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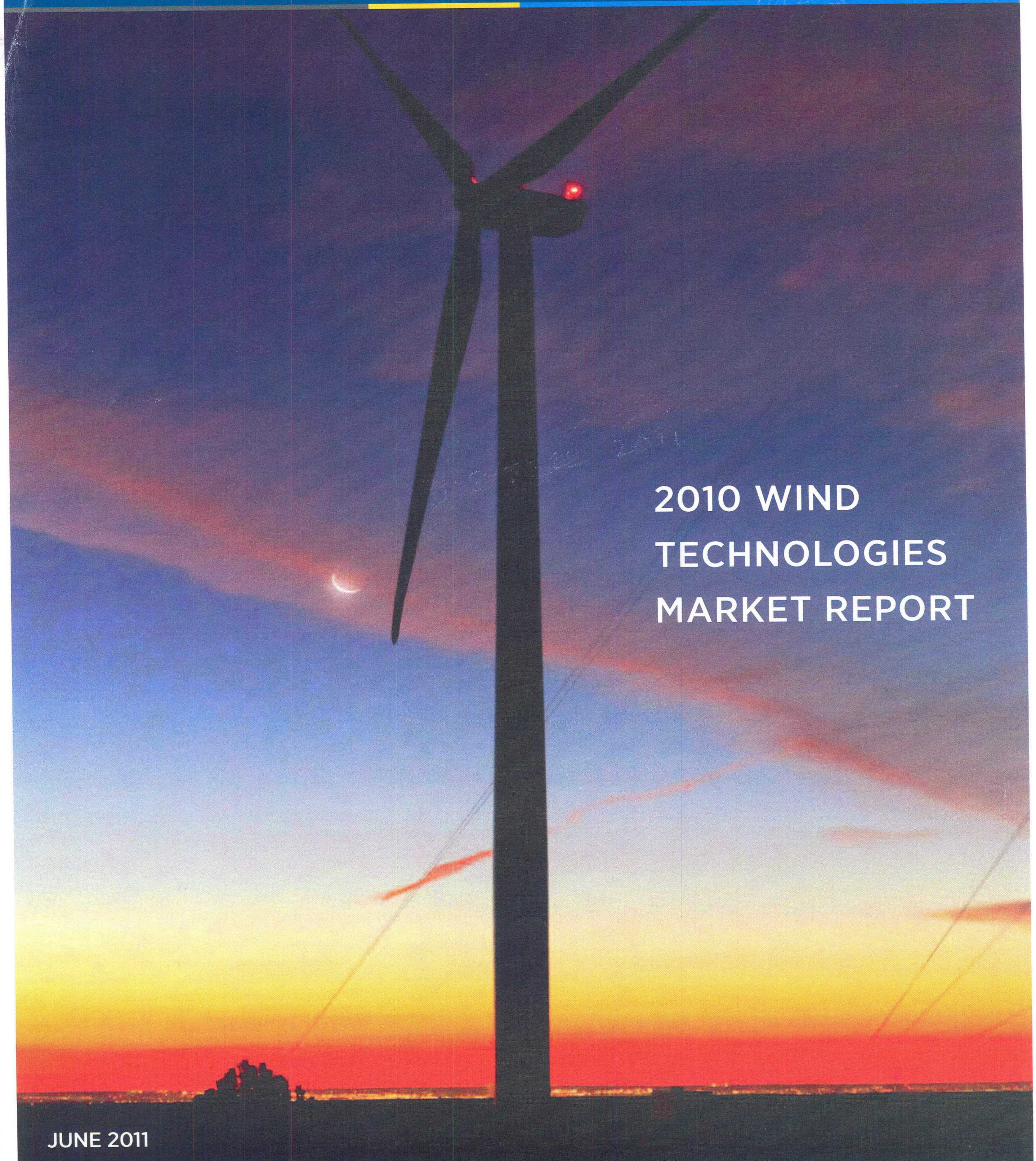

2010 WIND TECHNOLOGIES MARKET REPORT

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Table of Contents

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organizations, and the DOE also continue to take proactive steps to encourage transmission investment to improve access to renewable resources. Finally, construction and development progress was made in 2010 on a number of transmission projects that are designed, in part, to support wind power.

- **Integrating Wind Energy into Power Systems Is Manageable, but Not Free of Costs, and System Operators Are Implementing Methods to Accommodate Increased Penetration.** Recent studies show that wind energy integration costs are below $10/MWh – and often below $5/MWh – for wind power capacity penetrations up to about 40% of the peak load of the system in which the wind power is delivered. The increase in balancing reserves with increased wind power penetration is projected to be a *maximum* of 18% of the nameplate capacity of wind power, and typically considerably less than this figure, particularly in studies that use intra-hour scheduling. Moreover, a number of strategies that can help to ease the integration of increasing amounts of wind energy – including the use of larger balancing areas, the use of wind forecasts, and intra-hour scheduling – are being implemented by grid operators across the United States.

With federal incentives for wind energy in place through 2012, an improved project finance environment, and lower wind turbine and wind power pricing, modest growth in annual wind power capacity additions appears likely for 2011 relative to 2010. Additions are expected to remain well below the 2009 high, however, due in part to relatively low wholesale electricity prices and limited need for new electric capacity additions, and in part to existing state-level RPS programs that, in aggregate, are not sizable enough to support continued wind power capacity additions at 2008 and 2009 levels. Most projections show further growth in 2012, as the cost of wind energy continues to decline as a result of lower wind turbine pricing, and as wind project developers rush to capture federal incentives currently slated to expire at the end of that year. Forecasts for 2013, meanwhile, span a particularly wide range, depending in part on assumptions about the possible extension of federal incentives beyond 2012, but in general are weighed down by current policy uncertainty as well as the expected limited need for new electric capacity additions.

1. Introduction

The U.S. wind power industry experienced a trying year in 2010, with a significant reduction in new builds compared to both 2008 and 2009. The delayed impact of the global financial crisis, relatively low natural gas and wholesale electricity prices, and slumping overall demand for energy countered the ongoing availability of existing federal and state incentives for wind energy deployment. Nonetheless, cumulative wind power capacity still grew by a healthy 15% in 2010, and most expectations are for moderately higher wind power capacity additions in 2011 than witnessed in 2010, though 2011 additions are also expected to remain below the 2009 high.

Notwithstanding the slowed growth in 2010, the wind power sector is dynamic, making it difficult to keep up with evolving trends in the marketplace. This annual report – now in its fifth year – meets the need for timely, objective information on the industry and its progress by providing a detailed overview of developments and trends in the United States wind power market, with a particular focus on 2010.

As with previous editions, this report begins with an overview of key installation-related trends: trends in wind power capacity growth; how that growth compares to other countries and generation sources; the amount and percentage of wind energy in individual states; the status of offshore wind power development; and the quantity of proposed wind power capacity in various interconnection queues in the United States. Next, the report covers an array of wind power industry trends, including: developments in turbine manufacturer market share; manufacturing and supply-chain investments; wind turbine and component imports into and exports from the United States; wind turbine size, hub height, and rotor diameter; project financing developments; and trends among wind power project owners and power purchasers. The report then turns to a discussion of price, cost, and performance trends. In so doing, it reviews the prices paid for wind power in the United States, and how those prices compare to short-term wholesale electricity prices. The report also describes trends in installed wind power project costs, wind turbine transaction prices, project performance, and operations and maintenance expenses. Next, the report examines other policy and market factors impacting the domestic wind power market, including federal and state policy drivers, transmission issues, and grid integration. Finally, the report concludes with a preview of possible near-term market developments.

This fifth edition of the annual report updates data presented in previous editions, while highlighting key trends and important new developments from 2010. New to this edition is a more in-depth summary of developments in offshore wind energy; an expanded discussion of curtailment, with more (but still incomplete) data from several regions of the country; and further information on domestic nacelle assembly capacity. The report concentrates on larger-scale wind turbines, defined here as individual turbines that <u>exceed</u> 100 kW in size.[1] The U.S. wind power sector is multifaceted, however, and also includes smaller, customer-sited wind turbines used to power residences, farms, and businesses. Data on these latter applications are not the focus of this report, though a brief discussion on *Small Wind Turbines* is provided on page 4.

[1] The 100 kW cut-off between 'small' and 'large' wind turbines is strictly used for 2009 and 2010 projects, in part justified by the fact that the U.S. tax code makes a similar distinction; in years prior to 2009, however, different cut-offs are used to ensure that older utility-scale wind power projects in California are not excluded from the sample.

Much of the data included in this report were compiled by Berkeley Lab, and come from a variety of sources, including the American Wind Energy Association (AWEA), the Energy Information Administration (EIA), and the Federal Energy Regulatory Commission (FERC). The Appendix provides a summary of the many data sources used in the report, and a list of specific references follows the Appendix. Data on 2010 wind power capacity additions in the United States are based largely on information provided by AWEA; methodological differences exist in the processing of those and other data, however, and the data presented here therefore vary somewhat relative to AWEA (2011a).[2] In other cases, the data shown here represent only a sample of actual wind power projects installed in the United States; furthermore, the data vary in quality. As such, emphasis should be placed on overall trends, rather than on individual data points. Finally, each section of this document primarily focuses on historical market information, with an emphasis on 2010; with some limited exceptions (including the final section of the report), the report does not seek to forecast future trends.

[2] For example, large wind turbines are defined in this report as exceeding 100 kW, and by AWEA (2011a) as equal to and exceeding 100 kW. The accounting of older wind power plants also differs to a certain degree, yielding modestly different estimates for installed capacity. Other methodological differences between AWEA (2011a) and this report are noted as appropriate in the pages that follow.

Offshore Wind Power Project and Policy Developments Continued in 2010

At the end of 2010, global offshore wind power capacity stood at over 3,000 MW (BTM 2011), with the vast majority (>95%) of 2010 offshore wind power additions and cumulative capacity located in Europe. To date, no offshore projects have been installed in the United States, and the emergence of a U.S. offshore wind power market still faces many challenges. Perhaps most importantly, the projected near-term costs of offshore wind energy remain high. Additionally, though political support exists for offshore wind energy in some quarters, planning, siting, and permitting can be challenging, as demonstrated in the long history of the Cape Wind project. Competing uses of offshore waters and public concerns can complicate the process and, despite recent progress in clarifying the permitting procedures in federal waters, uncertainties in federal and state permitting processes remain.

Nonetheless, interest in developing offshore wind energy exists in several parts of the country. Driving this interest is the proximity of offshore wind resources to population centers, the potential for local economic development benefits, advances in technology, and superior capacity factors (and, in some instances, peak load coincidence) compared to the finite set of developable land-based wind power projects available in some regions.

Federal Activities

Several significant strides relating to offshore wind energy have been made recently in the federal arena. The U.S. Department of the Interior (DOI) signed a Memorandum of Understanding (MOU) with the governors of 10 coastal states in June 2010 forming the Atlantic Offshore Wind Energy Consortium.[11] The aim of the Consortium is to facilitate the coordination of offshore development off the Eastern Coast. Additionally, DOI's Bureau of Ocean Energy Management, Regulation, and Enforcement (BOEMRE) formed Renewable Energy Task Forces in several coastal states in late 2009. The mission of these Task Forces is to engage local stakeholders in the development of federal regulations for offshore renewable energy and the commercial leasing process. In 2010, Task Forces in Maryland, Delaware, and Massachusetts published Requests for Information (RFI) to gauge commercial interest and gather comments regarding potential commercial leases in designated areas; other state Task Forces have plans to publish similar RFIs in 2011.

Major news was made in April 2010, when the Cape Wind project in Massachusetts became the first proposed offshore wind plant to receive final federal regulatory approval from BOEMRE, with a final lease issued in October. Following from that first lease, in November 2010, DOI announced its "Smart from the Start" initiative, intended to streamline and shorten the federal offshore permitting process. The first of several targets of the initiative is to proactively identify high-priority Wind Energy Areas for offshore wind energy development and expedite the environmental review process and site assessment activities for leasing within these areas. In February 2011, BOEMRE unveiled four tentative Wind Energy Areas in the Mid-Atlantic for public comment (Figure 5). BOEMRE is expected to announce additional proposed Wind Energy Areas later in 2011. In March 2011, NRG Bluewater Wind's Delaware project became the first project to begin the commercial leasing process under the Smart from the Start program.

[11] Signatory states include Maine, New Hampshire, Massachusetts, Rhode Island, New York, New Jersey, Delaware, Maryland, Virginia, and North Carolina.