Northwest Power and Conservation Council

November 29, 2006

MEMORANDUM

TO: Council

FROM: Jeff King

SUBJECT: Wave energy briefing

Justin Klure of the Oregon Department of Energy will brief the Council regarding wave energy as a future source of electric power. The presentation will provide an opportunity for the Council to expand its understanding of wave power technology, Northwest potential, and issues needing resolution for the technology to develop into a reliable source of electricity. This will be an opportunity to explore actions that the Council might undertake to promote development of this resource.

Though in the demonstration stage, wave electricity generation could become a future player in the Northwest power system. The theoretical near-shore wave power potential of the Washington and Oregon coast has been estimated to be in excess of 25,000 megawatts. Wave power generators are expected to have an efficiency of at least 12 percent, suggesting a technical potential on the order of 3000 megawatts. Navigational, fisheries, aesthetic and environmental constraints will further limit the development of the resource. Wave power in the Northwest is strongly winter peaking, matching well with winter peak loads. Feasibility studies suggest that commercially mature wave energy projects might be economically competitive with wind power, currently the lowest cost source of bulk renewable power.

Wave power generation has received growing attention in recent years. Several firms have developed wave energy converters and the world's first commercial-scale project entered service in Portugal in October. Three offshore wave energy projects have been proposed in the Northwest. Each would initially consist of a small demonstration array of wave energy converters that could be expanded to a commercial-scale project if the technology and site prove suitable. In addition, the Oregon State University is working to establish a national wave energy research and demonstration center. Staff expects interest in this technology to continue grow given the adoption of renewable portfolio standards and increasing concern regarding greenhouse gas production.

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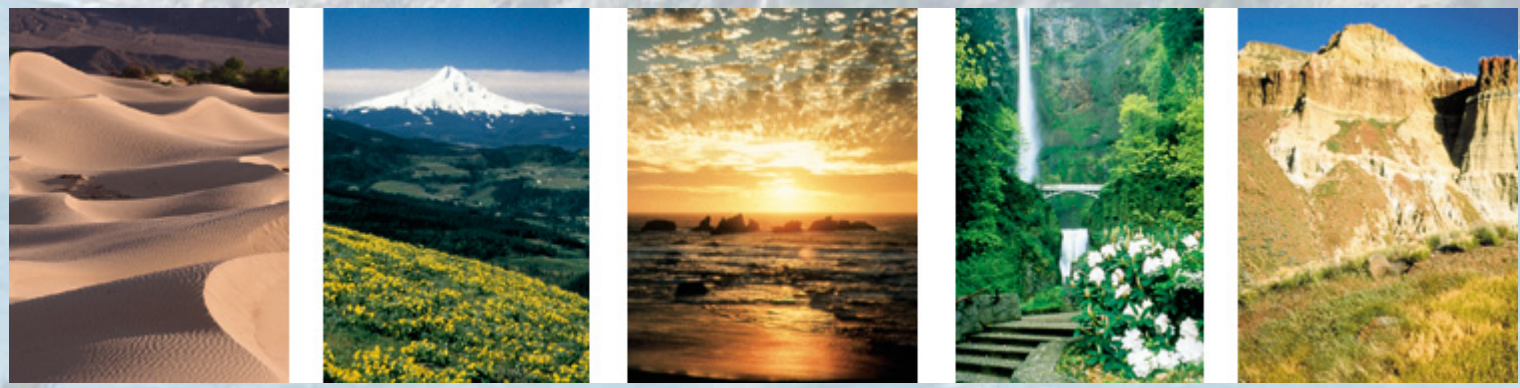


Development of a Wave Energy Industry

State of Oregon Progress

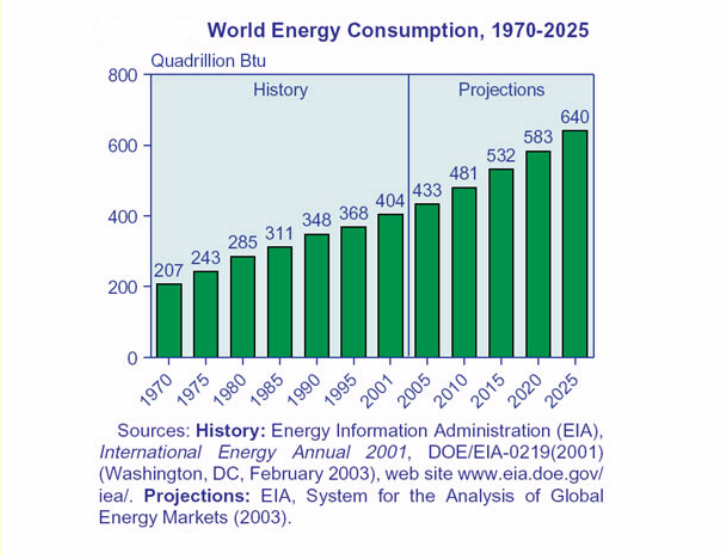
Northwest Power and Conservation Council

Dec. 12, 2006

Oregon's Objectives

- Create a nurturing environment for the wave energy industry
- Establish a world class research facility
- Grow and diversify local economies
- Meet renewable energy goals and diversify energy portfolio

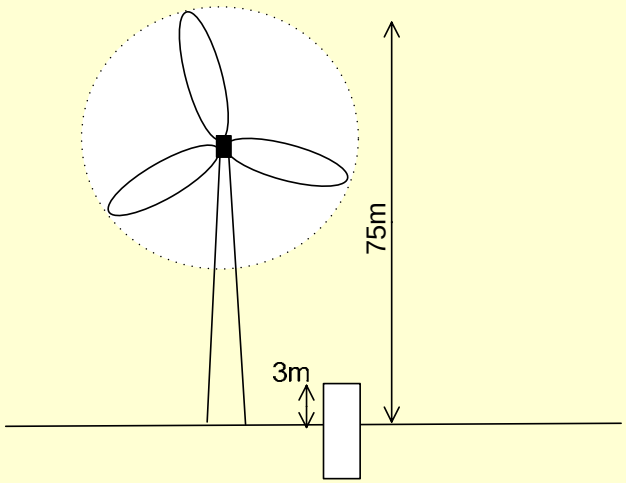
Energy Potential



Sources: **History:** Energy Information Administration (EIA), *International Energy Annual 2001*, DOE/EIA-0219(2001) (Washington, DC, February 2003), web site www.eia.doe.gov/iea/. **Projections:** EIA, System for the Analysis of Global Energy Markets (2003).

New forms of Energy are required!

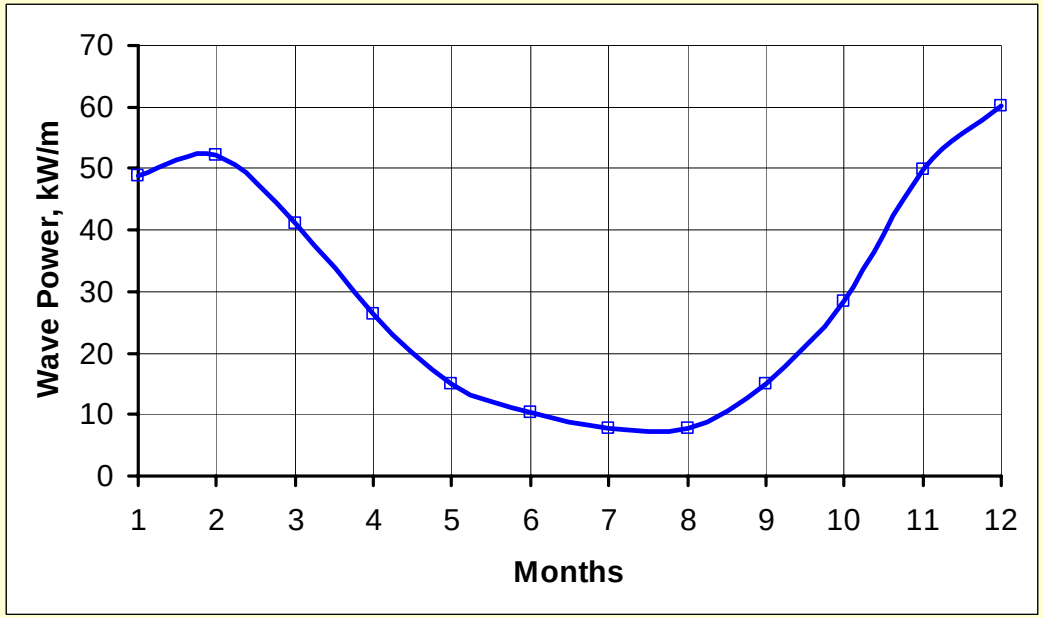
It is estimated that if 0.2% of the ocean's untapped energy could be harnessed, it could provide power sufficient for the entire world.



<u>Wave Energy Advantages</u>

- Higher energy density
- Availability (80 – 90%)
- Predictability

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 mi out

Seasonal variation

Good match for the NW load demand

Wave Energy Devices

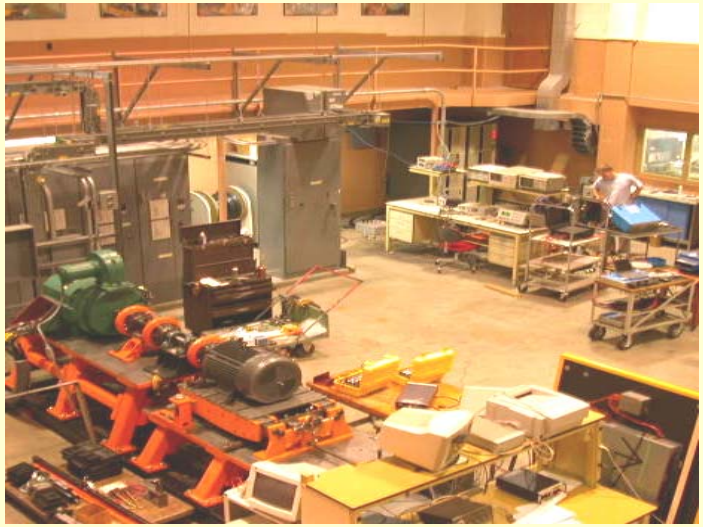
Point Absorber

Oscillating Water Column

Attenuator

Overtopping

Leveraged Resources



Motor Systems Resource Facility (MSRF)

O.H. Hinsdale Wave Research Lab (HWRL)

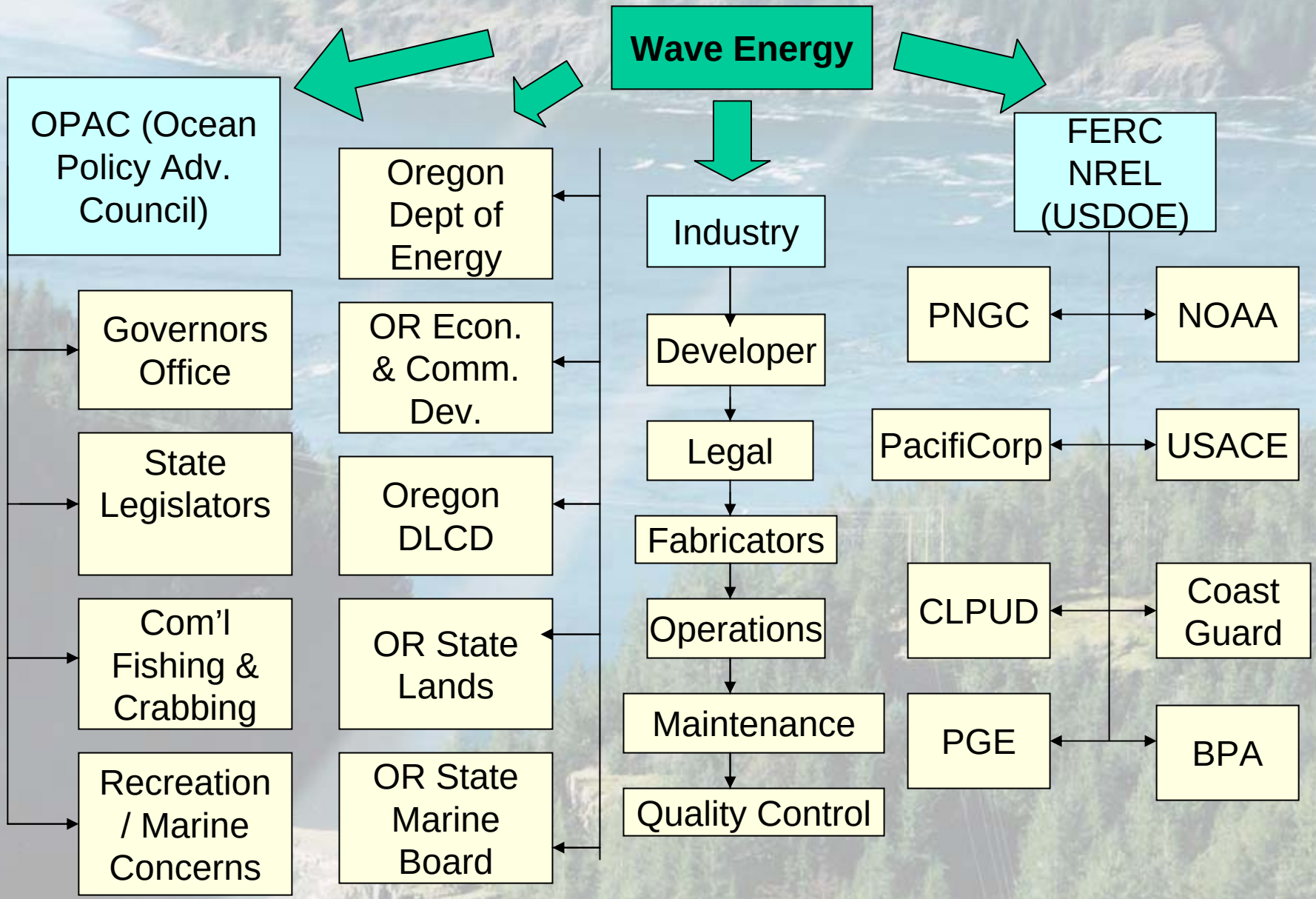
Stakeholder Process

People **O**regon **W**ave **E**nergy **R**esources

- Background
- Mission
- Goals and Objectives
- Action Plan
- Members

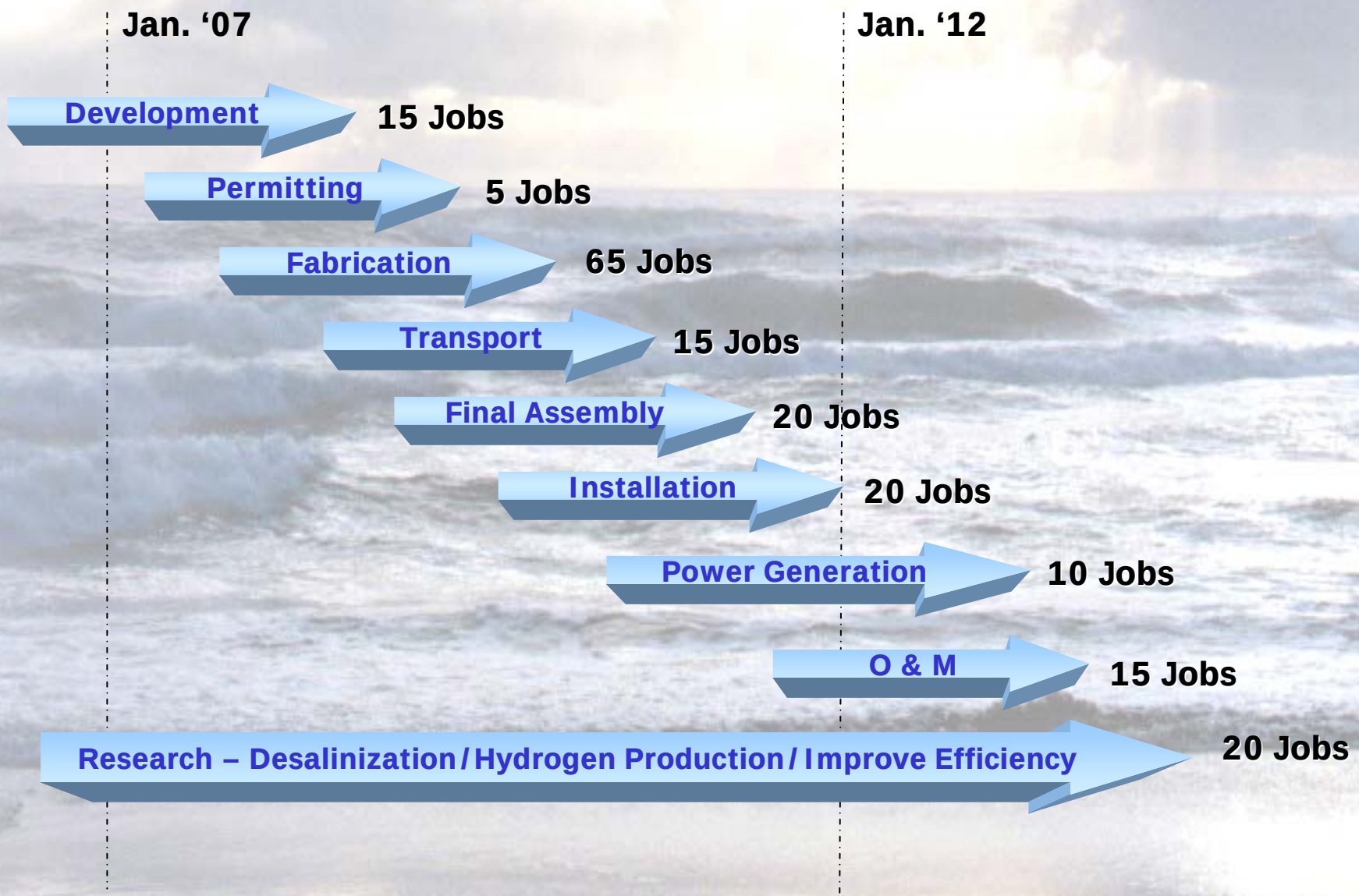
Oregon State University, EPRI and ODOE

Oregon Wave Energy Industry



Wave Energy

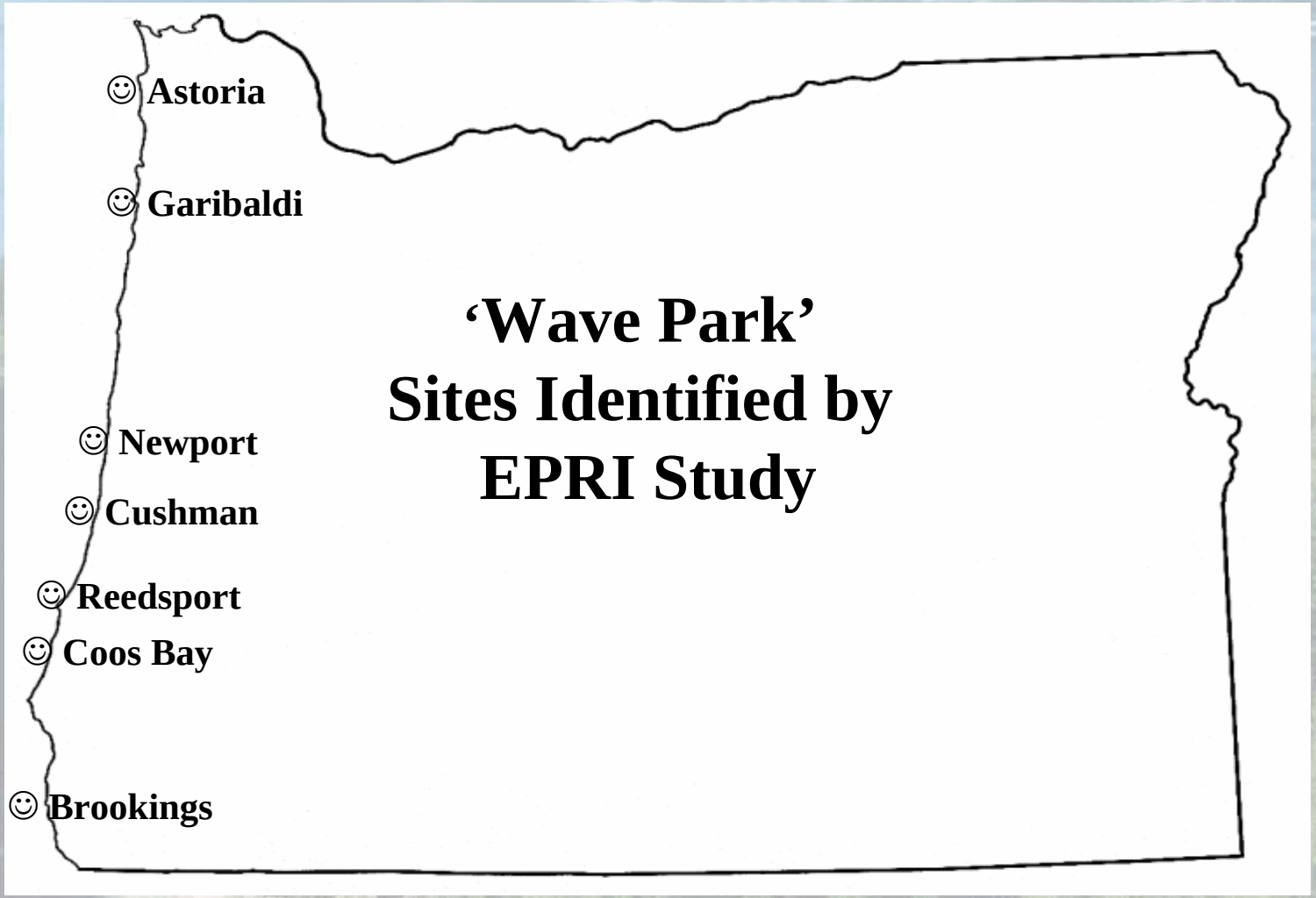
MEANS HIGH PAYING JOBS



Oregon's Competitive Advantage

- Unique ocean resource
- Established marine community
- Existing incentive package
- Positive political climate (both state & federal)
- Independent study by EPRI
- Industrial base standing by to support
- Support of utilities, including existing grid ties and capacity
- Proximity to markets
- Academic leader – only NSF funded research program

EPRI Study: Seven Oregon Sites



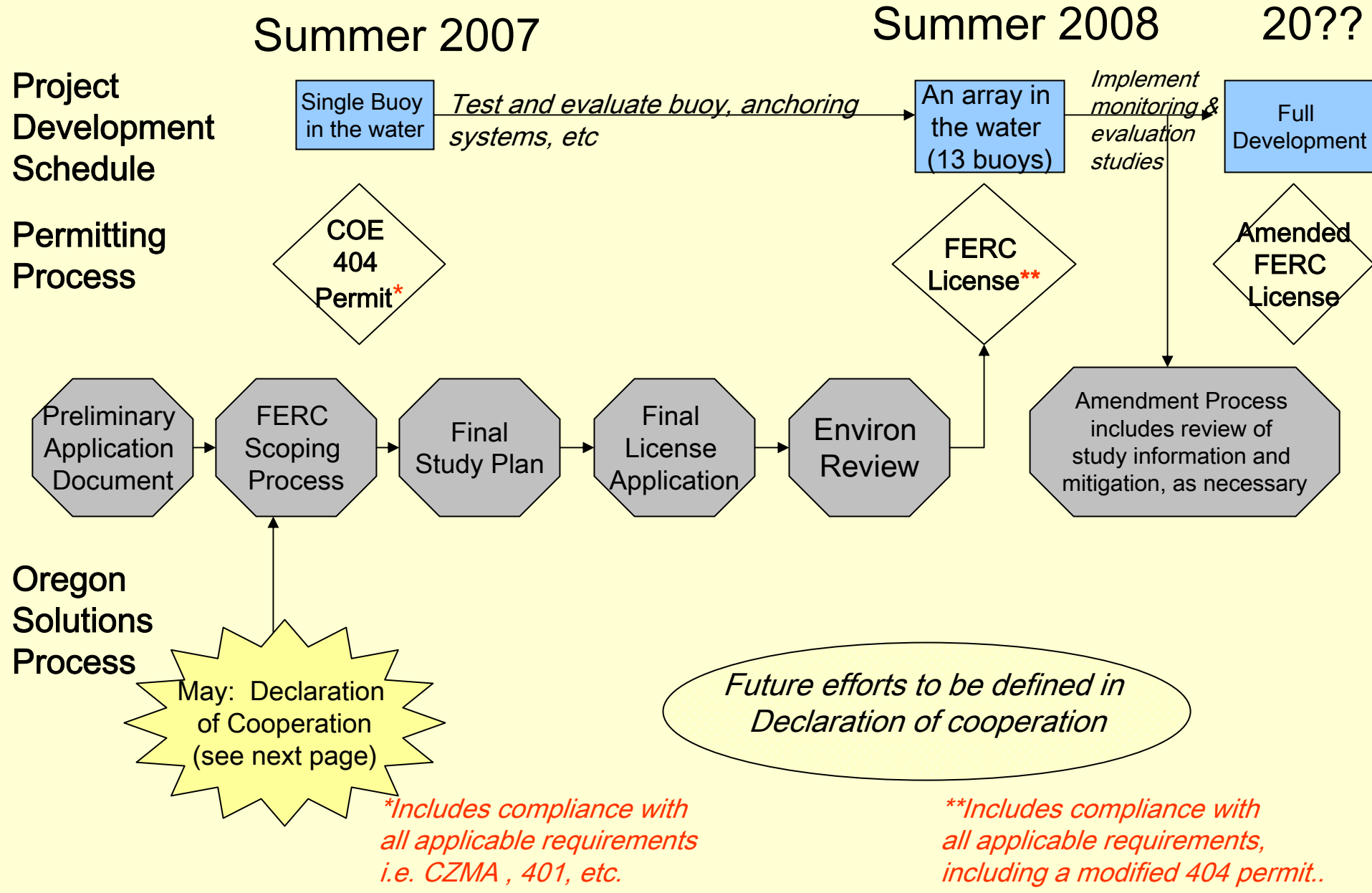
Latest Developments

- FERC Hearing and Applications

http://www.capitolconnection.gmu.edu/ferc/ferc.htm

- Oregon Innovation Council
- Oregon Solutions Project (Reedsport)
- Statewide Planning Process
- Environmental Assessment Workshop

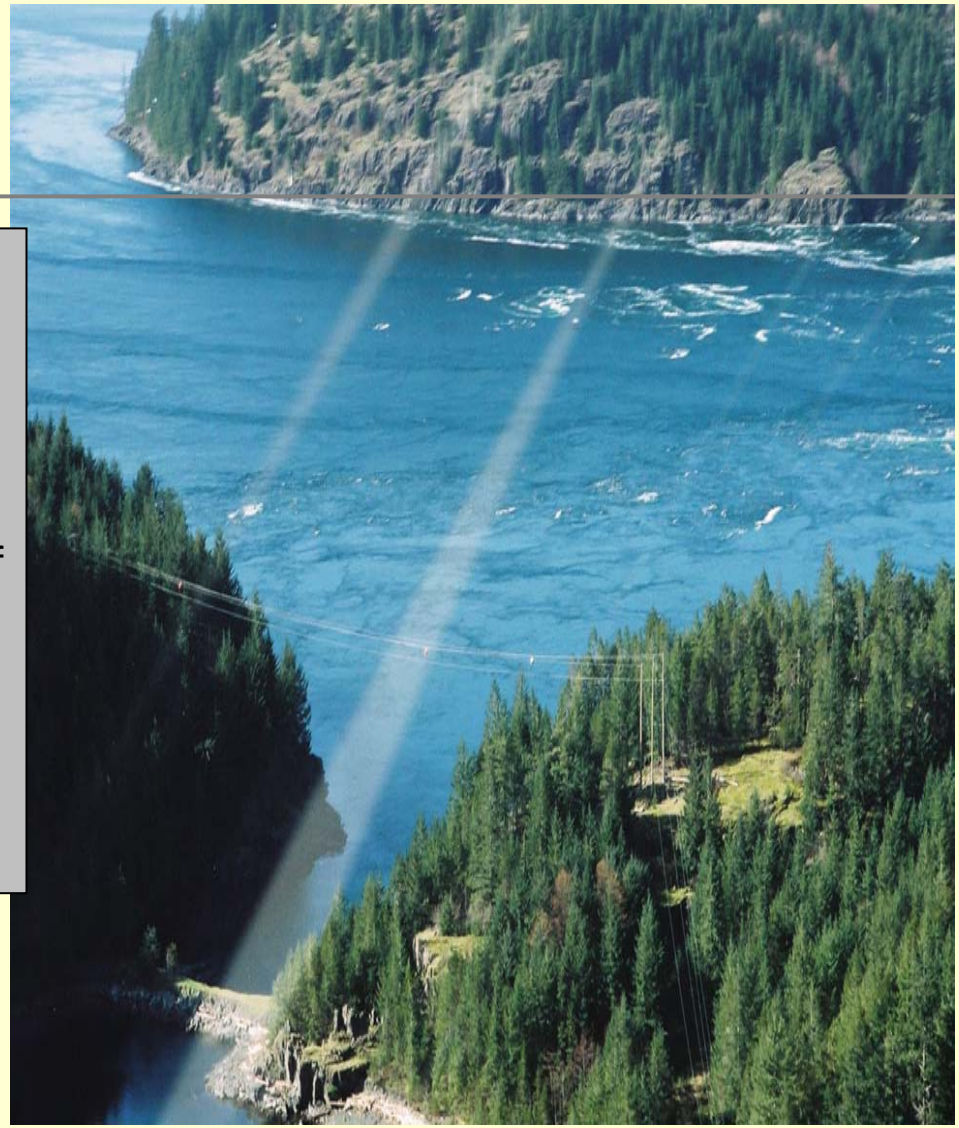
Reedsport Wave Energy Project
Process Map



Why Oregon?

- World class resource
- World class R&D facilities
- Stakeholder process
- Technical expertise
- Political support
- Incentive package
- Transmission capacity

- Based on Oregon's experience, we can limit CO_2 emissions and improve our economy.
- Education and efficient use of resources is essential.
- Renewable resources are Oregon's most beneficial resources.



www.oregon.gov/ENERGY

OREGON DEPARTMENT OF ENERGY