MMS OCEAN SCIENCE
VOLUME 3 ISSUE 3
MAY/JUNE 2006
THE SCIENCE & TECHNOLOGY JOURNAL OF THE MINERALS MANAGEMENT SERVICE

Bright and Stable Vision

Sand Renourishment

This Is Only a Test – Waiting to Be Discovered

The Answer is Blowing in the Wind

Alternative Energy Considerations

Going Deep – Cold Seep and Coral Communities

MAY/JUNE 2006
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MMS OCEAN SCIENCE is published bi-monthly by the Minerals Management Service to communicate recent ocean science and technological information and issues of interest related to offshore mineral recovery, ocean stewardship, and mineral revenues.

Please address all questions, comments, suggestions, and changes of address to:

Deborah Epperson
MMS OCEAN SCIENCE Editor
Minerals Management Service
1201 Elmwood Park Boulevard
New Orleans, LA 70123

deborah.epperson@mms.gov

(504) 736-3257

ABOUT THE COVERS

Top: Chevron's Jack Discovery Production Well Test with the Transocean Cajun Express Rig and Barges, Walker Ridge Block 758, Lease OCS-G 17015, Well #1. Image courtesy of Chevron North America Exploration and Production Company.

Bottom: The R/V *Atlantis* and DSV *ALVIN* combine to form one of the premier ocean science exploration and research tandems in the world. Image courtesy of Mark Spear, Woods Hole Oceanographic Institution.

All photos courtesy of Minerals Management Service unless otherwise noted.

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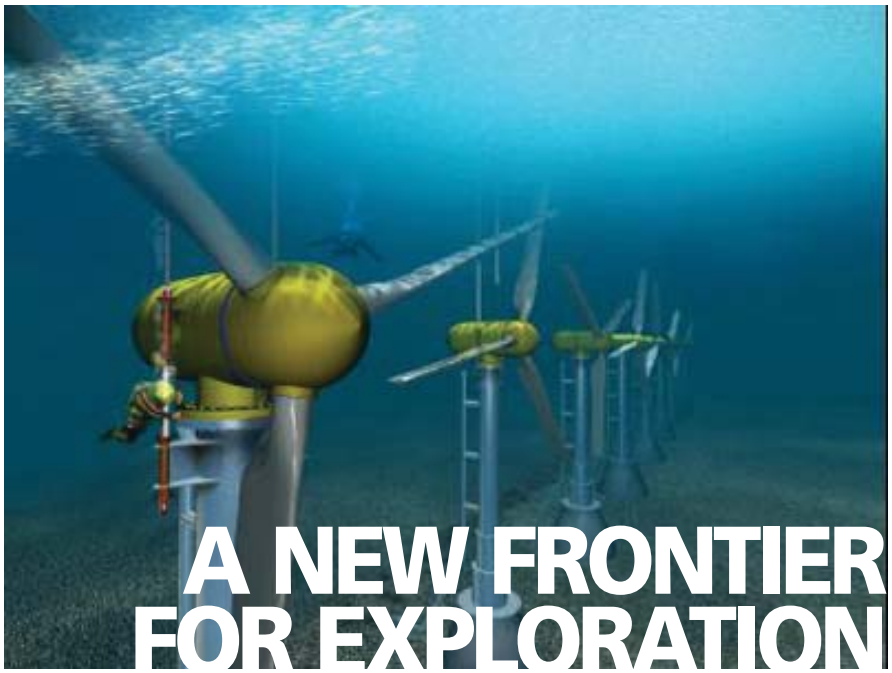


A NEW FRONTIER FOR EXPLORATION

BRIGHT AND STABLE VISION

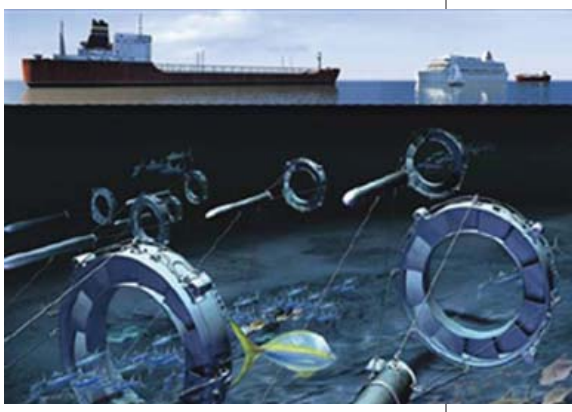
Since its inception, the Minerals Management Service (MMS) has been responsible for overseeing the planning and development of marine mineral resources of the Outer Continental Shelf (OCS), including the supervision of oil and gas leasing, development, and production. In its role as steward, MMS has ensured that oil and gas development has been conducted in an environmentally safe, fiscally responsible, and technologically innovative manner. In August 2005, MMS was given another major responsibility – oversight of offshore renewable energy and alternate uses of the OCS. The MMS's long history of expertise in energy development, environmental protection, and conservation of natural resources makes it the obvious choice to manage alternative energy and use.

One of MMS's first responsibilities is to develop a program that defines potential new energy sources and integrates those new sources with existing uses of OCS resources. This vital task will necessitate meeting with all stakeholders in the OCS – business, academic, and governmental – on State, local and Federal levels. The task will involve preparing guidelines that will protect the environment while encouraging new and innovative ideas; identifying what information needs to be gathered; deciding who should gather the information; and determining who should have access to the information once it is gathered.

In an Advance Notice of Proposed Rulemaking, MMS requested comments on the development of a regulatory program to implement Section 388 of the Energy Policy Act of 2005 – Alternate Energy-Related Uses on the OCS. Objectives of the new regulatory program are to provide access to the OCS in a way that balances competing and complementary uses of offshore acreage; ensure consultation with affected States and local governments; take into account the evolving nature of the energy industry; and provide a fair return to the United States for access to the OCS.

The MMS also held public scoping meetings at 10 sites across the country during the months of May and June 2006 to obtain comments from the public on renewable energy projects and alternate uses of facilities in Federal waters. The meetings are the first step in the preparation of a Programmatic Environmental Impact Statement (EIS) for the Nation's OCS Renewable Energy and Alternate Use Program. The MMS must also establish a formula by which coastal States within 15 miles of a project can share the revenue produced. Among other tasks, MMS is expected to streamline the permitting process while still ensuring that any project will be conducted in an environmentally safe manner. The MMS will also develop regulations that will help the Agency carry out its new mandate while not interfering with the permitting processes already put in place by other agencies and Congress.

Alternative energy uses present a new frontier for exploration and development in the OCS. Having a consistent, balanced, and stable vision for our Nation's offshore alternative energy development will ensure that our country's increasing needs will be addressed without sacrificing the natural resources that will someday belong to our children. The MMS is well suited for this enormous task.



Top: Water current turbines.
Bottom: Ocean current project.

A COOPERATIVE EFFORT

SAND RENOURISHMENT

When most people think of our Nation's offshore energy resources, they think only of oil and gas. Yet another resource is just as vital – sand and gravel. Portions of our Nation's coastlines and beaches are eroding every year. Whether from rising ocean levels, upstream flood control measures, sediment compaction, or climatic variations resulting in changing storm patterns, beaches and barrier islands are losing sediments at the rate of 5-10 feet a year in some areas.

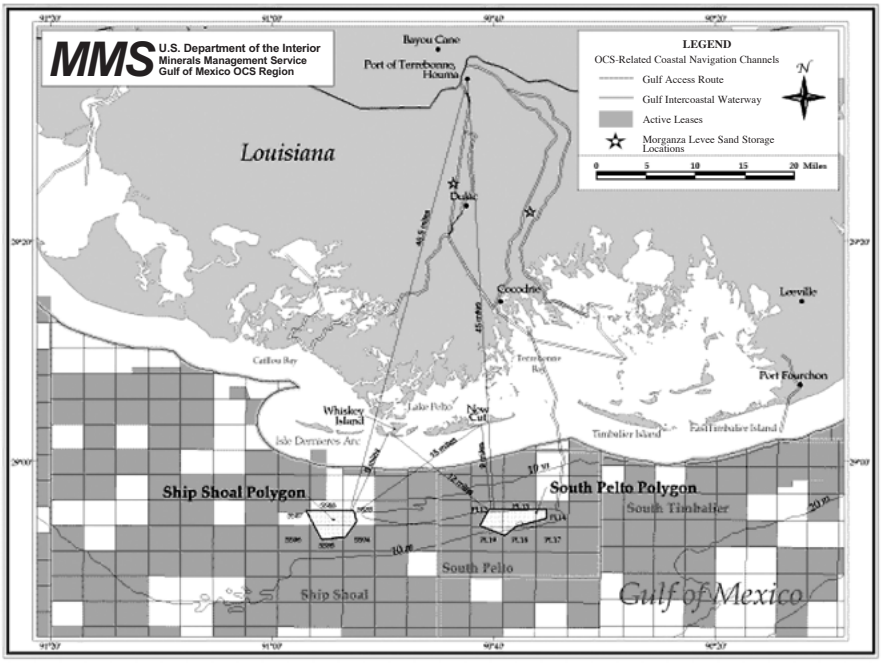
The Minerals Management Service (MMS) has been given the responsibility for "policy direction and guidance for the development of marine mineral resources of the Outer Continental Shelf (OCS)." On the basis of this mandate, MMS has entered into cooperative agreements with coastal State and local governments to alleviate coastal erosion, restore wetlands, and support levee construction using offshore Federal sand resources, wherever it is environmentally sound to do so. Under MMS guidance, over 22 million cubic yards of sand have been conveyed to State, local, and Federal entities.

Both the Atlantic and Gulf of Mexico (GOM) OCS regions have been ravaged by nature. In Florida, the 2004-2005 hurricane seasons damaged miles of beaches. In Naples, Florida, MMS partnered with local officials to re-nourish 8.6 miles of storm-damaged beach, with sand being transported from offshore deposits 33 miles away. Near Jacksonville, 10 miles of damaged beach were re-nourished.

In New England, several states have signed a multi-year cooperative agreement with MMS to assess their sand and gravel resources and their potential usefulness for restoration of wetlands, coastal beaches, and to dampen the tidal surge during storms. Finding sources that are of sufficient quality and quantity to nourish and maintain beaches and

Above: The MMS also signed a Memorandum of Agreement with the U.S. Air Force to provide up to 350,000 cubic yards of Federal sand to restore the Atlantic shoreline of Patrick Air Force Base, in Brevard County. The sand was dredged from Canaveral Shoals, then transported to the project sites and hydraulically pumped from the dredge ship. This project was completed on April 29, 2005.

Below: Map showing (1) sand borrow polygons in the Ship Shoal and South Pelto areas, (2) OCS block numbers, and (3) distances between sand borrow polygons, Isles Dernieres restoration projects, the project's shore base at the Port of Terrebonne at Houma, Louisiana, and temporary sand storage areas for the Morganza levee project.



MMS's cooperative efforts with states.

barrier islands is of vital economic and environmental interest to the tourism, fishing, shipping, and energy industries of the region.

The importance of beaches and barrier islands to the economy of a region is illustrated by the plight of southern Louisiana. The deltaic and coastal wetlands of southern Louisiana continue to be lost at rates estimated at between 25 and 40 square miles per year. The barrier islands protecting southern Louisiana's basins and wetlands may disappear by 2012 unless something is done to prevent or delay the erosion. Aside from the over 1.5 million people and countless plant and animal species that will be affected, vital energy infrastructure, including oil and gas wells, platforms, pipelines, roads, refineries, bridges, cities, towns, canals, and ports, are at risk. It is estimated that 80% of the oil and gas produced in the GOM passes through that infrastructure. A large barrier island remnant known as Ship Shoal, containing approximately 1.5 billion cubic yards of sand, is being earmarked to provide the resources needed to restore the barrier.

As Hurricanes Katrina and Rita emphasized, our coastal beaches and wetlands are vulnerable to storms and erosion. The MMS, State, and local officials are working together to ensure that these valuable national resources will not disappear, while ensuring the sand and gravel resources of the OCS are not depleted.

For more information:

OCS Sand and Gravel Mining

Website: www.gomr.mms.gov/homepg/offshore/sandgrvl.html

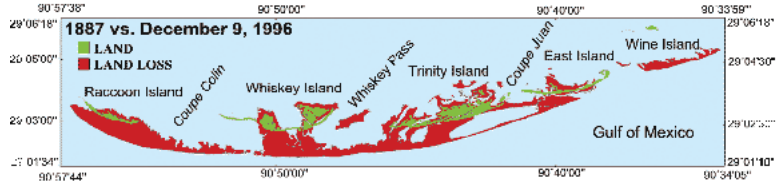
Atlantic OCS Area

Website: www.gomr.mms.gov/homepg/offshore/atlocs/atlocs.html

Barrier Island Restoration

The 1990 Coastal Wetlands Planning, Protection, and Restoration Act (CWPPRA; also known as the Breaux Act) funds wetland creation, island restoration, and beach nourishment projects nationwide in a cost-sharing arrangement between local sponsors and the Federal Government. Since 1997, all elements of Louisiana's coastal restoration planning were consolidated into a multiagency Louisiana Coastal Area Ecosystem Study to assist in establishing priorities for future projects. The MMS is a participant. Other Congressional actions authorize flood control structures and levees for coastal Louisiana areas, usually through the U.S. Army Corps of Engineers (COE).

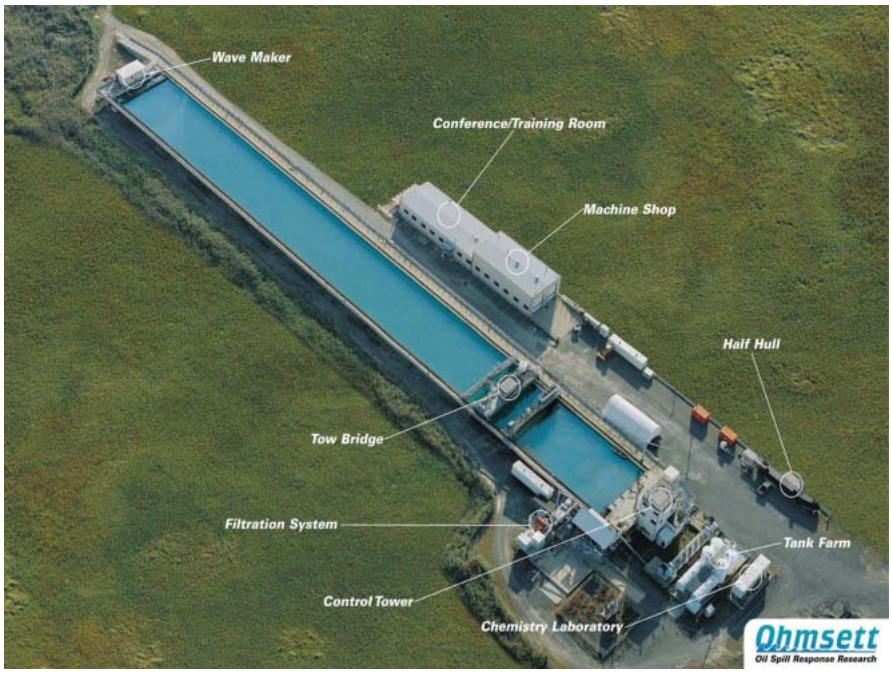
The first CWPPRA projects proposing to use Ship Shoal sand are two barrier island restoration projects sponsored by the State of Louisiana on Isles Dernieres, an important barrier island arc that has undergone significant erosion.



Map illustrating over 100 years of land loss on Isles Dernieres. Photo courtesy of University of New Orleans, Coastal Research Laboratory.

WAITING TO BE DISCOVERED

THIS IS ONLY A TEST!



Aerial view of the OHMSETT facility located in Leonardo, New Jersey.

In February of 2006, Minerals Management Service (MMS) hosted a multi-national version of "Show and Tell" at OHMSETT, the Oil and Hazardous Materials Simulated Environmental Test Tank, at the Naval Weapons Station in Leonardo, New Jersey. Observers were brought to the enormous facility to witness the testing of the dispersability of fresh and weathered Alaskan crude oil in cold water. Prior to the demonstration, it was the opinion of many experts that oil would not disperse in cold water.

The capabilities of the enormous OHMSETT facility were on full display as testing began. Potential clients and those who had already used the facility but had yet personally to see its testing and training potential were divided into groups and received tours of the installation. Among other features, the group was shown the 2.6 million gallon saltwater tank (equivalent to the volume of four Olympic-sized swimming pools) and the 60,000-gallon mobile storage tanks, which hold test fluids.

At OHMSETT, clients can create "real world" testing situations that use full-sized equipment, actual wave and saltwater action, and hands-on oil-spill response training under controlled environmental conditions. The techniques and devices developed here have led to a greater understanding of oil spills in all environmental conditions.

OHMSETT plays a vital role in adding to the body of knowledge regarding oil spills. This knowledge and experimentation will foster more effective methods of oil spill prevention and response. Will crude oil disperse in cold water? We now know the answer is yes.

For more information:

The National Oil Spill Response Test Facility – OHMSETT – Oil and Hazardous Materials Simulated Environmental Test Tank

Website: www.mms.gov/tarprojectcategories/ohmsett.htm

OHMSETT and MMS

OHMSETT is not only a vital component of MMS's oil-spill research program, it is also a national asset. Information gathered at OHMSETT plays an essential role in the development of new technology and in the creation of more effective procedures for responding to future oil spills. OHMSETT is also the premier training site for spill response personnel.

The OHMSETT test tank allows testing of full-scale equipment. The tank's wave generator creates realistic sea environments, while state-of-the-art data collection and video systems record test results.

Above: Oil containment boom being tested with oil in waves
Left: Breaking waves generated at OHMSETT.

THE ANSWER, MY FRIEND

Wind and waves from Hurricanes Katrina and Rita caused devastating destruction along the Gulf Coast and contributed to a disruption of oil and gas production and distribution. This destruction has contributed to higher gas prices for American consumers. Ironically, these same winds and waves in a more moderate form may help us reduce the Nation's reliance on foreign energy resources.

The use of the wind has some enormous advantages. The wind is free; it belongs to no country, state, or individual. There is no foreseeable wind shortage for the future. Plus, the production of usable energy from the wind is cost-effective and free of pollution and greenhouse-effect gases. The technology for harnessing the wind for man's use has been around for centuries. But the idea of offshore wind farms for energy production is relatively new, having been first envisioned in 1972. Europe has taken the lead in construction of offshore wind farms with 17 farms being constructed since 1991 and a current energy production of more than 600 megawatts.

Middelgrunden offshore wind farm, offshore of Copenhagen, Denmark.

Inspecting an offshore windfarm, Arklow Bank, Ireland. Photo courtesy of GE Energy.

Offshore wind turbines consist of a support foundation that holds a tower, which in turn encloses the components, supports the turbine, and houses support personnel. The wind moves over the blades (usually a three-bladed rotor), which rotate around a hub connected to a short shaft that powers the generator through a gearbox. Wind sensors turn the nacelle (the shell that encloses the gearbox, generator, and blade hub) to the position that maximizes energy production.

The optimal location for wind farms offshore is deeper water, where the increased wind speed produces eight times the power of turbines in more shallow water. Turbines in shallow water are constructed on concrete or steel monopiles, which are unsuitable for deeper water. The technology does not currently exist for producing a suitable foundation for the turbines at greater depths. Alternate systems such as floating foundations are being investigated and may prove to be viable.

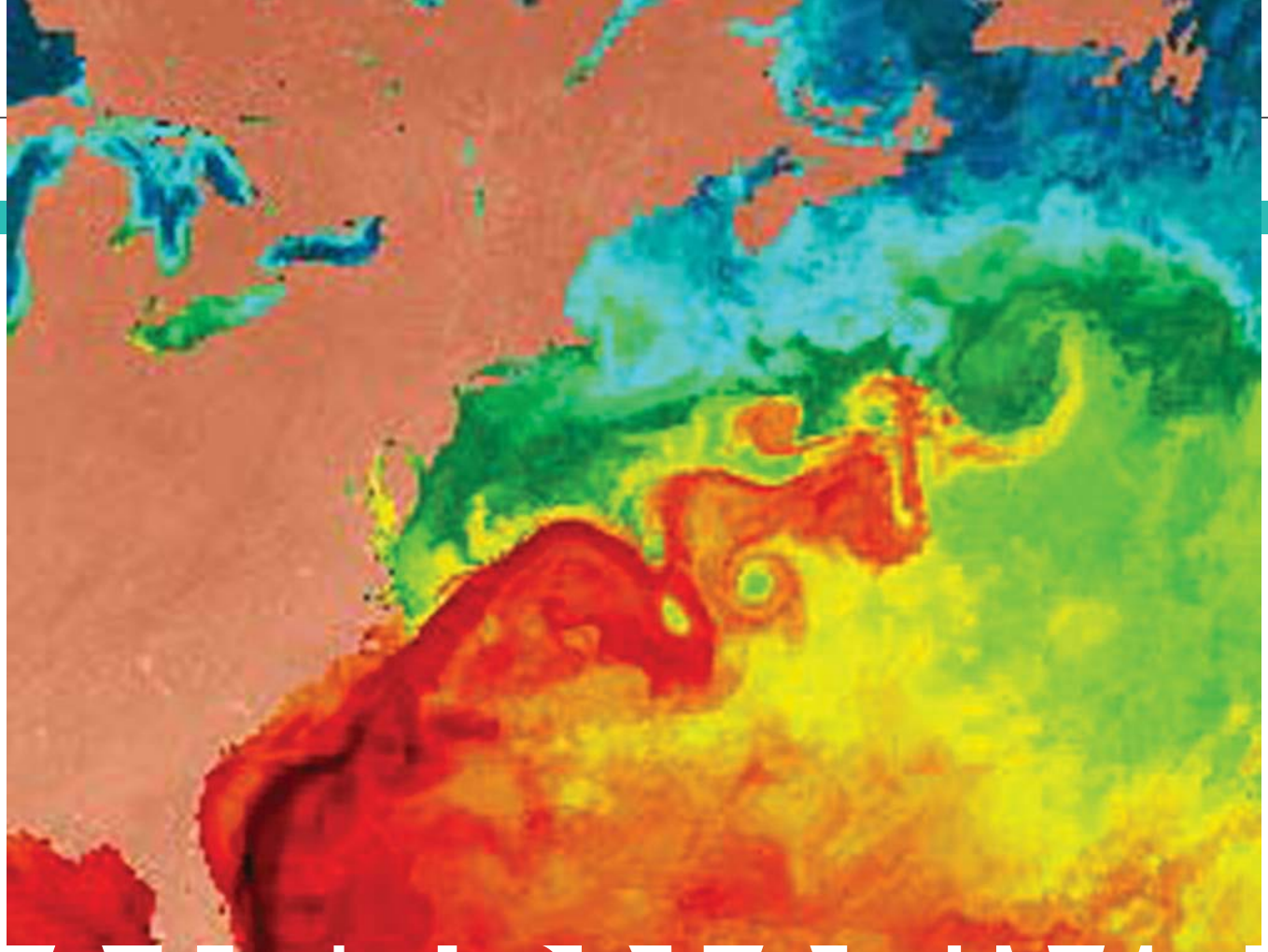
Wind farms at greater depth also require a greater distance for transmission, adding to the cost of energy. However, the increased speed of the wind at locations farther from shore may offset greater collection costs.

Several proposed wind projects are currently in the planning and permitting phases – the Cape Wind project off Massachusetts and the Long Island Offshore Wind project off the shores of Long Island.

FOR MORE INFORMATION:

Wind and Hydro

Website: www.eere.energy.gov/windandhydro/windpoweringamerica/pdfs/workshops/2005_summit/musial.pdf



Thermal image of the Gulf Stream

ALTERNATIVE ENERGY CONSIDERATIONS

Although there are many energy sources that have been proposed, four types of alternative energy sources and uses are now being explored with new vision and vigor: wind, solar, wave, and current power. As these increase in efficiency, stability, and scale, and as oil and gas prices continue to rise, these alternative energy sources will become more competitive with carbon fuels. However, obstacles to their use continue to exist and the widespread use and acceptance of these alternative energy sources will not occur until the obstacles are overcome.

Each of these energy sources can produce electricity at varying rates, but not always at the time and place it is needed. Consequently, storage and transportation methods are among the first obstacles that need to be addressed. One of the most direct transportation methods would be transmission of the electricity produced through submarine cables. However, the cables now in place were designed for transmission between short distances. Loss of power occurs when the current cables are used for longer distances. The good news is that strides are being made in the development of cables capable of carrying electricity for longer distances.

Currently, the most viable means of storage is through hydrogen (H_2), which can be stored onsite or transported to shore for later use. Hydrogen can be produced by several methods. The most widely used method onshore is steam reforming, which converts into hydrogen and carbon monoxide by reaction with steam over a nickel catalyst. The most viable method for hydrogen production offshore is electrolysis, which has been used commercially for years. Since each alternative energy source can produce electricity, electrical current can be used to split water molecules into pure hydrogen and oxygen.

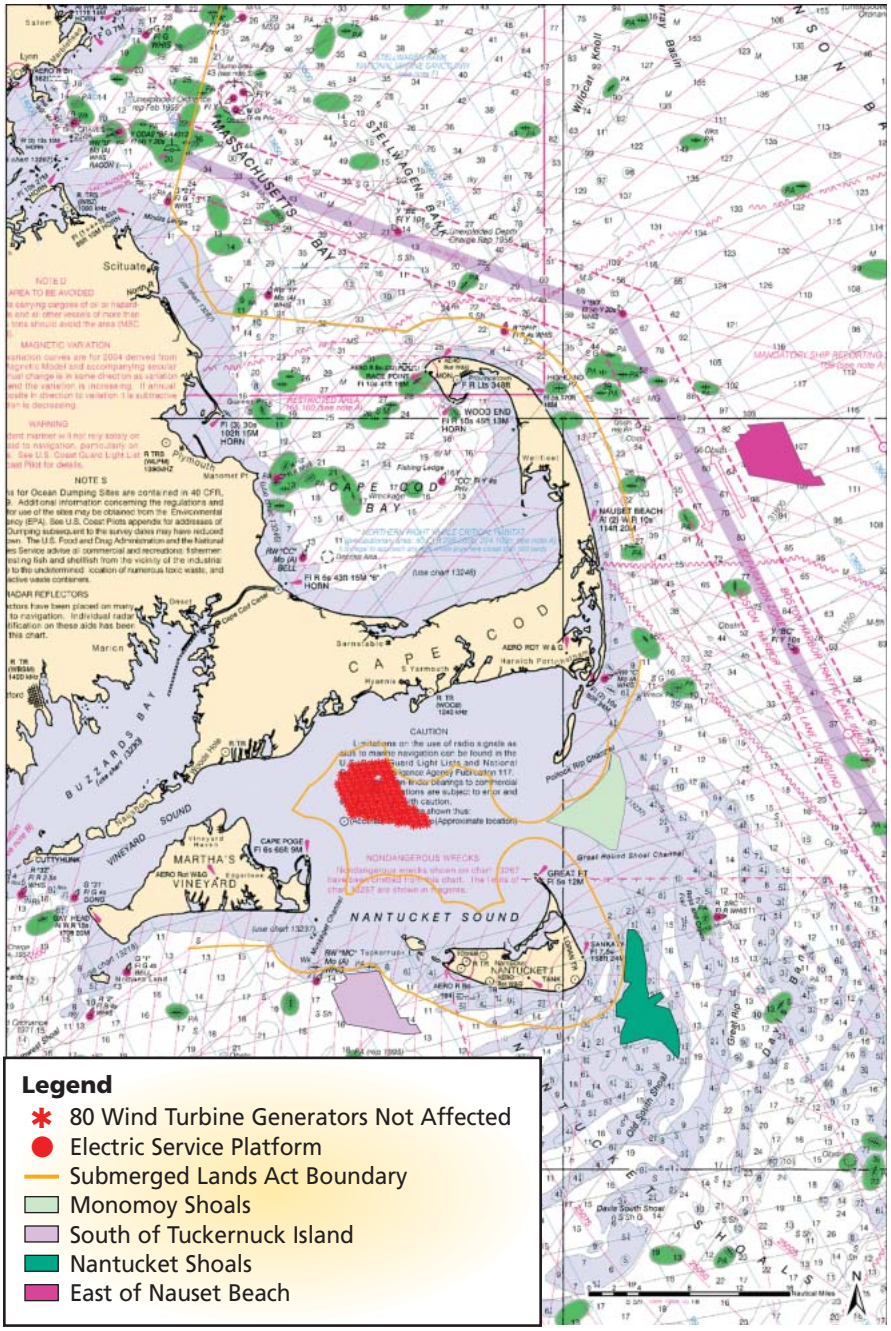
Once the hydrogen is produced, the question becomes, "How do we get the hydrogen to the consumer?" H_2 can be transported in one of three forms: gas, liquid, or in special hydrogen carriers. In its compressed gaseous form, hydrogen

can be transported through dedicated pipelines or via tanker. The issue with this method is that hydrogen can degrade the steel and welds used in pipelines and ships, increasing the risk of environmental damage. In addition, hydrogen requires special seals because of its low molecular weight. Sealing technology will need to be improved to prevent leakage.

H_2 in a liquefied form cannot be transported by pipeline because of the need to keep the H_2 below -423 ˚F. Ship or tanker transport in cryogenic containers would be necessary for this form of hydrogen. Transport by such means would add extra expense and increase the cost to the final user.

Hydrogen can also be carried in H_2 containers – not an enclosed container, but rather a substance, such as ammonia or liquid hydrocarbons, which can carry hydrogen in an altered form. The substance or carrier can be charged with hydrogen at the power generation site, then sent by pipeline, ship, or tanker to an onshore site where it would be distributed for use. Two-way carriers could then be sent back for recharging. There are no current commercially viable carrier systems being tested, although research is ongoing.

The impact of electrical cables and pipelines and the electromagnetic radiation they produce, as well as the possible leakage of hydrogen if seals fail or pipelines become brittle and the possible effects on marine traffic and ecosystems, are issues that must be considered when weighing the environmental and economic impact of alternative fuels development offshore. The current level of infrastructure that can be repurposed for alternative fuels, use as well as development, construction, delivery, and distribution costs, must all be considered before large-scale commercial facilities are put in place to develop and produce alternate energy sources.



Map of Cape Wind alternative sites.

For more information:

Renewable Energy & Alternate Uses

Website: www.mms.gov/offshore/RenewableEnergy/RenewableEnergyMain.htm

Federal Register / Vol. 70, No. 250

Website: www.mms.gov/federalregister/PDFs/AD30_ANPR.pdf

RENEWABLE ENERGY:

Energy resources that are naturally replenishing but flow-limited. They are virtually inexhaustible in duration but limited in the amount of energy that is available per unit of time. Renewable energy resources include biomass, hydro, geothermal, solar, wind, ocean thermal, wave action, and tidal action.

DEFINITIONS

Alternative energy: Fuel sources other than those derived from fossil fuels. Typically used interchangeably for renewable energy. Examples include wind, solar, biomass, wave, and tidal energy.

British thermal unit (BTU): The amount of heat required to increase the temperature of a pound of water 1° Fahrenheit. A BTU is used as a common measure of heating value for different fuels. Prices of different fuels and their units of measure (dollars per barrel of crude, dollars per ton of coal, cents per gallon of gasoline, cents per thousand cubic feet of natural gas) can be easily compared when expressed as dollars and cents per million BTU's.

Crude Oil: A mixture of hydrocarbons naturally existing as a liquid in underground reservoirs and that remains a liquid at atmospheric pressure. Crude oil is the raw material that is refined into gasoline, heating oil, jet fuel, propane, petrochemicals, plastics, pharmaceuticals, and other products.

Easement: Authorization for the use, for a specified purpose, of land not owned by the user. For the OCS, a right of use and easement usually refers to the authorization by MMS to an operator for the construction and maintenance of a structure on OCS lands not subject to a lease granted to the operator.

Energy: The capacity for doing work as measured by the capability of doing work (potential energy) or the conversion of this capability to motion (kinetic energy). Energy has several forms, some of which are easily convertible and can be changed to another form useful for work. Electrical energy is usually measured in kilowatt hours, while heat energy is usually measured in British thermal units (BTU).

Exclusive Economic Zone (EEZ): A seazone over which a Nation has special rights over the exploration and use of marine resources. Generally a Nation's EEZ extends to a distance of 200 nautical miles (370 kilometers) out from its coast, except where resulting points would be closer to another country. Technically, it does not include the Nation's territorial waters, so the EEZ's inner boundary follows the borders of the Nation's territorial waters.

Fee: A fixed sum charged, as by an institution or by law, for a privilege.

Hydrocarbon: Any compound or mix of compounds, solid, liquid, or gas, comprising carbon and hydrogen (e.g., coal, crude oil, and natural gas).

Lease: A legal document executed between a landowner, as lessor, and a company or individual (as lessee) that conveys the right to use the premises for minerals or other products for a specified period over a given area.

Moratorium: Delay, a period during which certain proceedings or obligations are suspended.

Multiple-use: Land management for more than one purpose, such as wood production, water, wildlife, recreation, forage, aesthetics, or clean air.

Nonrenewable fuels: Fuels that cannot be easily made or "renewed," such as oil, natural gas, and coal.

Outer Continental Shelf (OCS): The part of the continental shelf beyond the line that marks State ownership; that part of the offshore lands under Federal jurisdiction.

Photovoltaic: Comes from the words photo (meaning light) and volt, a measurement of electricity.

Public notice: Notification by a government entity informing the public of actions such as the issuance of a draft permit or scheduling of a hearing.

Recoverable reserves: The proportion of hydrocarbons that can be recovered from a reservoir by using existing techniques.

Right-of-way: In property law, an easement to use another's land for passage. For the OCS, a right-of-way is most commonly used for pipelines that cross lands that the operator does not control entirely by lease.

Royalty: A share of the minerals produced from a lease; a percentage of production either in money or in kind that a lessee is required to pay.

Stakeholder: One who has a share or an interest. MMS stakeholders include citizens, public interest groups, local and State governments, and industry groups.

Territorial sea: The territorial sea of the United States is a maritime zone extending beyond the land territory and internal waters of the United States over which the United States exercises sovereignty and jurisdiction, a sovereignty and jurisdiction that extends to the airspace over the territorial sea, as well as to its bed and subsoil.

Watt: A metric unit of power, usually used in electric measurements, which gives the rate at which work is done or energy used. Also, Kilowatt: a unit of power equal to 1,000 watts, and Megawatt: a unit of power equal to 1 million watts.

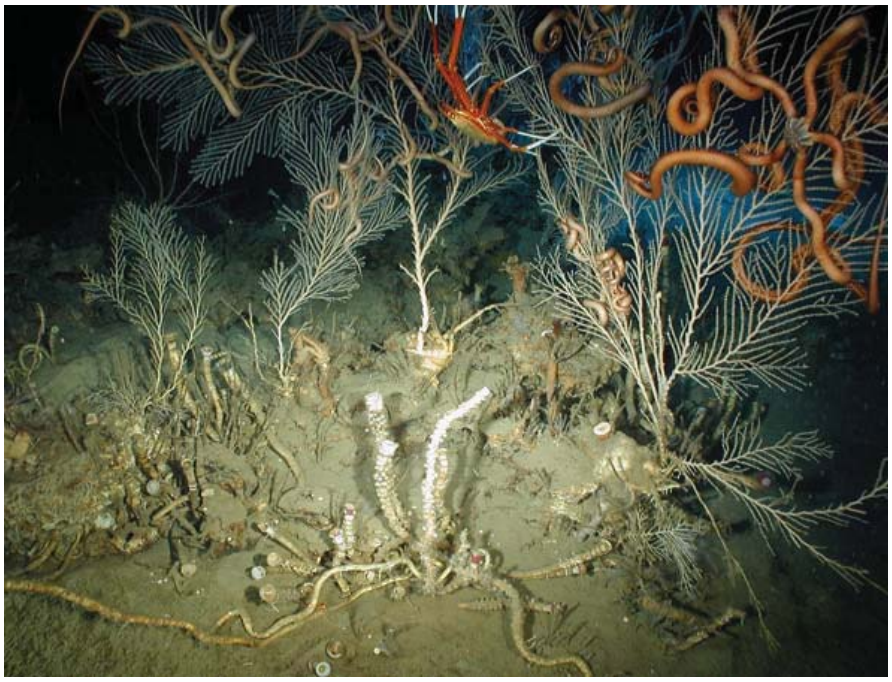
COLD SEEP AND CORAL COMMUNITIES

GOING DEEP

This spring, scientists saw sights never before seen by man or woman. They explored communities that never see light, and life is based on chemosynthesis, unlike most all other life on earth. This spring scientists began the first systematic exploration of hydrocarbon seep communities that are deeper than 1,000 m below the water's surface.

Using the R/V *Atlantis* and the submersible ***Alvin,*** visiting scientists from Germany, France, and Australia were joined with leading U.S. scientists contracted by the Minerals Management Service (MMS) and the National Oceanic and Atmospheric Administration (NOAA), the sponsors of the exploration. The mission was to learn as much about the ecology, microbiology, physiology, geology, and geochemistry of the cold seep and coral communities as possible and with that knowledge, help protect these unique communities from man's impact.

As we go deeper and deeper into the Gulf of Mexico, it is vital that we know as much as possible about the area in which we will be operating, the communities which will be our neighbors, and how our presence may affect the world around these newly discovered habitats.

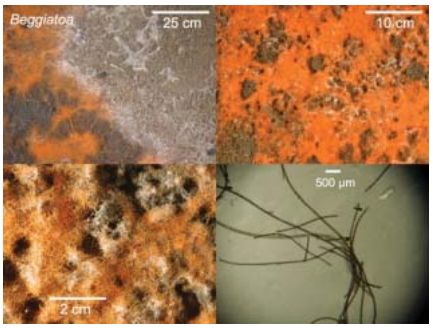


A group of very old tubeworms *(Lamellibrachia luymesi* and *Seepiophila jonesi)* living on the same piece of carbonate rock as large colonies of the gorgonian *Callogorgia Americana americana,* with brittle stars and a galatheid crab crawling on the gorgonians. Photo by Derk Bergquist.

For more information

Expedition to the Deep Slope

Website: www.oceanexplorer.noaa.gov/explorations/06mexico/



Beggiatoa mats on the seafloor around a Gulf of Mexico cold seep. The image mosaic L to R and top to bottom shows increasing magnification of the individual filaments, which are clearly visible in the 2-cm scale bar panel. Image courtesy of Ian McDonald and Mandy Joye.

Mission Facts

- The Gulf of Mexico Outer Continental Shelf (OCS) provides about 21 percent of our domestic natural gas and 30 percent of our domestic oil.
- 50 percent of leased acreage in the Gulf of Mexico OCS is in deep water (greater than 1,000 feet).
- In May 2006, there were over 3,900 oil and gas platforms in the Gulf of Mexico. This also represents the largest de facto artificial reef system in the world.
- The deepwater OCS accounts for over 60 percent of the total Gulf of Mexico OCS oil production and 24 percent of the total Gulf of Mexico OCS natural gas production.
- 3.9 seconds of OCS production would allow a car to travel around the earth at its equator (25,000 miles).
- America uses almost 20 million barrels of oil per day to fuel our automobiles and airplanes, power our factories, and generate the electricity needed to heat and cool our homes.
- Seven of the top 20 oil fields in the U.S. (ranked by liquids proved reserves) are now located in Federal deepwater areas.
- The first exploratory well in over 10,000 feet of water has been drilled in the Gulf of Mexico (world water-depth record).

MMS – A Leader in Securing the Nation's Domestic Energy Supply

Wind turbines in
Nysted Offshore Windfarm, Denmark.
Photo courtesy of Nysted Havmøllepark.

NEW WAVES
Late-breaking News & Information

MMS: Fishing for Answers in the Northern Gulf of Mexico

Prior to 1942, when the first petroleum platform was installed on the Outer Continental Shelf (OCS) in the Gulf of Mexico (GOM), offshore sport fishing in Louisiana was almost nonexistent. But by 1997, most of the nearly 5,600 platforms erected on the OCS were off the coasts of Louisiana and Texas. Those platforms are now the largest contributor to a lucrative offshore sport fishing industry in coastal Louisiana, where "fishing the oil rigs" is a common expression.

How lucrative? According to 2002 statistics, the economic impact to coastal counties in Texas, Louisiana, Mississippi, and Alabama from fishing and diving at platforms is $324.6 million. These industries support 5,560 full-time jobs.

Red snapper *(Lutjanus campechanus)* is a common species at many platforms in the northern GOM. Knowledge of red snapper fidelity – how long the fish stay at a particular platform – will lead to more effective management by clarifying the specific function of these structures as habitat and their importance to the red snapper population.

The Minerals Management Service (MMS) recently released findings of a study evaluating the habitat value of standing and toppled platforms by monitoring the fidelity of red snapper to these structures (MMS 2006-005: *Fidelity of Red Snapper to Petroleum Platforms and Artificial Reefs in the Northern Gulf of Mexico*). Unlike previous studies, this one used acoustic telemetry (high-tech "pinging" equipment).

Despite Tropical Storm Bill moving through the study area in June 2003 and certain equipment limitations, it was evident the red snapper exhibited high short-term site fidelity, not moving from platform to platform on a daily or even weekly basis. Over a longer period, previous studies have shown that red snapper are unlikely to remain at one location for more than a few consecutive months.

By "fishing" for answers with new information from studies such as this, MMS is provided with data that assist in the decisionmaking process, while adding to a larger foundation of data on which plans can be based.

MMS OCEAN SCIENCE
Minerals Management Service
Mail Stop 5431
1201 Elmwood Park Boulevard
New Orleans, LA 70123