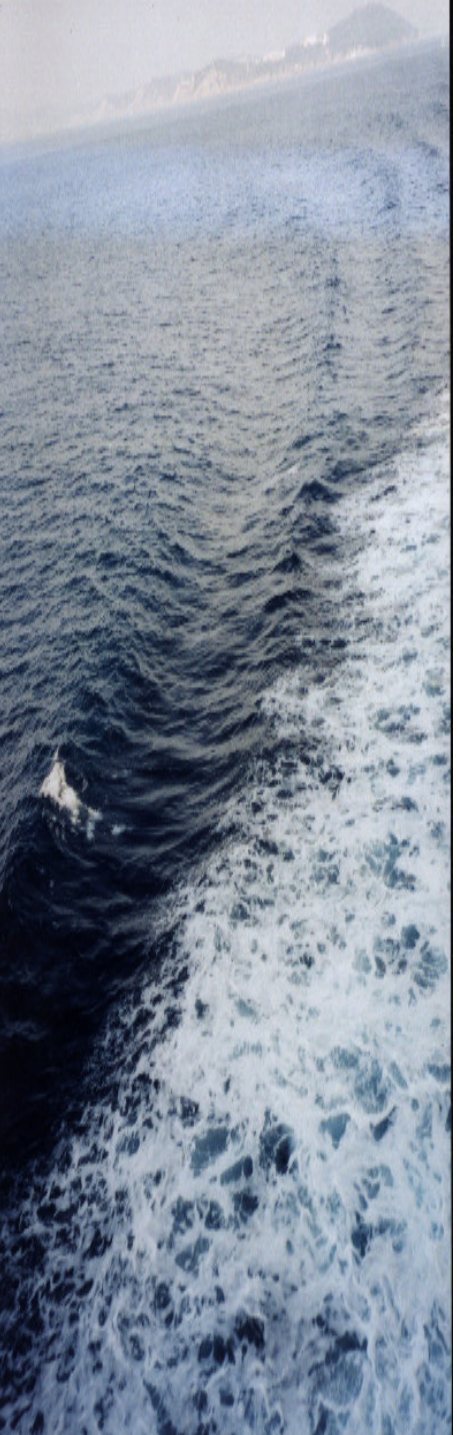


Oregon Wave Energy Trust (OWET)

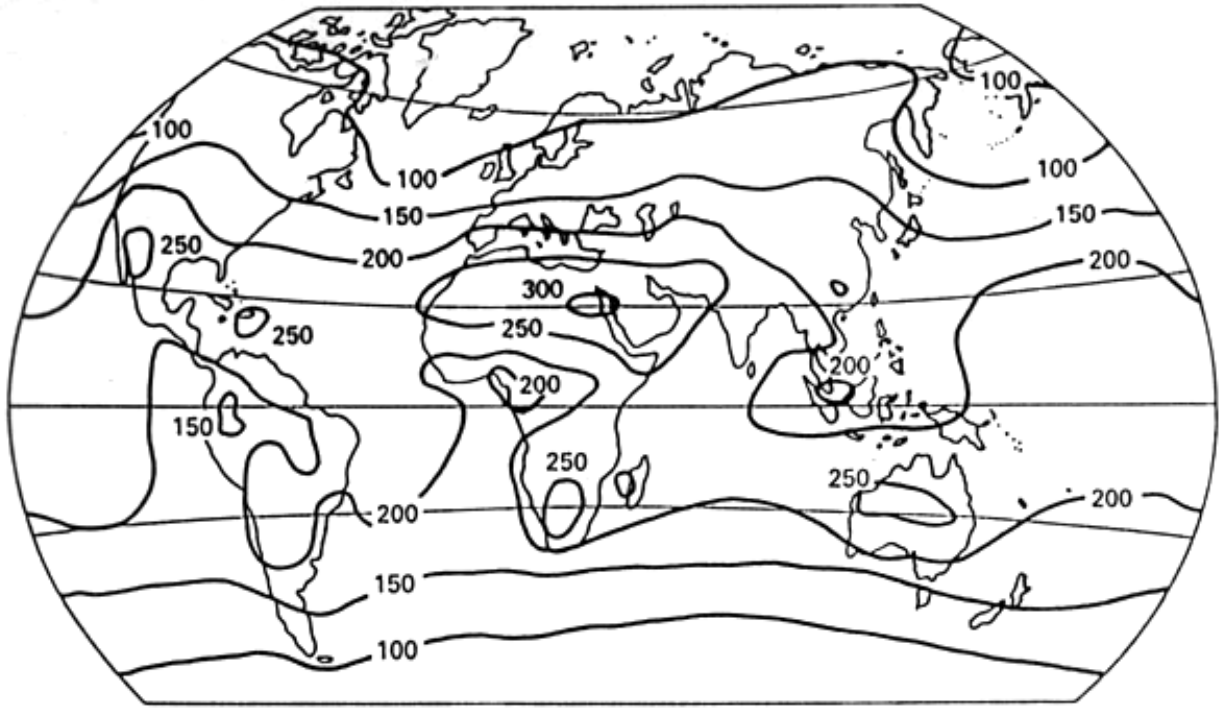
Justin Klure

Acting Director

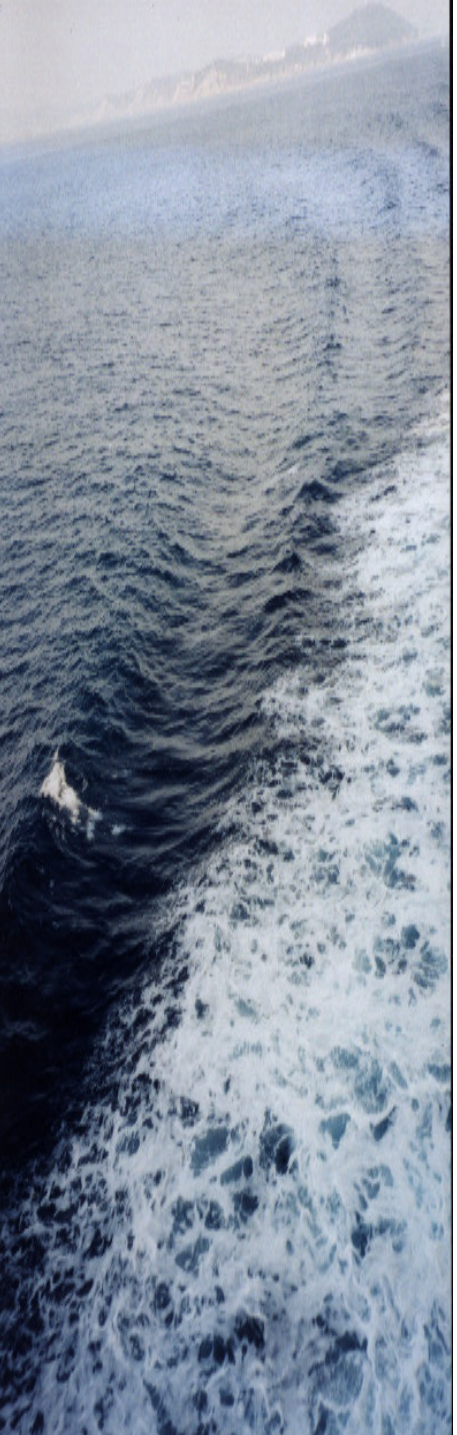
August 30, 2007



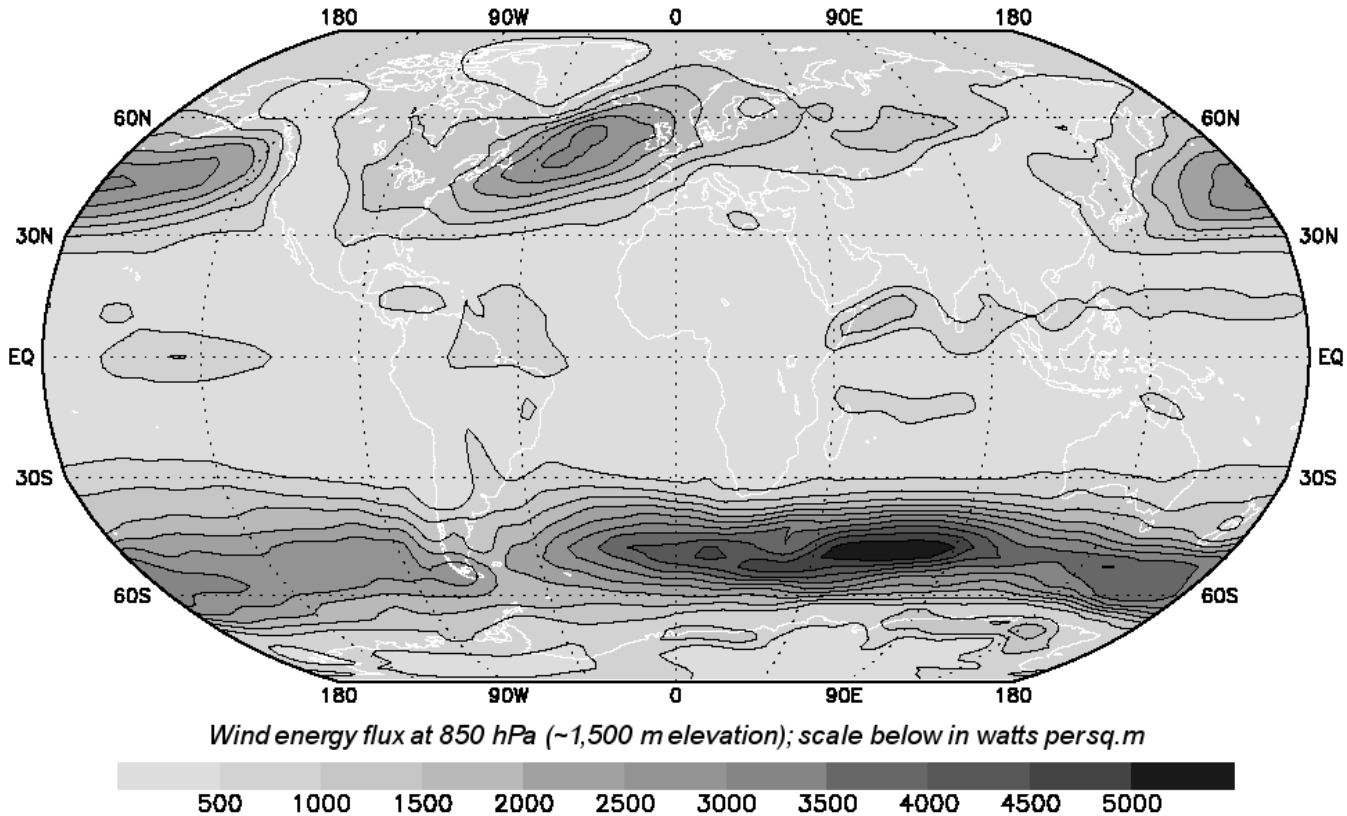
Global Solar Power Distribution



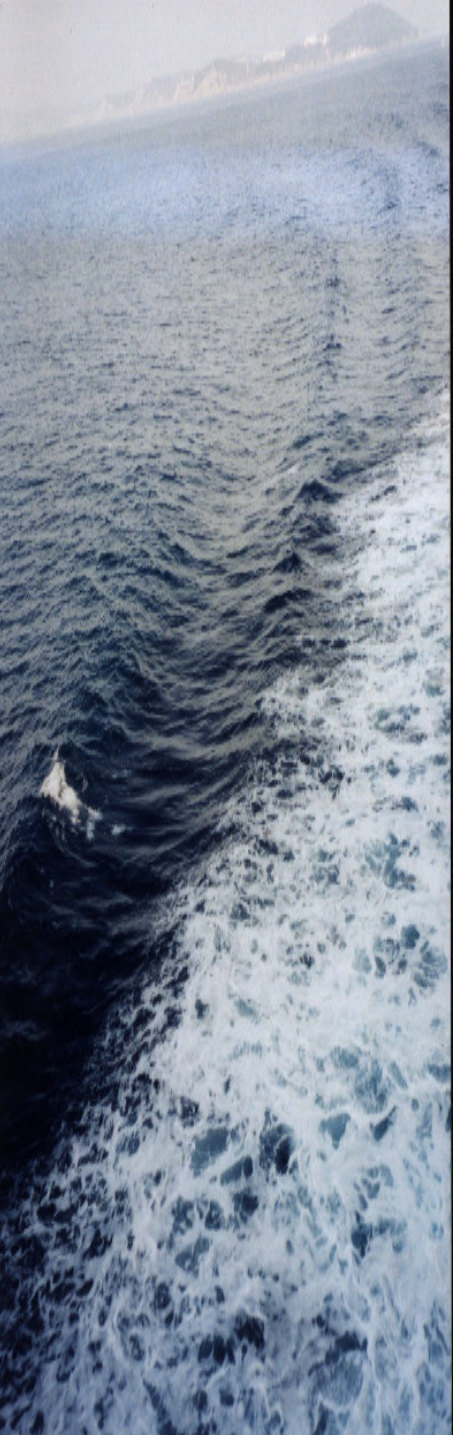
The highest annual average solar energy flux incident on the ocean surface is **300 watts per sq.m** of horizontal area (*i.e.,* solar cell surface area). Earth-orbiting satellites with solar panels continually facing sun receive ~ 1,370 watts per sq.m.



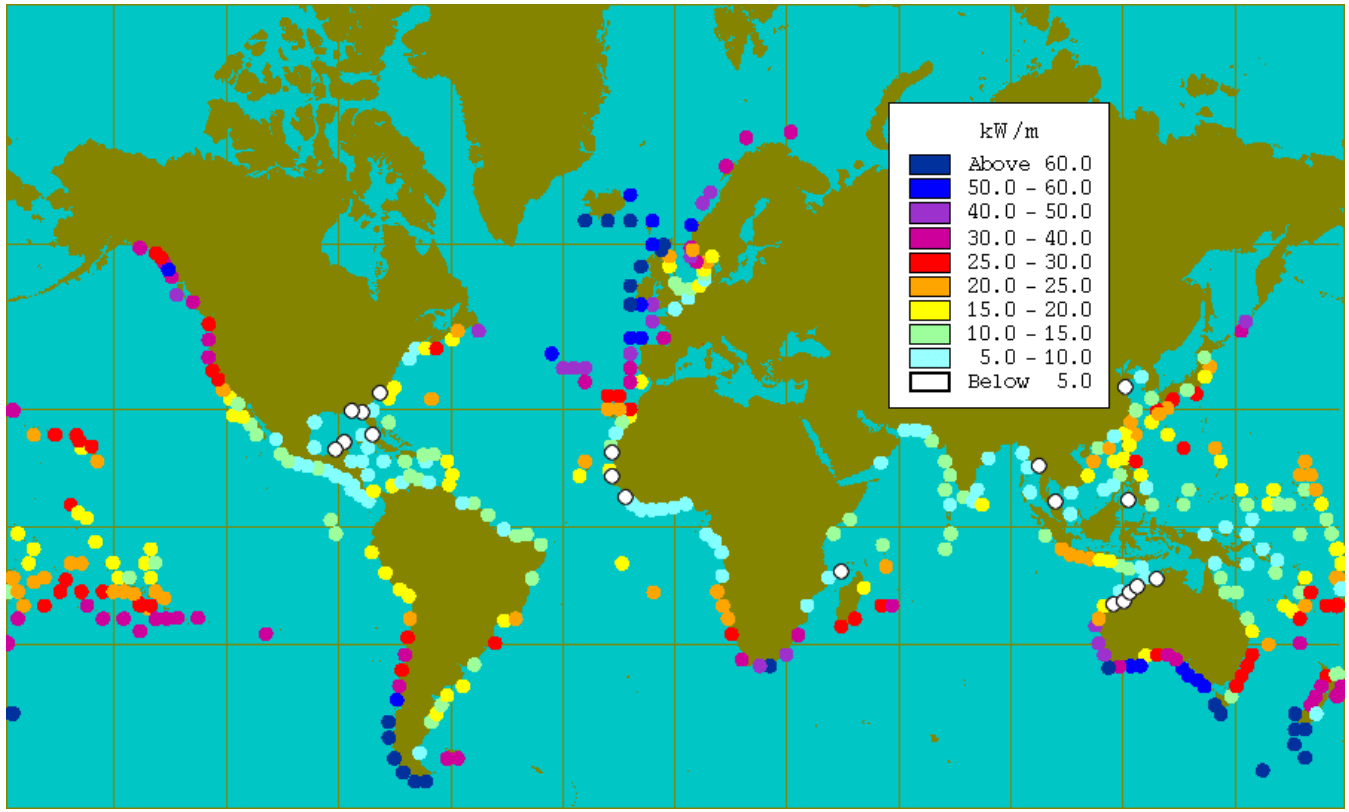
Global Wind Power Distribution



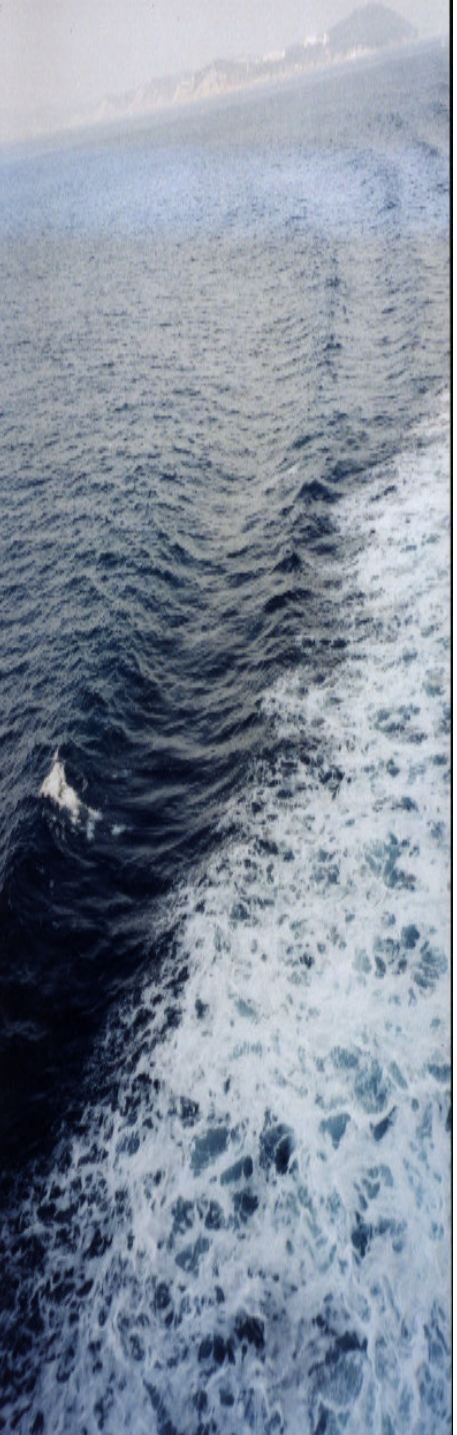
The highest average wind energy flux at the top of the Planetary Boundary Layer is 5,000 watts (5 kilowatts) per sq.m of vertical area (*i.e.* turbine rotor swept area).



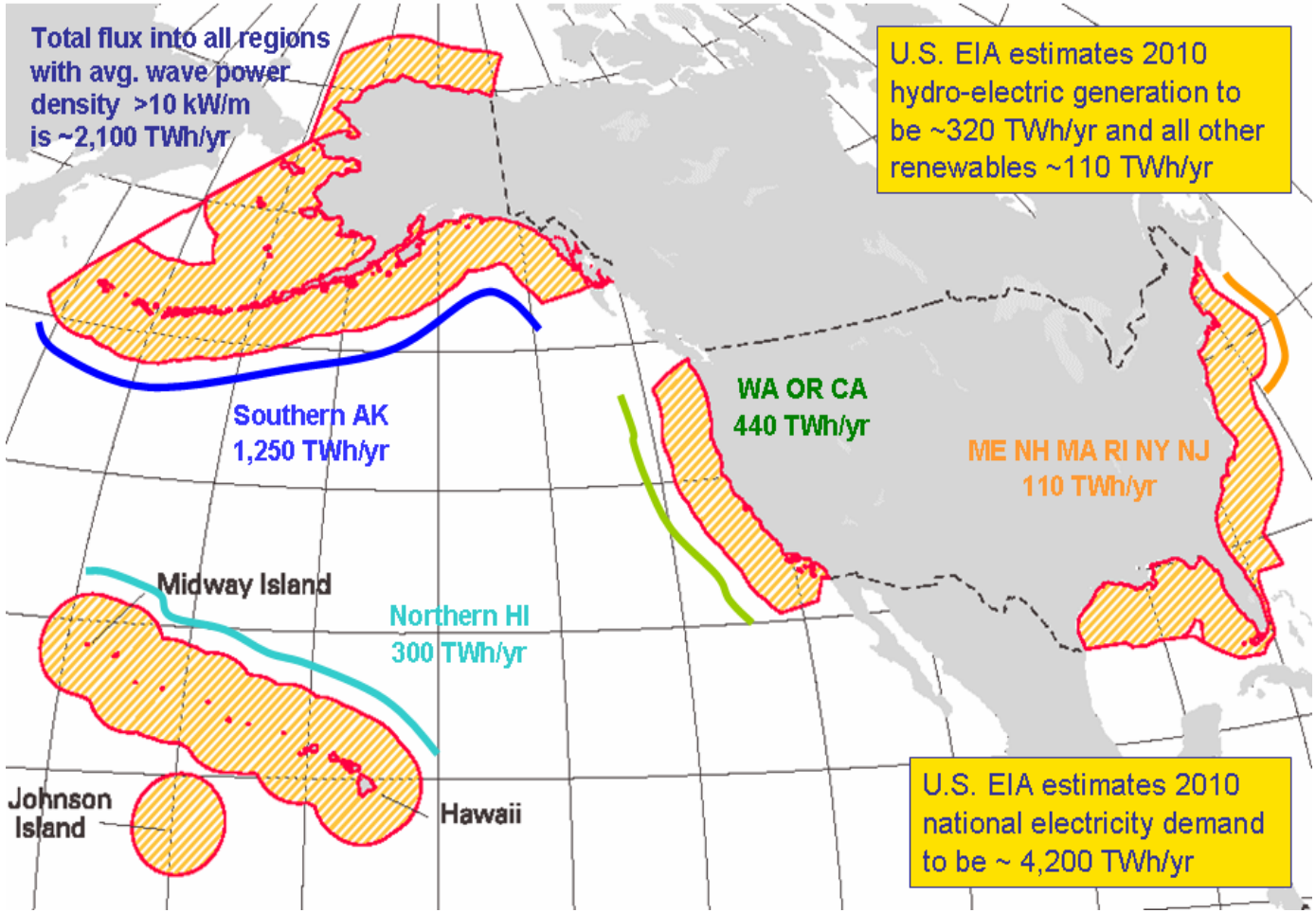
Global Wave Power Distribution

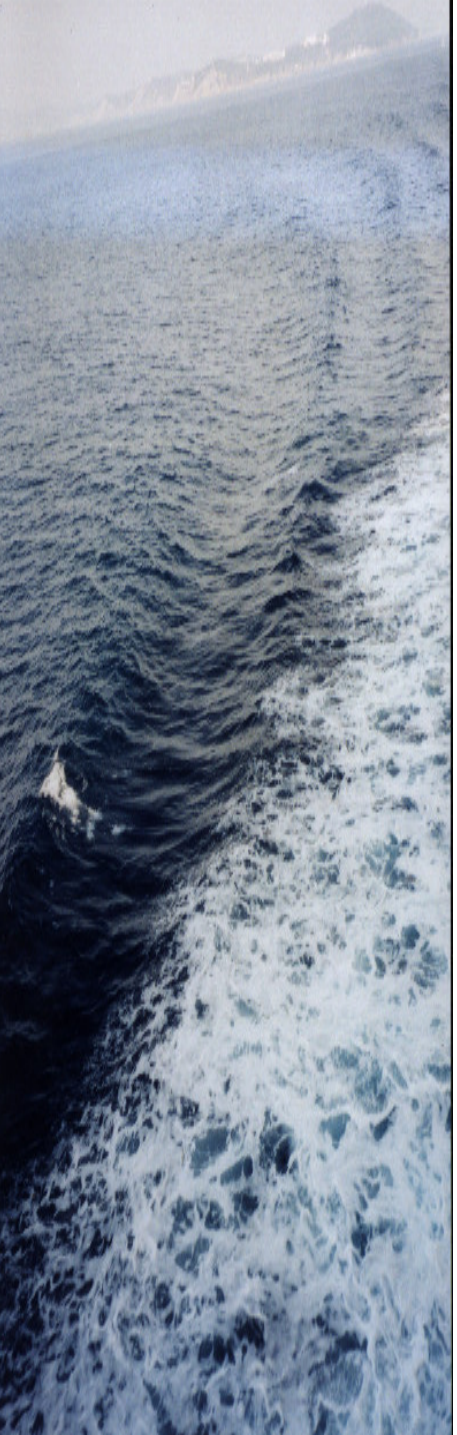


Annual average wave energy flux per unit width of wave crest (kilowatts per m)



How Big? Wave Energy Flux in the U.S.



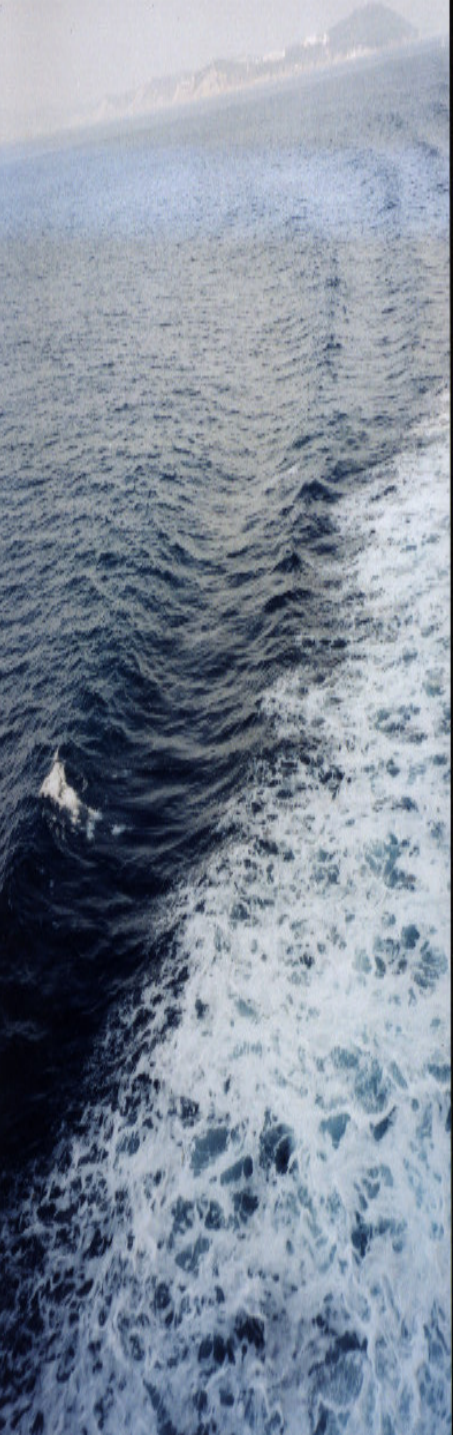


Advantages of the Ocean Resource

- Density (water 1000x more dense than air)
- Availability (24/7 resource)
- Predictability (lead time for utility)
- Close to sources of load
- Bypass transmission constraints
- Low visual impact
- No fuel volatility (price or political)
- No emissions

. . . The ocean is the largest, most concentrated source of renewable energy on Earth

. . . Ocean energy has the potential to supply 10% of the world's electricity needs



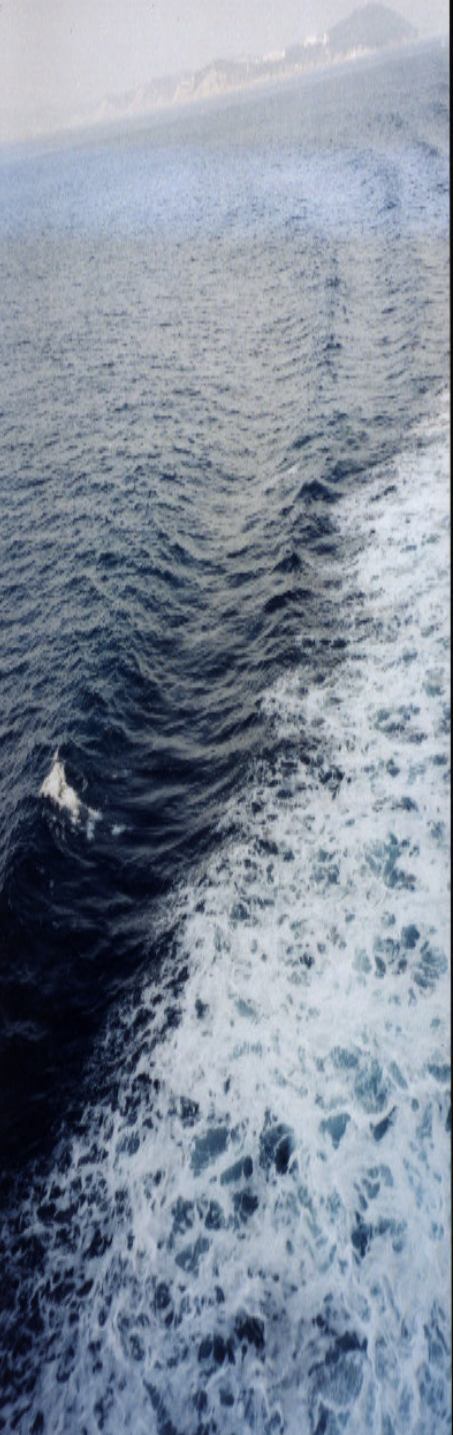
Wave Energy Devices

Point Absorber

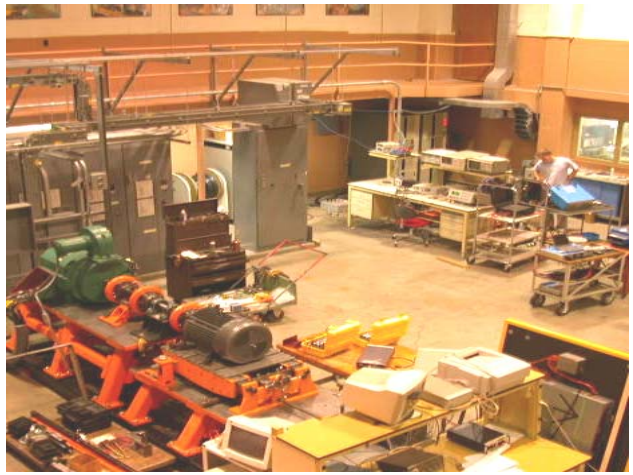
Oscillating Water Column

Attenuator

Overtopping

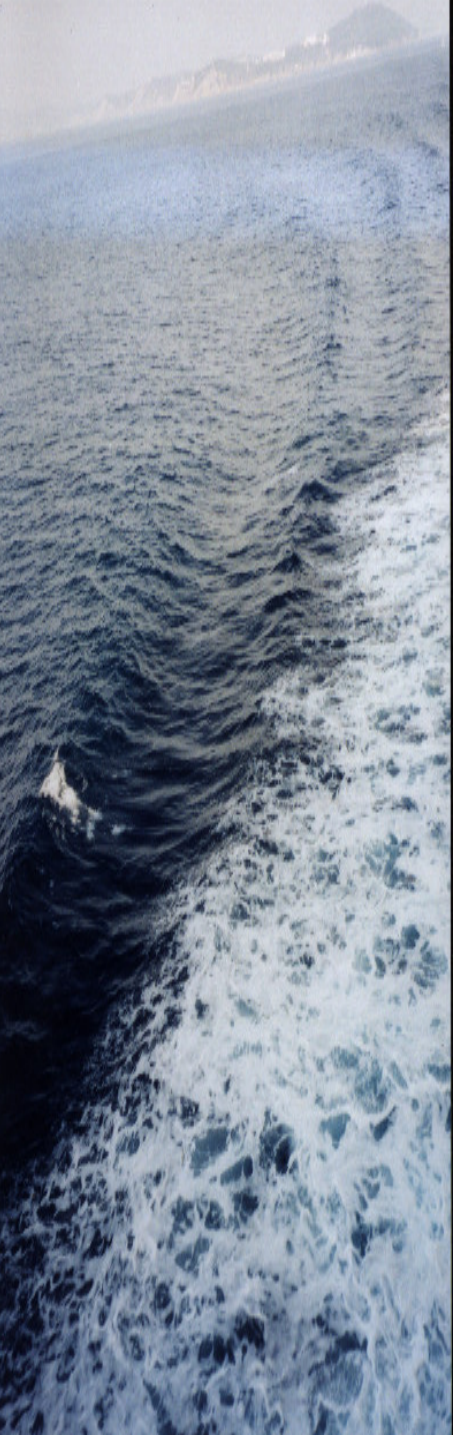


Leveraged Resources: Oregon State University

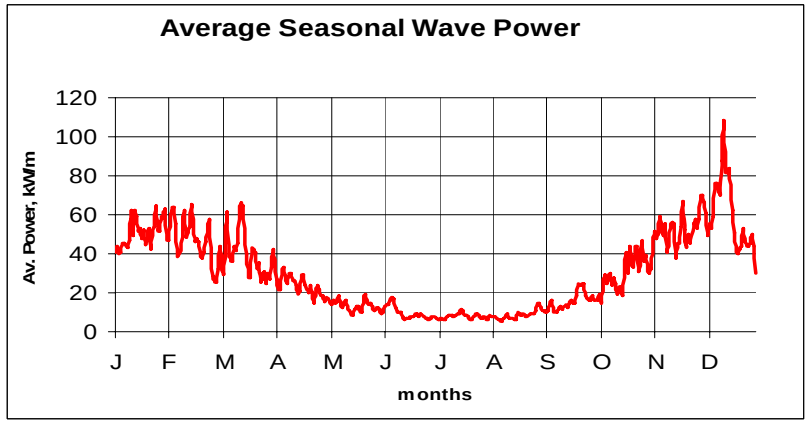


Motor Systems Resource Facility (MSRF)

O.H. Hinsdale Wave Research Lab (HWRL)



Opportunity in Oregon . . . Power from ocean waves



Data buoys are 2-200mi off shore, with waves traveling 15-20mph, gives 10+ hours forecast time for buoy generators

located 2 miles out

(wave data From National Data Buoy Center, Power estimated from 5 buoys off the Oregon coast over past 10 years)

Power from a wave is: W/m of crest length (distance along an individual crest)

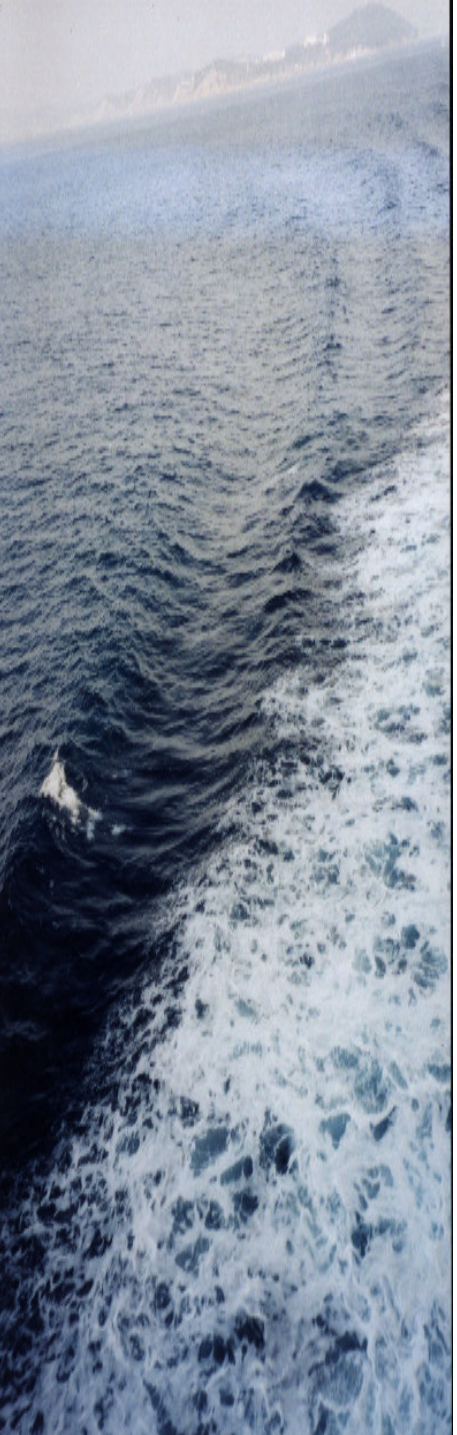
$$P = \frac{\rho g^2 T H^2}{32\pi}$$

ρ = the density of sea water = 1025 kg/m3

g = acceleration due to gravity = 9.8 m/s/s

T = period of wave (s) (averages 8s in the winter to 6s in the summer

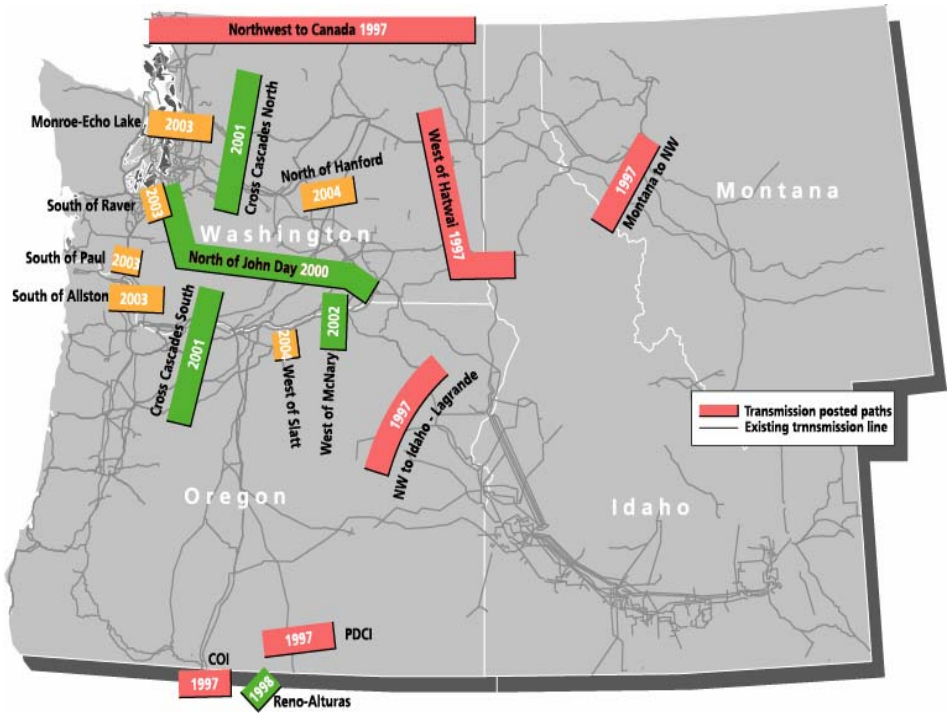
H = wave height (m) (averages 3.5m in the winter to 1.5m in the summer)

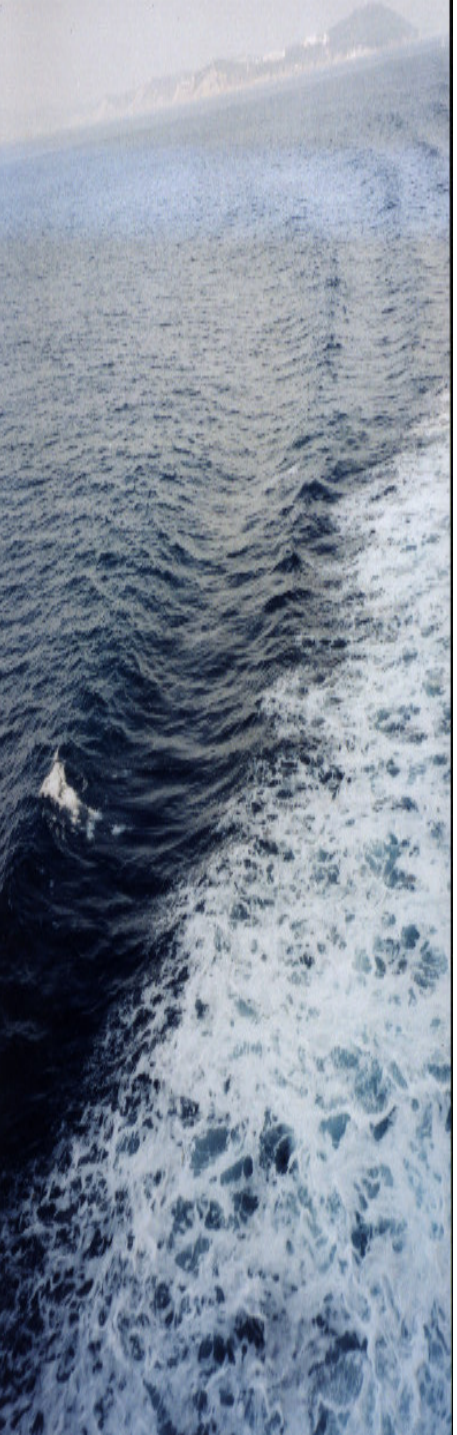


Opportunity in Oregon . . . Transmission benefits

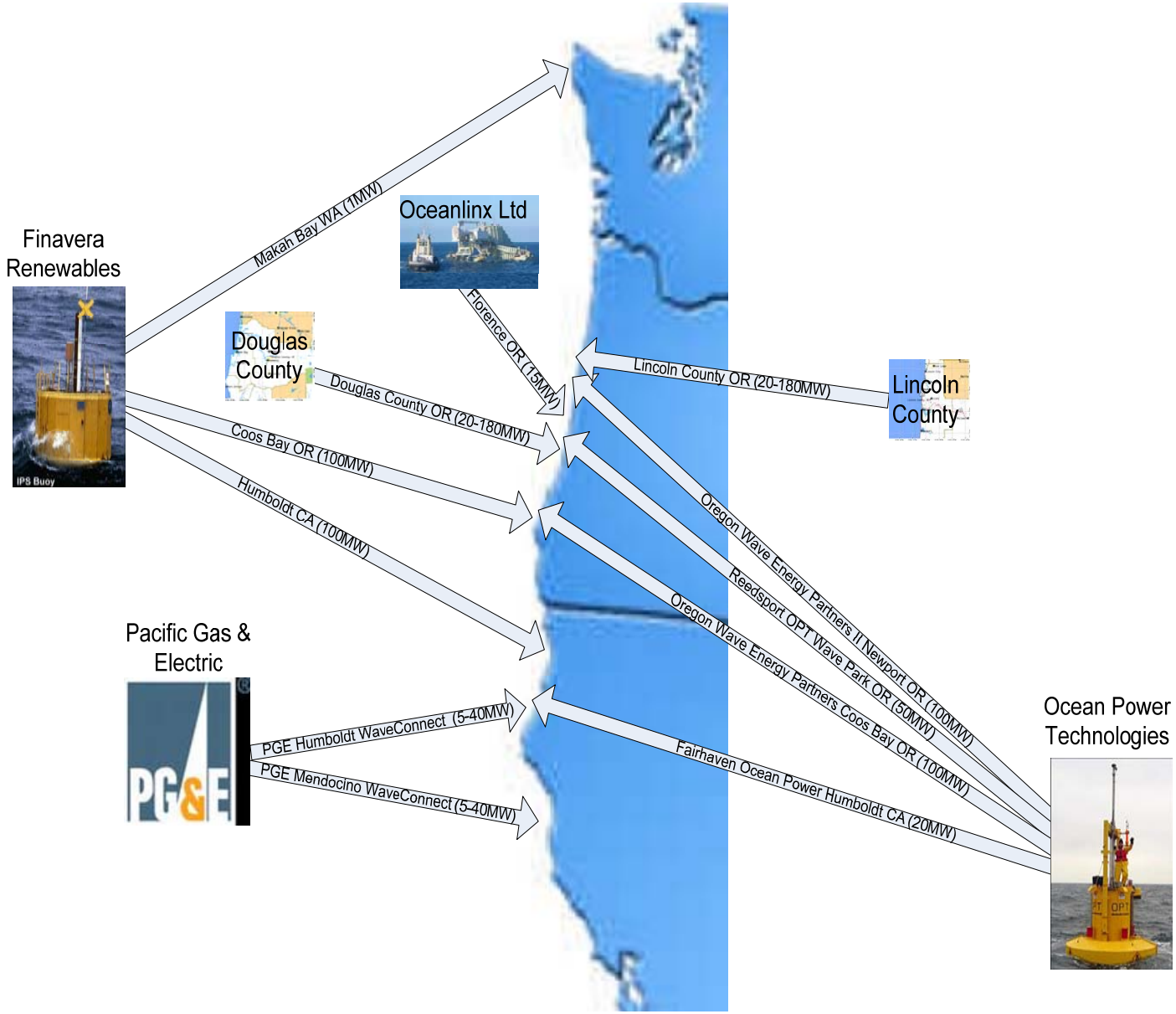
Transmission Constraints . . .

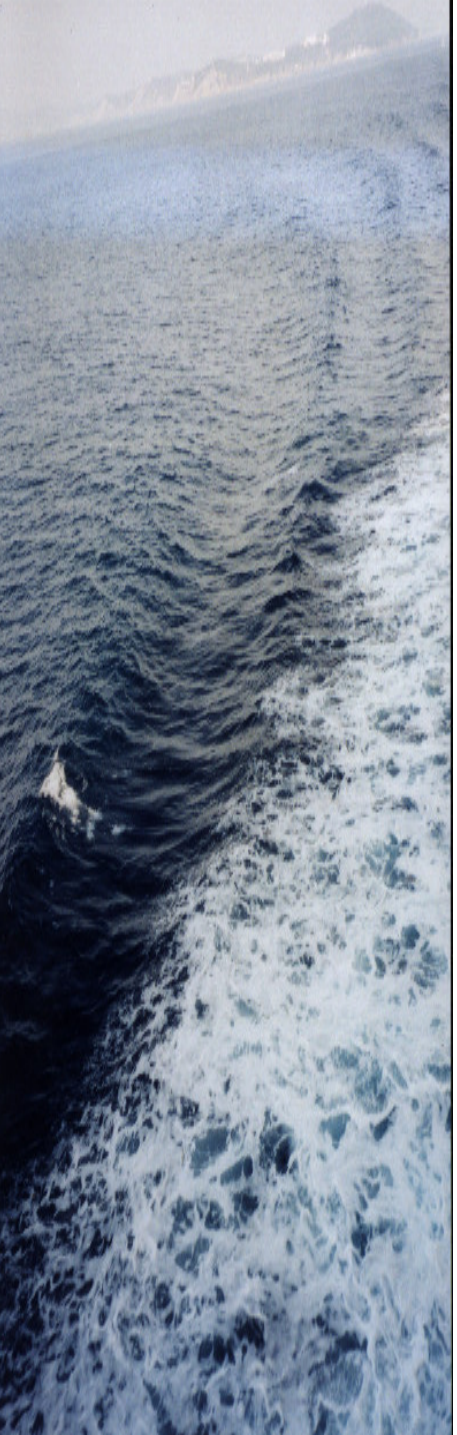
From east to west, north to south



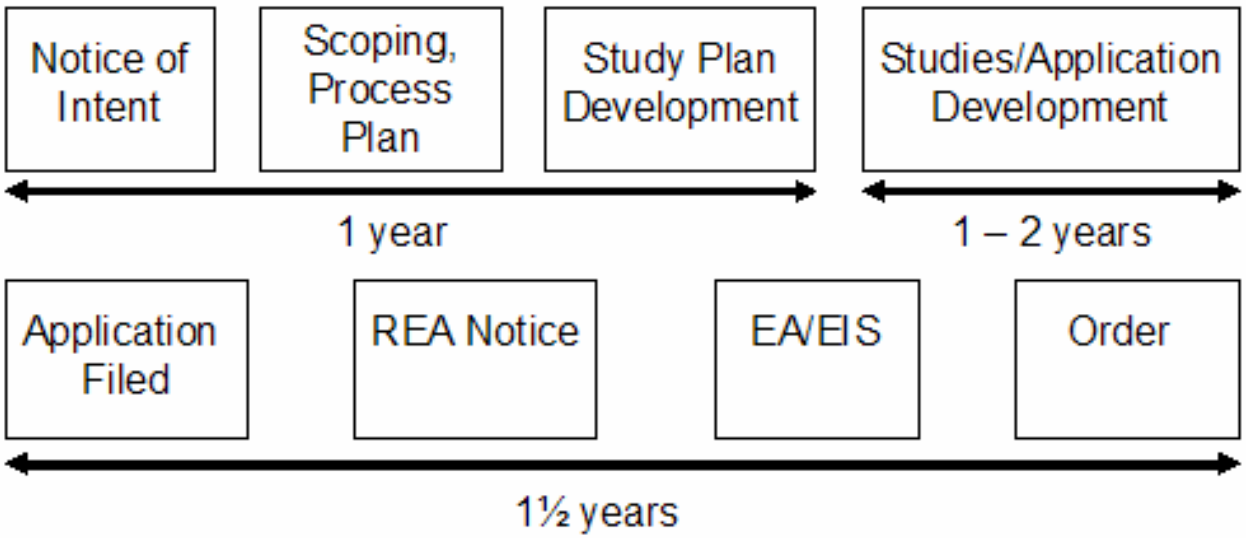


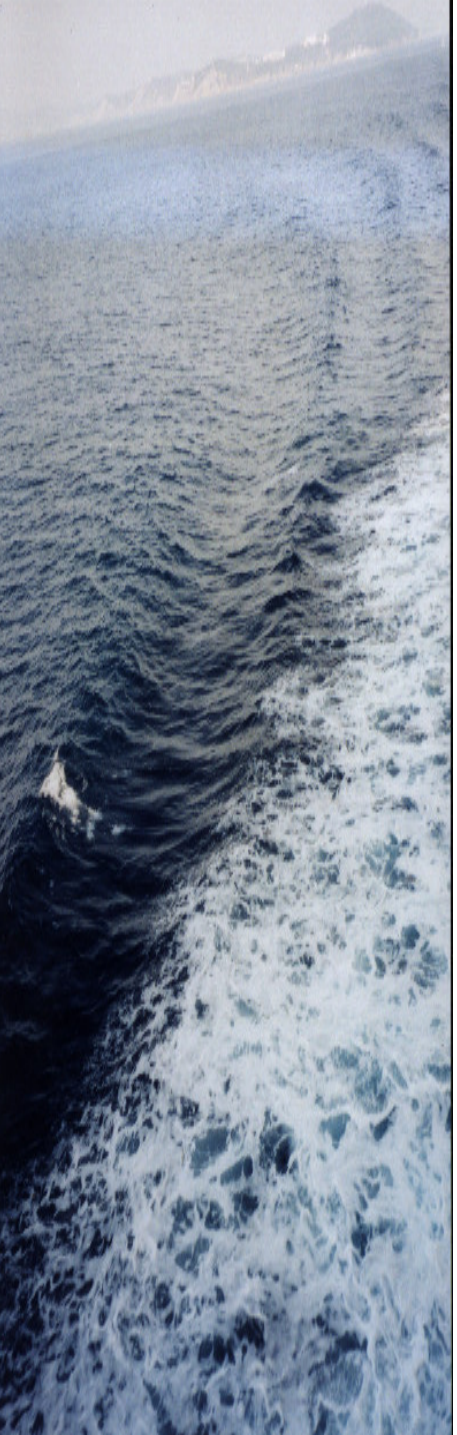
West Coast Wave Energy Projects





Likely Licensing Process





Oregon Players

Utilities

- PNGC Power
- PGE
- Central Lincoln PUD
- Pacificorp

Developers

- Finavera Renewables
- Ocean Power Technologies
- Ocean Power Delivery
- Columbia Power Technologies
- Oceanlinx

Environmental

- Oregon Shores
- Surfrider Foundation
- Oregon Environmental Council

Government

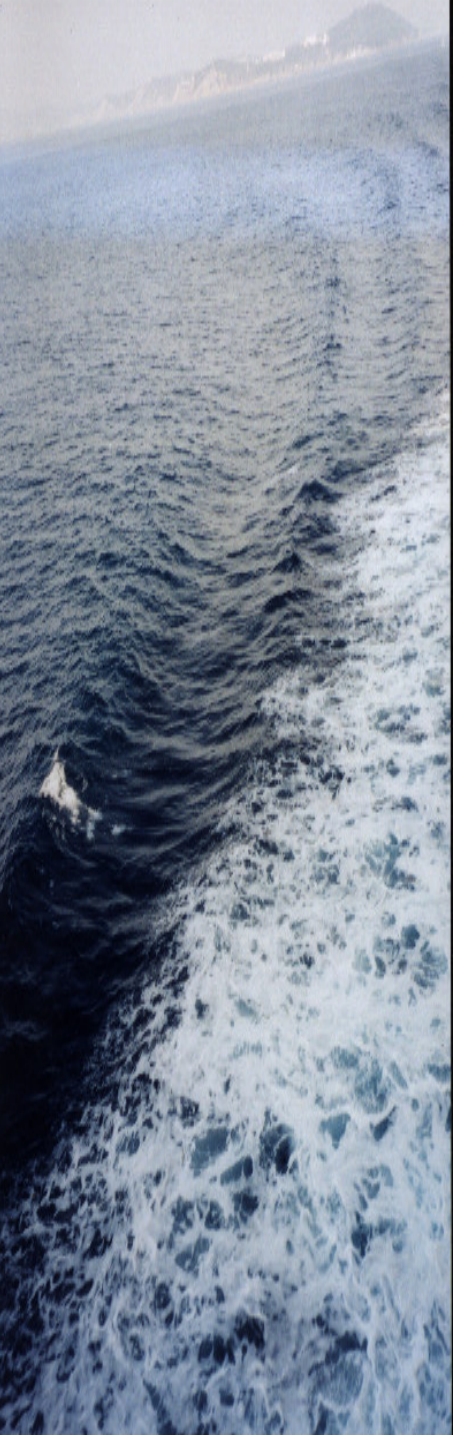
- State of Oregon
- Federal Agencies
- Local governments
- Ocean Policy Advisory Council

Industry

- Oregon Iron Works
- Commercial Fishing
- Port Commissions
- Consulting
- Financial
- Legal

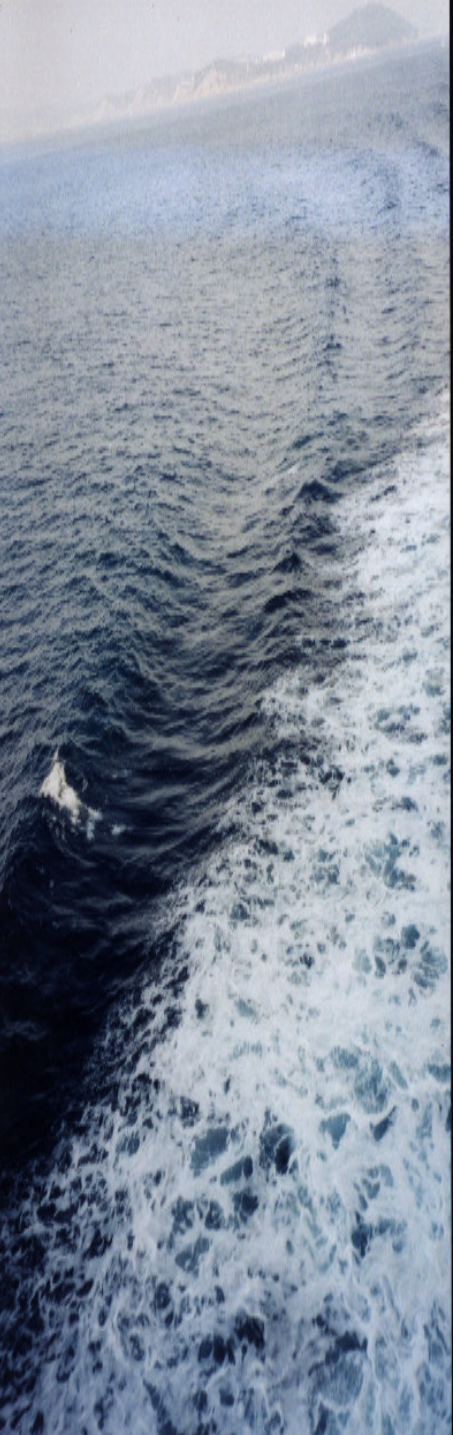
Higher Education

- Oregon State University
- Portland State University



Oregon Stakeholder Efforts

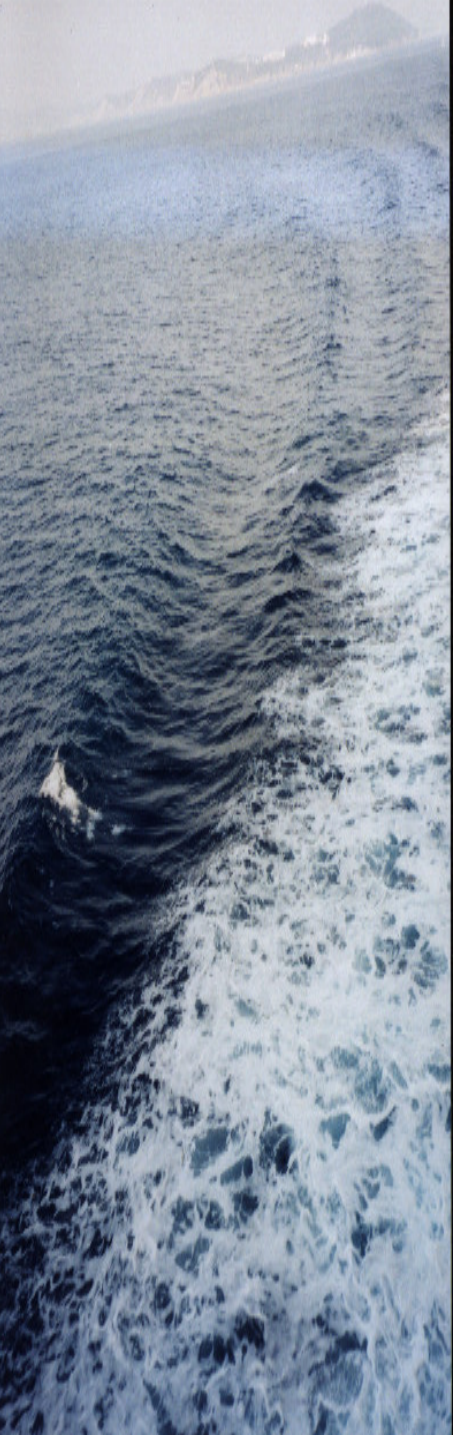
- POWER Group
- Local Communities and Government
- Oregon Solutions Process
- Ocean Policy Advisory Council
- Oregon Regulatory Agency Work Group
- FINE Committee
- Oregon Innovation Council
- Oregon Coastal Zone Management Association
- Wave Energy Ecological Effects Workshop
- **Oregon Wave Energy Trust**



Oregon InC - SWOT Analysis

Strengths	Weaknesses	Opportunities	Threats
Unique wave resource	Uncertain permitting requirements	Create high paying jobs	Regional competitors: California, Mass
Transmission capacity and utility support	Low cost of existing power in the region	Support and connect existing clusters	International Competitors: Norway, UK, Canada, Portugal, Spain
Experienced marine industry, including transportation infrastructure	Relatively small local energy market	Meet Western Oregon's electrical power deficit	Uncertainty in permitting process
Highly capable metals & fabrication industry	No federal incentives or established program funding	Diversify coastal economies/export devices	
Leader in academic research (OSU)		Increase OSU/OUS prestige	
Oregon culture supports renewable energy		Strengthen Oregon as global industry leader	

Strategy: To compete against large subsidies and high energy prices elsewhere in the world, make Oregon an attractive place to deploy devices **'first'** that capitalize on Oregon's competitive advantage - and therefore gain the economic benefits (design, construction, intellectual property, siting expertise, etc.) of the emerging industry.



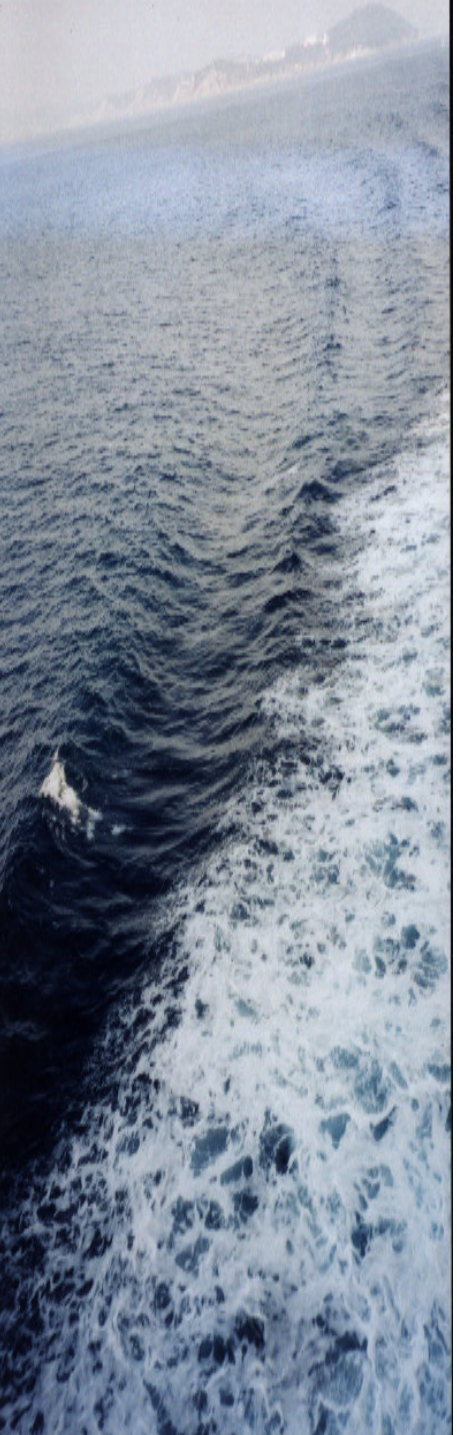
Oregon Wave Energy Trust

Mission:

To build and share the expertise needed to accelerate the development of the Wave Energy industry in a responsible

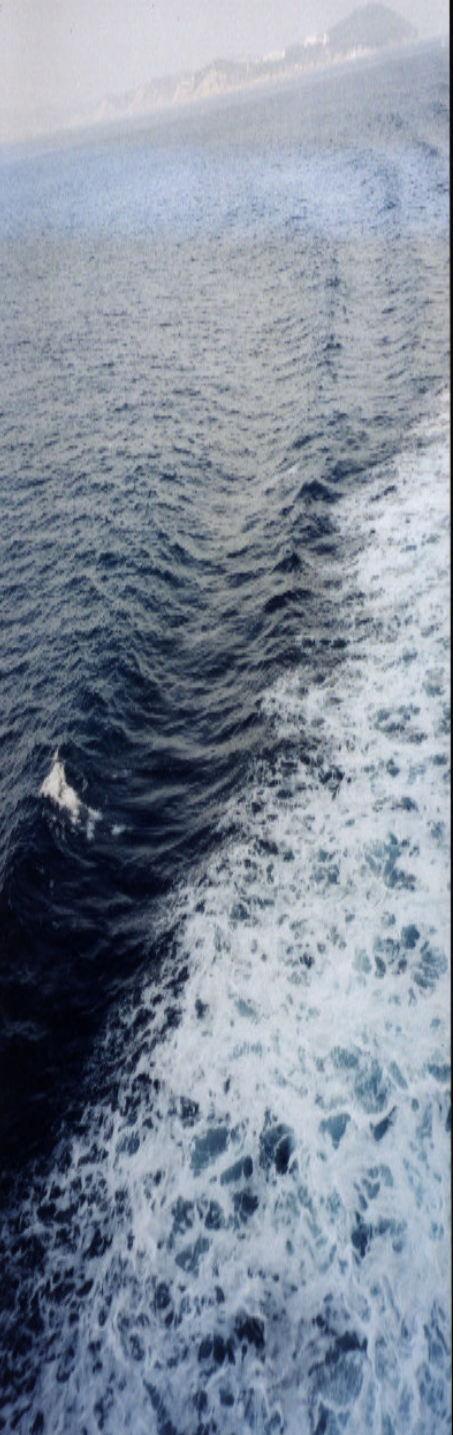
Goals:

- Develop safe, reliable, renewable energy
- Promote industry and create jobs
- Ensure responsible development
- Diversified technology, reliable, and low cost
- Leverage Oregon's investment



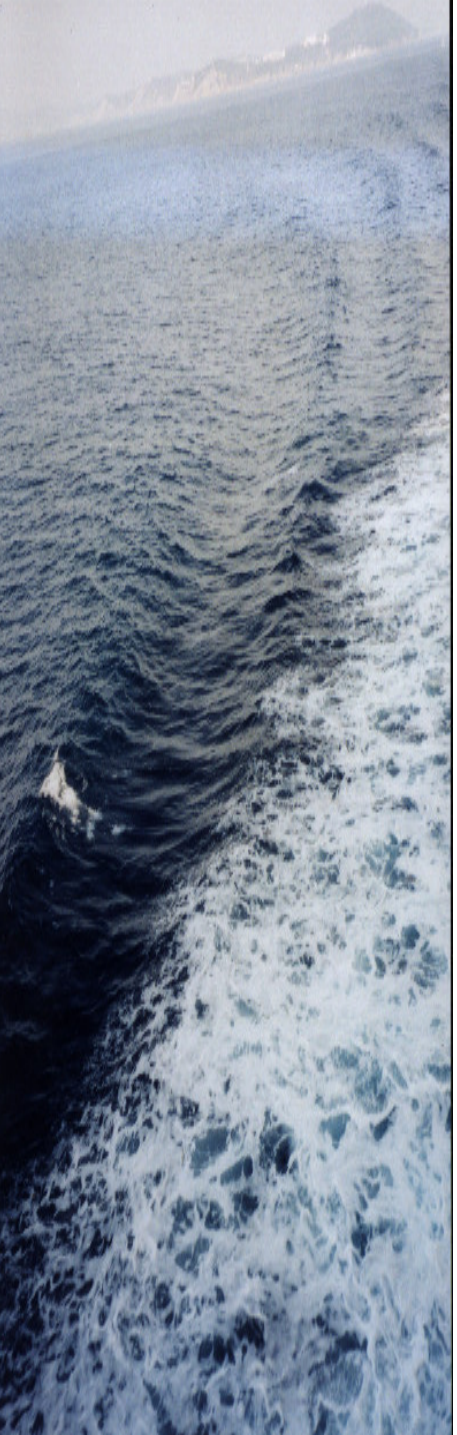
Guiding Principles

- OWET is a public-private partnership that is respectful all perspectives.
- OWET does not develop specific projects, but instead nurtures and coordinates the collaborative efforts of all wave energy stakeholder groups on behalf of the citizens of Oregon.
- OWET supports a balanced and sustainable approach to wave energy development aimed at economic development, environmental protection and community stability.
- OWET will engage stakeholders by sharing information with the public and work collaboratively to identify and resolve conflicts.



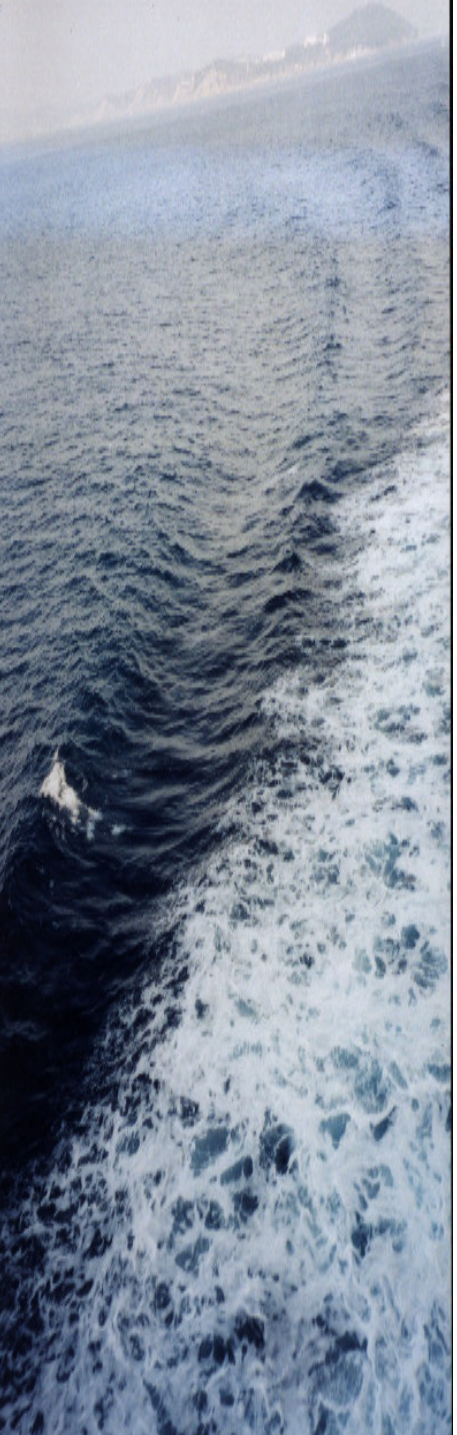
Key Functions

- Wave Energy Clearinghouse
- Project Streamlining
- Research and Development
- Administer Incentive Programs



Milestones

- Establish non-profit entity to manage ‘Initiative’
- Begin permitting OSU Wave Energy Center
- 2 commercial projects engaged in FERC license
- 2 MW pilot project complete
- **500 MW total installed in Oregon by 2025**

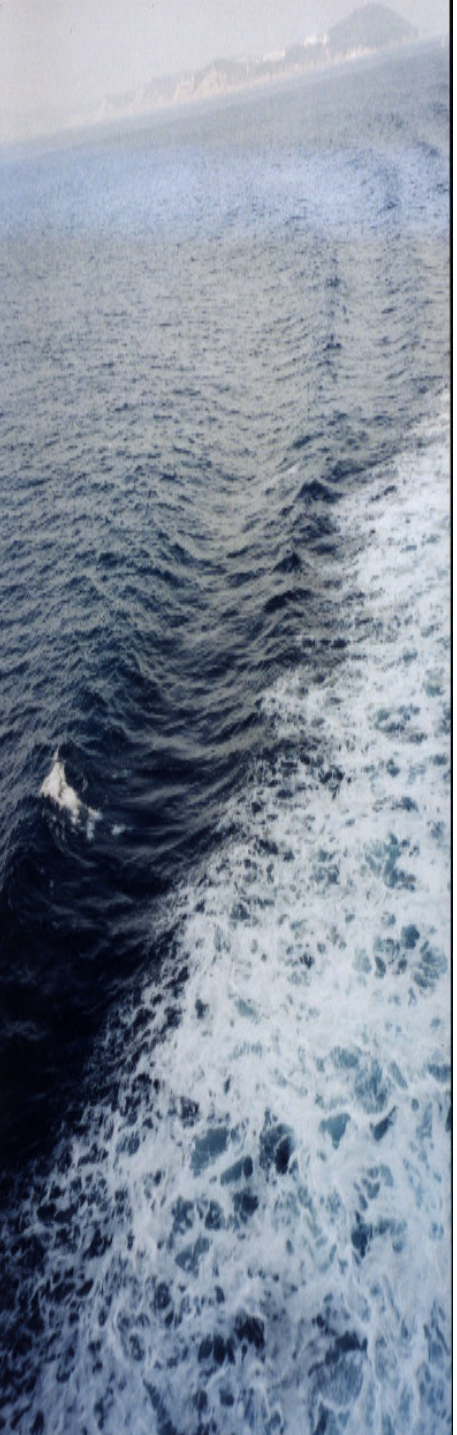


Benefits to Oregon and the Region

What do Oregon and the NW have to gain?

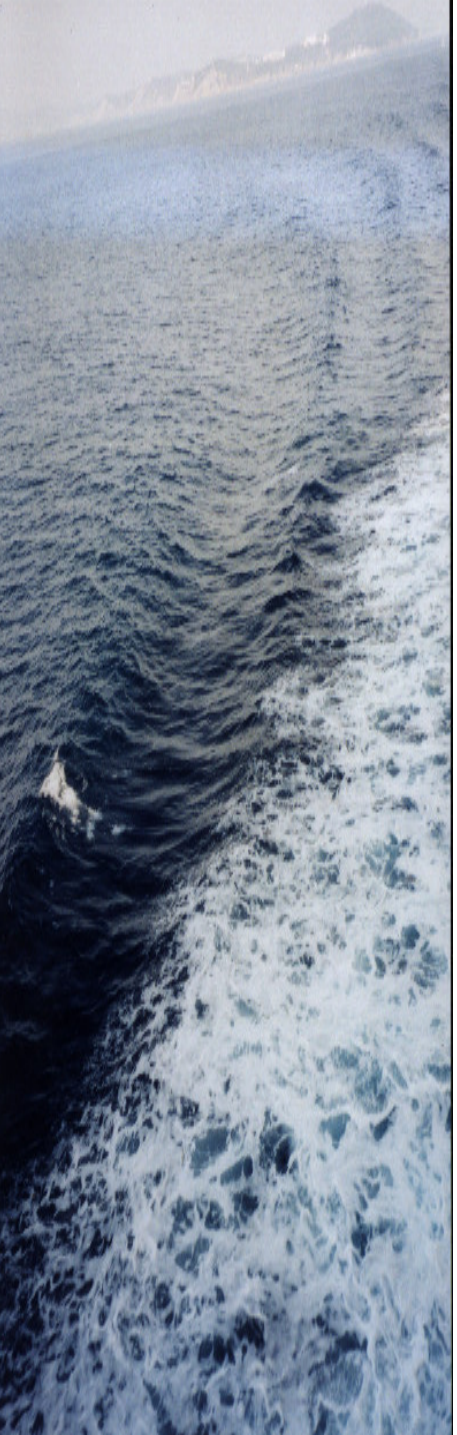
- Economic development
- Increase renewable energy resources
- Reduce greenhouse gases
- Diversify fuel portfolio
- Alignment with public policy
- Strategic market development

Oregon is in the leadership position . . .



Oregon Policy Drivers

- Renewable Portfolio Standard
- Financial Incentives
  - Tax Credits
  - Loans
- Governor's Oregon Solutions Program
- Political Leadership
- Stakeholder Involvement



Questions?

jklure@oregonwave.org