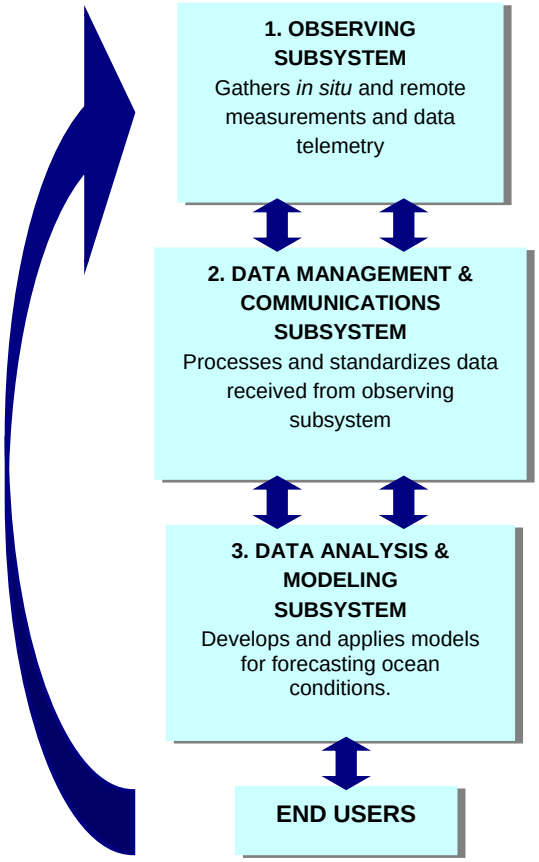
IOOS and Renewable Energy

What does IOOS do?

IOOS (Integrated Ocean Observing System) is a **multidisciplinary** system designed to provide weather, climate, ocean, and coastal data in the formats, rates, and scales required for decision-making, based initially on the **integration** of existing private, federal, state, and local systems. Consisting of three major subsystems (see figure at right), IOOS will constantly evolve according to user needs.



Currently, numerous ocean and weather data collection systems are maintained by scores of different federal, state, and non-governmental agencies and organizations (see Table 1 for a few examples). IOOS is gathering these useful but disparate and isolated data sources into integrated systems, permitting users to readily access all ocean-related data gathered by all possible sources. In addition, IOOS will allow any compilation of data specified by the user to be manipulated using myriad existing forecasting models, thereby turning raw numbers into actionable information relevant to the user's specific concerns. Finally, IOOS is seeking new research and enhancements to add to its already-extensive catalog of products. In this way, IOOS becomes a flexible, adaptable system capable of keeping up with new developments while maintaining the reliable delivery of data, analyses, and forecasting results. IOOS will focus initially on seven priority variables. For example, IOOS information on sea surface winds can help with the siting and design of offshore and coastal wind farms.

Table 1. Examples of already-existing data collection systems for Renewable Energy

Existing Data Source	Measurements Collected by Data Source	Representative Outcomes
Coastal Ocean Observation Laboratory (COOL) Room (http://marine.rutgers.edu/coolroom/)	Sea surface temperature, surface currents, coastal wave measurements	Forecasts of coastal weather fronts at high-resolution scales, applicable for renewable energy applications.
Central and Northern California Coastal Ocean Observing System (CeNCOOS) Monterey Bay Surface Wind Demonstration Product (http://www.cencoos.org/data_winds.htm)	Near real-time surface winds from a mesoscale atmosphere model together with winds measured at four ocean buoys and seven coastal stations from various institutions that are collaborating with CeNCOOS	Better characterization of wind and ocean resources.

How can IOOS Help the Renewable Energy Sector?

Given its ocean and coastal focus, IOOS has the greatest potential to help the wind and ocean energy sectors of renewable energy. IOOS can help the wind energy sector by improving wind resource assessments and forecasts for offshore and coastal areas, and improving the spatial and temporal coverage of the ocean information required for offshore wind system design, construction, and operation. Wind energy, and more broadly renewable energy, is receiving increased attention as 23 states and the District

of Columbia have adopted renewable portfolio standards or mandates aimed at increasing the share of renewable power in their energy mix. National Renewable Energy Laboratory (NREL) resource maps indicate very large areas of strong and reliable winds in shallow and deep offshore waters. In addition, many urban load centers are in coastal areas, increasing the incentive to develop energy resources offshore and in coastal regions. A coastal resource assessment recently carried out by NREL found that with sufficient technology improvements and volume production, costs could reach $0.051/kWh for deployment of deepwater offshore wind turbines by 2015 and $0.041/kWh by 2012 for shallow water areas[1]. A study conducted for New York State concluded that state-of-the-art wind generation forecasts can improve the value of wind energy by around 25 percent[2]. By bringing together disparate information sources on sea surface winds (e.g., high frequency radar, Voluntary Observing Ships measurements, and Quicksat satellite data), IOOS will provide the wind energy sector with comprehensive information for resource assessment and forecasting. In addition, IOOS information on priority variables such as currents and waves will be utilized in the design and construction planning of offshore wind turbines.

Wave Power and IOOS

An Electric Power Research Institute (EPRI) report on Wave Energy Conversion in the U.S. concluded that there is a potential for wider application of wave energy. The report analyzed the wave potential at various coastal sites in the United States, examined the economics and viability of various ocean technologies, and provided an overview of potentially applicable permitting regimes. Representing a general reversal in industry attitude, the EPRI report concluded that generation of electricity from wave energy may be economically feasible in the near future. The improved information on wave height, currents, and circulation, as a result of IOOS, will be key to the further development of wave energy.

Source: Previsic, M. 2004. E2I EPRI Guidelines for Preliminary Estimation of Power Production by Offshore Wave Energy Conversion Devices. http://www.oceanpd.com/PDFS/E21%20EPRI%20Assessment.pdf

Another renewable energy technology with potential to benefit from IOOS is ocean energy. Although still in the early stages, this represents one of the most directly relevant energy options with the most to gain from IOOS as the evolution of both IOOS and ocean energy coincide. Whether the focus is on wave energy, tidal energy, or ocean thermal energy conversion, IOOS can help the ocean energy sector by providing improved ocean information needed for resource assessment and technology development. Specifically, improved information on wave height, currents, sea level, and ocean circulation, all of which are included in the IOOS seven priority variables, will be key to further development of ocean energy.

What Can the Renewable Energy Sector Do?

The value added from the integrating and sustaining power of IOOS will only be realized with Regional Association (RA) **participation** (www.ocean.us/regional_associations). RAs are critical for engaging private and public user groups to identify regional data and information needs. Additionally, RAs can be critical entry points for a user to get involved with specific IOOS pilot projects (many of which are happening right now) through which users help improve and refine IOOS. Pilot projects and RAs can facilitate data sharing, the cornerstone of IOOS, between previously unconnected parties. Even by sharing small amounts of data, the benefits are reaped tenfold through invaluable forecasting results.

[1] Musial, W. and S. Butterfield, Future for Offshore Wind Energy in the United States. NREL Report No. NREL/CP-500-36313, 2004, http://www.nrel.gov/docs/fy04osti/36313.pdf.

[2] The Effects of Integrating Wind Power on Transmission System Planning Reliability and Operations Report Phase 2, March 2005, http://www.nyserda.org/publications/wind_integration_report.pdf.