

EXECUTIVE SUMMARY

The offshore renewable sector has changed over the past three years and can no longer be regarded as “tomorrow’s potential” but as a developing industry in its own right ... With continuing support from national governments and the coming together of the required industrial knowledge there is the potential to develop a new and distinct industry that not only generates clean electricity but also brings major long-term economic benefits, however, this new sector needs stability, commitment and innovation.

The World Offshore Renewable Energy Report 2002-2007
Douglas Westwood Limited for Renewables UK

The creation of this document, *A Framework for Offshore Wind Energy Development in the United States*, was organized and supported by the United States Department of Energy (U.S. DOE), GE, and the Massachusetts Technology Collaborative (MTC) in anticipation of the growing interest in offshore wind as an energy source. The potential to address a variety of serious environmental and energy supply concerns and leverage significant economic and technology development opportunities calls for a focused, coordinated approach to planning, research and development, and policy development for this new industry. Each member of this Organizing Group arrived at this conclusion from different perspectives that proved to be both complementary and synergistic.

MTC administers the Renewable Energy Trust, which seeks to maximize environmental and economic benefits for the Commonwealth’s citizens by fostering the emergence of sustainable markets for electricity generated from renewable sources. GE built, operates, and owns Ireland’s first offshore wind plant, demonstrating its 3.6 megawatts (MW) offshore wind equipment and services technologies for the growing offshore market. The U.S. DOE supports wind energy research and development, and is expanding efforts to increase the viability of offshore wind power as a substantial opportunity to help meet the nation’s growing needs for clean, affordable energy. These interests were the catalyst driving the collaboration, initially focusing on the Northeast, to explore the potential for the creation of a U.S. offshore wind energy industry.

Wind energy has been the world’s fastest growing energy source on a percentage basis for more than a

decade. If growth trends continue at the same pace, wind capacity will double approximately every three to four years. This trend can be largely attributed to the public’s growing demand for clean, renewable energy and to wind technology’s achievements in reliability and cost-effectiveness.

Offshore wind has emerged as a promising renewable energy resource for a number of reasons: the strongest, most consistent winds are offshore and in relative proximity to major load centers—particularly the energy-constrained northeastern United States; the long-term potential for over-the-horizon siting and undersea transmission lines counters the aesthetic and land-use concerns associated with on shore wind installations; and wind as a fuel is both cost-free and emission-free.

More than 600 MW of offshore wind energy is currently installed worldwide—all of it off the coast of Europe in shallow waters less than 20 meters deep. However, with serious projects being proposed in the waters off the Northeast coast, the Mid-Atlantic coast, and the Gulf Coast, interest in developing offshore wind energy resources in the United States is clearly growing. The U.S. DOE estimates that there are more than 900,000 MW of potential wind energy off the coasts of the United States, in many cases, relatively near major population centers. This amount approaches the total current installed U.S. electrical capacity.

In January 2004, New England came dangerously close to experiencing a blackout during a severe cold spell as a result of limited natural gas supplies being diverted away from electricity generating plants to meet demands for home heating.¹ Those in charge of managing New England’s electric grid are uncertain

1. ISO New England, Inc., Market Monitoring Department. *Interim Report on Electricity Supply Conditions in New England During the January 14-16, 2004 “Cold Snap”*. May 10, 2004.



Nysted Offshore Wind Farm
at Rødsand, Denmark
Photo by Laura Wasserman

how the region will continue to meet peak demand for electricity beyond the year 2006. Offshore wind is one of the Northeast's local renewable energy sources with the potential to address the anticipated unmet demand.

States in other regions—including the Mid-Atlantic, the Gulf Coast, and the Great Lakes—are also beginning to consider the potential role for offshore wind in addressing their particular energy concerns, paving the way for a national offshore wind energy collaboration.

Sustainably tapping the U.S. Outer Continental Shelf's vast wind resource will require addressing formidable engineering, environmental, economic, and policy challenges. This *Framework* identifies these challenges and suggests a comprehensive approach to overcoming them. A principal focus is to broaden the available wind resource potential through the development of technologies and policies that will allow turbines to be responsibly sited in deeper water and further offshore.

Interestingly, the move towards offshore wind energy development is leading to a convergence of two of society's most pressing environmental challenges: to curtail the emissions of noxious and heat-trapping gases being released into the atmosphere and to sustainably manage our ocean resources.

Earth's oceans and atmosphere are both in peril. As recent studies document, our oceans face a greater array of problems than ever before in history.² In particular, unprecedented concentrations of carbon dioxide, nitrogen oxide, and other emissions resulting from the combustion of fossil fuels threaten to alter the composition of the atmosphere and

undermine the integrity of both aquatic and terrestrial ecosystems. An aggressive push for renewable energy production will start us down a path to reducing these environmental and public health threats.

The critical, overarching context for this renewable energy development initiative is the urgent need for policies to guide the sustainable use and conservation of ocean resources, acknowledged at the state and national levels. It is imperative that offshore wind energy is included as an integral part of the ocean management dialogue and that the development of a U.S. offshore wind energy industry is conducted in a way that supports the improved health and management of our nation's marine resources.

The *Framework* lays out the challenges and suggested strategies for addressing them in the following five areas:

- Technology Development
- Environmental Compatibility
- Economic and Financial Viability
- Regulation and Government Policies
- Leadership Coordination

Issues and proposed approaches were identified with input from more than 60 experts via interviews and workshops sponsored by the Organizing Group. Participants represented a wide range of relevant expertise and perspectives. An effort was made to encompass the full range of questions and concerns regarding the potential for siting wind energy systems offshore, and engagement in this process was not limited to parties with a positive stance on offshore wind energy development.

2. The Pew Charitable Trusts. *America's Living Oceans: Charting a Course for Sea Change*. 2003.

Strategies for Addressing Challenges and Achieving Sustainable Offshore Wind Energy Development:

Advance Technology Development

Current offshore wind energy system designs have been adapted from land-based versions and deployed in shallow waters off northern European coastlines for more than a decade. Offshore wind energy technology is evolving toward larger-scale and fully marinized systems that can be deployed in a range of water depths across a wider range of geographical areas.

Strategies:

- Develop Design Standards for Offshore Wind Energy Systems
- Integrate Environmental Condition and Design Parameters
- Tailor Support Structure Designs to Site-Specific Conditions
- Achieve High Levels of Wind System Availability and Performance through Optimized Approaches to Operations and Maintenance
- Address Power Transmission and Grid Interconnection Issues
- Develop and Leverage Expertise

Achieve Environmental Compatibility

Beyond technical and economic issues, the sustainability of an offshore wind power industry in the United States will depend on focusing on environmental compatibility and impact mitigation as high design priorities, and on improving understanding of the interactions that will occur between offshore wind development and marine ecosystems in the United States.

Strategies:

- Identify Current Conditions and Trends of Marine Ecosystems and Ocean Uses
- Identify Potential Areas for Offshore Wind Energy Development
- Identify Potential Impacts and Environmental Changes from Offshore Wind Energy Systems
- Identify Appropriate and Effective Mitigation Strategies for Potential Environmental Impacts and Conflicting Uses
- Document and Quantify Environmental Benefits

Achieve Economic and Financial Viability

Although today's costs of offshore wind energy production are higher than onshore, expectations are that several factors working together will make the development of offshore wind energy sources more cost effective. These factors include technology innovations, stronger wind regimes, economies of scale from large-scale development, close proximity to high-value load centers, and incentive programs responding to the public's growing demand for clean energy.

Strategies:

- Develop Current Understanding of Costs of Offshore Wind Energy Systems and Implement Research and Development Opportunities for Cost Reduction
- Evaluate Ownership and Financing Structures and Associated Risks
- Increase Availability of Long-Term Power Purchase Agreements
- Develop Confidence in Technology among Financial, Insurance, and Public Sectors

Clarify Roles for Regulation and Government Policies

Achieving a cost-competitive offshore wind energy industry will require significant advances in the technology and policy arenas. Many of the challenges require an integrated approach. For example, public acceptance of offshore wind facilities is linked to development of a credible planning and permitting process that ensures the recognition of public benefits from use of the resource.

Strategies:

- Establish a Process for Siting and Development that Gains Public Acceptance
- Develop Policies with a Tiered and Phased Incentive Program to Foster Early Development of Offshore Wind Energy
- Create Stable Rules and Processes for Transmission and Grid Integration

Establish Leadership, Coordination, Collaboration, and Support

A national collaborative can play an important role as it works to coordinate and leverage the resources to address the challenges in an efficient and synergistic manner. The level of resources needed to fund a collaborative approach will depend on the form the collaborative takes and on the roles its members play in providing and recruiting technical and financial support. Regional collaboratives will also be useful for addressing regional and local planning challenges and needs.

Strategies:

- Establish a Credible Mechanism for Leadership, Collaboration, and Support for Offshore Wind Energy Development
- Create and Maintain a Vision of Offshore Wind as Part of the Mainstream Energy Mix
- Attract, Apply, and Coordinate Resources
- Establish and Implement a Mechanism for Convening Parties Interested in Offshore Wind Energy
- Develop and Support a Coordinated Research Program to Accomplish Technical, Environmental, Economic, and Regulatory Goals
- Support Integration of Activities in All Arenas

Next Step

The next step in this process will be to create an Organizational Development Plan for an *offshore wind collaborative*, with an initial focus on the waters of the Atlantic off the Northeast coast. The plan will propose a clear role for this new partnership in implementing the agenda put forth in the *Framework*, making the case for establishing a multi-sector cooperative effort to address key aspects of the U.S offshore wind energy development strategy. The plan will describe the organizational structure; define relationships and responsibilities among collaborators; define specific opportunities and benefits of participation for industry, government, and non-governmental partners; and establish funding needs and sources.