The Industrialization of Our Ocean:

Wave Device Arrays: Blessing or Curse?

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Bodega Marine Lab
Our Coast Now:
World’s four major productive oceanic upwelling centers:

- Humboldt Current off the coast of Chile and Peru.
- Canary Current off northwest Africa and the Iberian Peninsula.
- Benguela Current off northwest Africa.
- California Current: Just north of Ft. Bragg to Pt. Arena.

- Each located on the western edges of their continents at midlatitude, where the winds that drive upwelling persist.
World’s four major productive oceanic upwelling centers:

- Though upwelling centers make up less than 2 percent of the surface area of the ocean, these regions have historically supplied approximately half of the world’s fish catch.
Upwelling at Capes

- Upwelling Jet
- Upwelling Trap
- Upwelling Shadow
- Upwelling Plume
- Downstream convergence
Current Status of Ocean Zoning
Gulf of the Farallones and Cordell Bank National Marine Sanctuaries Boundary Modification and Protection Act

2322 Square Nautical Miles

Gulf of the Farallones National Marine Sanctuary Expansion Area

356 Square Nautical Miles

Cordell Bank Expansion Area

Proposed Sanctuary Expansions

Existing Marine Sanctuaries

Area in square nautical miles of existing sanctuaries:
Cordell Bank: 359
Monterey Bay: 3764
Gulf of the Farallones: 933
FEDERAL WATERS (Minerals Management Service, Department of Interior)

STATE WATERS (California State Lands Commission, Federal Energy Regulatory Commission)

3 miles
Oregon Coast

Ocean Wave Energy
FERC Preliminary Permits
Granted and Pending

DRAFT
Environmental Impacts of Renewable Energy
Klondike Wave Rush
Wave Energy Issues:

- Hazards to Navigation.
- Toxic Biofouling Chemicals.
- Cable Routing, Landfalls.
- Marine Mammal Interactions.
- Seabirds.
- Space Use Conflicts: Fishing Grounds, Safe Anchorages.
- Habitat Conversion.
Responsible Decommissioning

- Thorough Site Restoration Post-Project.

- Bonding.
PG&E Mendocino WaveConnect Project

Permit application boundary shows proposed area of investigation. Actual project would occupy smaller area. Possible footprints of 5MW and 40MW projects are shown below for reference.

Map showing potential project areas, shaded areas indicate areas to be considered for wave energy projects. Unshaded section is example of area left open for harbor access.

Water depth in fathoms: 1 fathom = 6 feet
Source: NOAA chart # 18620
PG&E Proposal off of Mendocino County:

- Proposed Capacity 40 MW.
- From one-half to six miles off the coast of Mendocino County.
- Permit boundary straddles line between state submerged lands and federal Outer Continental Shelf lands.
Streamlined Permit Proposal for Wave Installations:

- **FERC Jurisdiction.**
- “Small” Projects, 5 MW or less.
- **Connected to Power Grid.**
- Revocable, if damage to environment can be proven.
- Can be Extended to 30-50 years.
Circumventing Federal Environmental Laws:

- Marine Mammal Protection Act.
- National Environmental Policy Act.
- Endangered Species Act.
- National Historic Preservation Act.
- Coastal Zone Management Act.
Circumventing Federal Environmental Laws:

- Proposing Company Becomes Lead Agency.
- Fiscal Incentives.
Why Apply to FERC?

- AB-32
- Agency and County GHG Reduction Commitment
- Emphasis on Renewable Energy Resources
- Local Control of Process
Emerging Technologies

• Magnetic Generator Buoy
• Point Absorber
• Pelamis Wave Power Converter
• Other Technologies
Oregon State University Conceptual Wave Park

1-2 miles offshore

Magnetic Shaft anchored to sea floor

Electric Coil secured to heaving buoy

Permanent Magnet Linear Generator Buoy
Full Scale Pelamis
Issues to be Considered

- Environmental Impacts
- Aesthetic Impacts
- Economic Impacts
- Power Transmission
- Cost
Sonoma County Ocean Energy Considerations

- Previous HF Radar Infrastructure Investment
- Local Governance consistent with sustainable objectives & Ocean Commissions recommendations
- Consistent with IRWMP objectives
- Allows for scalable and manageable benefits
- CeNCOOS member
Estimated Costs

• Review and study of feasibility ($250,000)
• Field Studies ($250,000)
• Evaluation of Specific Sites and Technologies ($250,000)
• Focused Evaluation of Project Alternatives ($250,000)
• Environmental Report ($750,000)
Wave of the Future??