OCEAN ENERGY DEVELOPMENT: LINKING POLICY, SCIENCE AND INDUSTRY IN CALIFORNIA

Laura Engeman, California Ocean Protection Council
Sheila Semans California Ocean Protection Council
Paul Siri, Ocean Science Applications Consultant, California State Coastal Conservancy

California has emerged as a world leader in ocean resource management and meeting the challenges of climate change. With one of the planet's most dynamic wave climates, ocean energy is increasingly being considered a viable form of renewable energy generation for powering California's coastal communities and decreasing the state's reliance on fossil fuel energy generation. Development of alternative ocean renewable energy sources provides one path for California to meet its mandated greenhouse gas emissions cap. Over the last year, five proposals were submitted for ocean energy demonstration projects off the coast of California, most of them north of San Francisco Bay.

Ocean energy pilot projects in California present new economic opportunities as well as environmental challenges. State policy supports renewable technology development balanced with the preservation of healthy marine and coastal resources. However, limited baseline information coupled with an evolving technology require that ocean energy siting and management involve adaptive ecosystem based approaches and in particular, reliable and sustained ocean data. Today's ocean observing system information can provide a critical role in this process. Real time physical, biological and chemical observations integrated with high resolution sea floor mapping represent high quality data sets with the potential for new modeling capability assisting managers with important prediction and forecast tools. The following paper outlines several case studies linking ocean data to several scales of energy development and management.

Background

The California Ocean Protection Council (OPC) was established in 2004, pursuant to the California Ocean Protection Act. The council consists of the Secretary for Resources Mike Chrisman (Chair); State Lands Commission Chair, State Controller John Chiang; Secretary for Environmental Protection Linda Adams; two public members, Susan Golding, CEO and President of the Golding Group, and Geraldine Knatz, Executive Director of the Port of Los Angeles; and two non voting members, Senator Darrell Steinberg and Assemblymember Pedro Nava.

OPC is tasked to coordinate and improve the protection and management of California's ocean and coastal resources and accomplishes this by: enhancing the capacity and coordination of government programs responsible for coastal and marine resource management; investing in research and monitoring to improve our understanding of the ocean and coastal ecosystems; supporting innovative approaches to improving water quality and habitat, and encouraging emerging coastal and economic activities that can be conducted in a sustainable manner.

One of OPC's most substantial efforts has been to expand research and monitoring of marine and coastal ecosystems through the California Seafloor Mapping program, and the development of ocean observing applications in coordination with the Integrated Ocean Observing System Program (IOOS). The Central and Northern California Ocean Observing System (CeNCOOS) together with the Southern California Ocean Observing System (SCCOOS) are the regional IOOS centers of expertise where real time observations using standardized formats can be integrated to create customized information products. These applications allow data users to consistently monitor the coastal and marine environment – a crucial component to understanding the effectiveness of management actions while creating increasingly potent prediction and forecast tools.

The California Seafloor Mapping program has undertaken the mapping of California's coastal and nearshore waters. These seafloor maps provide accurate images of the seafloor substrate, marine habitat types, and bathymetry (underwater topography). Information derived from these maps provides insight into wave dynamics (as the map of the famous Maverick's surf site revealed), sediment delivery and transport, faults and tsunami potential, and circulation and ecosystem patterns.

Another ocean observing application, the California Ocean Currents Monitoring Program (COCMP), collects data on coastal ocean currents. COCMP is a cooperative program that includes government agencies, academic institutions and private interests with the goal of integrating ocean current monitoring efforts. HF radar instrumentation measures and delivers real-time surface current maps, out to about 180 Kilometers. The movement of the sea surface plays a central role in transporting inorganic and organic material (natural and pollutants) and distributing the larvae of marine animals. While the information from COCMP can be used to track and predict trajectories of oil or sewage spills, it can also be used to help create models for understanding the larger ecosystem. The program is already working on incorporating wind and near shore bathymetry data to create three dimensional models.

The Coastal Data Information Program (CDIP) is an extensive network for monitoring waves along the coastlines of the United States. The program was established in 1975 as a cooperative agreement between the California Department of Boating and Waterways and the United States Army Corps of Engineers. There are currently 19 operational buoys in California and data are transmitted every 30 minutes to the National Weather Service. CDIP buoys provide archived wave, wind, and temperature data along the California coast, useful for establishing historic patterns of coastal weather effects on the shoreline and the nearshore environment. These buoys are also assisting the maritime community by providing new navigation tools. The west coast's ocean observing programs are integrating ocean buoy and weather data into single web-based interfaces reducing the risk of maritime accidents.

Ocean Energy Applications

With industry confirming California's viability for ocean energy development, ocean observing tools are increasingly being used to inform the regulation and development of this experimental marine technology.

Baseline information is crucial for making management decisions about siting offshore energy devices. However, marine science data is extremely limited for the north coast of California, where most of the ocean energy devices are proposed. Existing ocean observational applications provide the best available baseline data for determining the oceanographic conditions of the proposed energy fields. Bathymetric information derived from seafloor mapping offers insight into wave height potential. Seafloor substrate and habitat descriptions also provide useful information for avoiding ecologically sensitive areas. In addition, COCMP and CDIP's new high quality data sets can assist in the siting of ocean energy buoy fields while creating archived wave statistics necessary for understanding and evaluating different wave energy conversion technologies.

Monitoring experimental energy devices is also a critical element to developing a sustainable industry. Potential impacts from wave energy conversion devices could include benthic habitat disturbances; reductions in wave power along the nearshore resulting in changes in sediment transport and wave dependent ecosystems; acoustic or magnetic effects on marine mammals and fish populations; and interference with migratory species. Ocean observing data, supported by state and federally funded infrastructure, will provide valuable background information for evaluating these effects.

Long term sea-surface current data combined with salinity, temperature and several biogeochemical parameters can inform regulators, developers and stakeholders whether the offshore infrastructure or a natural event is causing biological changes, such as a deteriorating nearshore environment, or a change in the migratory patterns of whales. Specifically, the large geo-spatial scale observations represented by CDIP and COCMP will allow us to evaluate wave refraction created by increasing wave energy infrastructure. Appropriate biological assessments coupled with this wave refraction data can provide critical insight into positive or negative changes in these high energy wave environments.

In addition, the regional expanse of ocean observing data also provides a broader picture of conditions offshore and all along the West Coast. Considering that wave energy devices are being implemented in various locations along the coast, this geographic range offers a unique opportunity for evaluating the devices in a broader context. The West Coast Governor's Agreement cites some of the attributes of the emerging tri-state ocean observing systems and their benefits to management including sustainable ocean energy development over the geography of the California Current Large Marine Ecosystem.

Finally, expanding ocean observing technology will be critical for developing standards and criteria for ocean energy devices. By co-locating instrumentation, regulators and technology designers have the potential to consistently evaluate turbidity, wave power, currents, and other significant parameters. These types of information inputs provide unique opportunities to adaptively manage the design and operation of the device and mitigate environmental impacts.

Although undefined regulatory requirements pose a challenge for collaboration between industry and government regulators, high-quality information derived from ocean observing applications can assist in the development of pilot projects while simultaneously creating opportunities for engaging partners critical to the successful development of ocean renewable energy technologies.

Laura Engeman
California Ocean Protection Council
1330 Broadway, Suite 1300
Oakland, California, 94612, USA
ph (831) 688-4095
fax (510) 286-0470
lengeman@scc.ca.gov