

## TECHNICAL SUMMARY

**Study Title:** Worldwide Synthesis and Analysis of Existing Information Regarding Environmental Effects of Alternative Energy Uses on the Outer Continental Shelf

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**Contract Number:** 1435-01-06-CT-39821

**Sponsoring OCS Region:** Headquarters– Alternative Energy and Alternate Use Program

**Applicable Planning Areas:** East Coast, Gulf of Mexico, and Pacific Coast

**Completion Date of Report:** June 2007

**Costs:** FY 2007: \$298,878

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**Key Words:** alternative energy, offshore wind, wave energy, current energy, benthic, fishes, marine mammals, sea turtles, aquatic resources, birds, bats, aesthetic, space-use conflicts

**Background:** The Energy Policy Act of 2005 gave MMS new responsibilities over offshore renewable energy and related uses. Alternative energy sources that could be developed on the OCS include wind, ocean wave, ocean current, solar, biomass, and hydrogen. Large-scale, near shore wind projects are currently in operation internationally and are in the pre-planning or permitting stage in the United States. Ocean wave technology is deployed on a small, prototype scale at few locations, but is still in its infancy. Ocean current, solar, and hydrogen technologies are in the early stages of design. Under this new responsibility, MMS is working to establish an MMS Alternative Energy and Alternate Use Program that will provide for sound multiple-use management of federal offshore lands for nontraditional energy and related uses. Synthesis and analysis of existing data on environmental effects of alternative energy uses on the OCS were needed to provide the basis for developing future environmental studies to fill critical data gaps and support decision-making.

**Objectives:** The project objectives were to identify, collect, evaluate, and synthesize existing information on offshore alternative energy activities for the following topics:

- Current offshore energy technologies and future trends
- How public acceptance of existing projects was or was not achieved
- Potential direct, indirect, and cumulative environmental impacts of offshore energy technologies
- Previously used mitigation measures that could avoid, minimize, rectify, eliminate, or compensate for environmental impacts
- Current physical and numerical models designed to determine environmental impacts
- Information needs to address gaps in our current understanding of environmental impacts

**Description:** A comprehensive literature search was completed and a database containing XX documents was created to support the synthesis analysis. Most available literature was based on assessments or studies of existing or planned offshore wind parks in Europe. There were a few

prototype or demonstration projects for wave energy devices and tidal current systems for deployment nearshore, but there were no full-scale installations in operation. While existing literature provided valuable information on the potential magnitude of impacts for environmental resources in the project areas, more information is needed to address environmental assessment of alternative energy projects in the offshore waters of the United States. These information needs are described in detail for the broad resource categories of physical processes, benthic resources, fishery resources, marine mammals, sea turtles, and flying animals (birds, bats, and flying insects) at the end of each section on wind, wave, and ocean current technologies. The lists of information needs for each resource are comprehensive, and they cover a wide range of types of studies and priorities.

The information needs can be divided into the following five general categories:

1. Finer-grained data on the distribution and life history for key species in each regional ecosystem; environmental assessments for specific projects need more detailed data on benthic habitats and multiyear studies of seasonal abundance and distribution of key species of each resource.
2. Development of better field data collection methods for baseline studies and postconstruction monitoring surveys to improve the confidence of impact detection; study of highly mobile species in offshore areas is particularly difficult, requiring new approaches and technologies.
3. Focused laboratory studies to determine thresholds for potential effects resulting from exposure to the types and levels of sound and electromagnetic fields likely to be generated by different types of alternative energy devices in full-scale installations.
4. Development of protocols for field studies on potential effects from exposure to sound, electromagnetic fields, and obstructions on the behavior and survival of key species of each resource of concern.
5. Development of guidelines to set acceptable limits of direct, indirect, and cumulative impacts resulting from the installation and operation of offshore alternative energy projects; guidelines are needed for all types of potential impacts such as changes to the hydrodynamic climate, erosion of adjacent shorelines, habitat loss and alteration, avoidance and attraction behavior, mortality, aesthetics, and lost use.

MMS has conducted preliminary analyses of the likely geographic locations where alternative energy development is most feasible based on existing and near-term technologies and physical factors such as wind speed, wave energy, and water depth. The scale of these analyses is very coarse, indicating wind parks in shallow water (less than 100 m in depth) along the Atlantic and Gulf of Mexico coasts, wave technologies along the Pacific coast, and ocean current technologies where the Gulf Stream passes close to Florida. Many of the resource concerns are associated with mobile and migratory species, and baseline studies in broad geographic areas are very expensive. To better identify and prioritize where studies of key resources should be conducted, geospatial analyses are suggested to identify the most likely areas of OCS alternative energy development in the near term. These maps would then be used to identify where more detailed resource studies are needed.

**Study Products:** Michel, J., Dunagan, H., Boring, C., Healy, E., Evans, W., Dean, J.M., McGillis, A. and Hain, J. 2007. Worldwide Synthesis and Analysis of Existing Information Regarding Environmental Effects of Alternative Energy Uses on the Outer Continental Shelf. U.S. Department of the Interior, Minerals Management Service, Herndon, VA, MMS OCS Report 2007-038. 254 pp.