Overview of the Wind Energy Industry

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American Wind Energy Association
Overview
Basics
Current Statistics
US Wind Potential
Market Drivers and Policy
Basics
Wind Turbines: Power for a House or City
In 2010, average turbine size was rated **1.77 MW** - enough to power over **500 homes**.

An average wind project in 2010 was **76 MW (≈43 turbines)** The average project would supply electricity for over **20,000 homes**.

This picture shows a Vestas 80-meter diameter 2-MW wind turbine superimposed on a Boeing 747 jumbo jet.
Current Statistics
U.S. Annual and Cumulative Wind Power Capacity Growth

- The wind industry installed 5,116 MW in the U.S. in 2010
- Installed in 1Q 11: 1,100 MW
- Total U.S. wind installations stand at 40,181 MW
- U.S. wind installations represent over 21% of global wind capacity

Regional Installation and Construction Activities

Source: American Wind Energy Association · 1st Quarter 2011 Market Report
New wind capacity represented 26% of all new capacity installed in 2010.

Wind power remained the second largest source of new installed capacity, second to natural gas.

All renewable capacity combined represented nearly 33% of new capacity.

Wind installed over 35% of all new generating capacity between 2007 and 2010 with 28,740 MW
Wind provided 2.3% of U.S. electricity in 2010

Electricity from wind power capacity in the U.S. will supply the equivalent of:

- Over 10 million American homes
- Nearly 10 nuclear power plants

U.S. Wind Power Capacity Installations by State in 2010 (MW)

There are roughly 275,000 MW of wind projects lined up in the interconnection queues for transmission access.

U.S. Top 20 Wind Power Capacity Owners in 2010

Ownership is on a net basis, so if two owners have a half share of a 100-MW wind farm, each company is credited with 50 MW. Ownership does not include structural investors, which may have a share of equity.

Wind Turbine Manufacturers’ Share of 2010 U.S. Wind Power Installations


* Suzlon owns 91% of REpower.

Includes turbines 100 kW and larger.

Turbine installation data is reported by the project owner.
Overall, the U.S. wind industry supported 75,000 direct and indirect jobs in 2010.

U.S. Wind Industry Jobs by State

US Wind Potential
The 20% Wind Vision

“20% Wind Energy by 2030”


» What would it take for the U.S. to get 20% of its electricity by the year 2030?

» Report analyzed barriers and areas to focus on to achieve this target
20% Wind: Cumulative Installed Capacity

Cumulative Installed Capacity (GW)

- Offshore
- Land-based

20% Wind: Growth Path

After ramping up manufacturing capacity, the 20% scenario calls for over 16 GW to be installed annually.
20% Wind: Installations by State

Installed Wind Nameplate Capacity by State (2030)

Wind Capacity
Total Installed (2030)
(GW)

- 0.0 - 0.1
- 0.1 - 1
- 1 - 5
- 5 - 10
- > 10

Includes offshore wind.

The black open square in the center of a state represents the land area needed for a single wind farm to produce the projected installed capacity in that state. The brown square represents the actual land area that would be dedicated to the wind turbines (2% of the black open square).
20% Wind: CO$_2$ Reductions

Cumulative Reductions (Left Axis)
Annual Reductions (Right Axis)

Cumulative Reduction in CO2 Emissions (million tons)
Annual Reduction in CO2 Emissions (million tons)

20% Wind: Flattens Electric Industry CO₂ Emissions
20% Wind: Wind Electricity Generation Mix

No New Wind

- Natural Gas
- Coal
- Nuclear
- Hydro
- Wind

20% Wind

- Natural Gas
- Coal
- Nuclear
- Hydro
- Wind
Market Drivers and Policy
History of Boom & Bust Tax Credit

Demand Drivers

1. **State RPS**: 3-4 Gigawatts/year
   - CA and Mid-Atlantic each 1-2 GW/year 2011-13

2. **Power Demand**: 2.5 GW/year if wind supplies 25% of demand growth

3. **Retirements due to environmental regs**: 450 MW/year if wind supplies 25% of this market

4. **Other policies**...
Market-Driven Growth Possible

![Graph showing levelized cost of energy per kWh for Wind, Natural Gas CC, Coal, and Nuclear.](Data Source: Lazard, Levelized Cost of Energy, June 2008)
Policy Motivation: Diversity of Power Sources

Source: EIA, Net Generation All sectors

*All Renewables does not include hydro
• **Production tax credit (PTC) of 2.2 cents/kWh for large wind available through 2012**
  • Or 30% investment tax credit (ITC), and receive cash grant in its place through 2011

• **Prospects for extension:**
  • Treasury direct payment option not favored.
  • PTC/ITC extension prospects as good as ever. Need a tax vehicle to move.
  • Severe budget constraints, apply more to spending than tax credits.
With new Congress, proponents of clean energy have broadened Renewable Electricity Standard (RES) to include low carbon sources in a Clean Energy Standard (CES).

- Republicans not clear on what they will push yet.
- Gasoline prices, EPA regulations, and challenges with natural gas, nuclear, and coal drive interest in acting on energy.
Call to Action: National Renewable Electricity Standard

- Short-term policy does not drive projects or manufacturing.
- U.S. is competing the countries around the world.
- U.S. has infrastructure, workforce, skill-set and power demand making us the perfect candidate for building a new manufacturing sector.

The wind industry simply needs a long-term and stable market signal to make the investment in renewables.
Call to Action:
National Renewable Electricity Standard

- **Nations with hard renewable commitments**
  - **China:**
    - 100 GW of wind by 2020
    - CAP on GHG Emissions
    - Feed-in Tariffs
  - **United States:**
  - **European Union:**
    - 20% Renewable Energy by 2020
    - CAP on GHG Emissions
    - Feed-in Tariffs
Long Term Policy Outlook

- Wind cost-competitiveness shows great promise, both in unregulated markets and in the estimated cost of RPS.
- Predictable policy is now a widely supported goal in Washington...but the budget “scoring” of long term tax credits remains a barrier.
- Promoting clean energy is more popular than regulating pollution.
- Water will be an increasingly important policy and market driver.
Conceptual Transmission Plan

This map shows the wind resource data used by the WindS model for the 20% Wind Scenario. It is a combination of high resolution and low resolution datasets produced by NREL and other organizations. The data was screened to eliminate areas unlikely to be developed onshore due to land use or environmental issues. In many states, the wind resource on this map is visually enhanced to better show the distribution on ridge crests and other features.
Questions?

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Introduction to Project Siting

Presented By

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Director of Environmental Permitting
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What is Siting?

- The step-wise evaluation of the potential effects from the development, construction, and operation of a wind farm with respect to local, state, and federal requirements that lead to design or operation considerations by the developer.
Purpose of Siting

- To avoid, minimize and mitigate the effects to the environment.
- To prepare the operational wind farm for financial security and continued operation.
Steps for Siting

- Establish the Enviro-Socio-Geographic setting of the project
- Establish the Regulatory environment of the project
- Identify critical issues
- Evaluate the project activities against issues related to E-S-Geographic and regulatory setting
- Address issues through design modification or mitigation
This needs to be done to identify issues that are expected to develop based on environmental or sociologic conditions or species that occur on the project site or within the project area.

- Prepare as detailed a project description as possible
  - Foot print, roads, turbine layout, transmission, etc.
- What type of lands are you dealing with
  - Public, Private, Mixed
- Are the lands developed, used agriculture, natural conditions, protected
- Are there dwellings or sensitive activities adjacent to the project
Regulatory Environment

- Are there any discretionary action required?
  - Federal Agency
  - State Agency
  - County, Local Government
- What are the ordinances, laws, regulations for each
- Establish the permitting path for the project
Project Description/Design

E-S-Geo Setting
- Identify the Studies Required
- Wind Resource Assessment
- Establish Dates and Timelines for Surveys
- Public Input
- Identify Sensitive Resources

Regulatory Environment
- Identify Authority(s) for Approval
- Identify Type of Approval Required
- Coordination with agencies
- Select Interdisciplinary Team
- Identify Permits Required
- Establish Timelines for Permitting
E-S-Geo Setting

Environmental Documents
Proforma
Design Approvals
Mitigation Measures
Site Use Conditions

Constructible
Reduced Operational Risk
Reduced Financial Risk
Proper Siting Means Environmentally Sound and Economically Viable.
Relative Timelines
Assuming Surveys Complete

Private Land, No Critical Resources, Agricultural Use, No Social Issues
Local Permitting and Approval – Less than one year

Public Land/Federal Nexus, No Critical Resources, Agricultural Use, No Social Issues
Federal Environmental Document: Environmental Assessment : 12-18 months

Private Land, Listed Species, Agricultural Use, No Social Issues
Section 10 requiring Habitat Conservation Plan : EIS 2-5 years

Public Land / Federal Nexus, Listed Species, Agricultural Use, No Social Issues
Section 7 requiring consultation : EA 12-18 months; EIS 18-24 months
Economics of Wind Power

Presented By

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USRG Clean Energy Capital

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Discussion will focus on:

- Project level economics
  - Revenue
  - Costs
    - Development
    - Construction and Equipment
    - Capital

Source: BNEF, AWEA, GWEC
The global wind power industry:
- Over 35,900 MW of wind power was installed in 2010
- Despite a 5.5% drop in growth in 2010, the industry has grown at a CAGR of 21% over the last 5 years

The U.S. wind power industry:
- Approximately 5,000 MW of wind power was installed in 2010
- New build dropped by ~50% in 2010
- 2010 asset finance in North America totaled ~$16 billion

Source: BNEF, AWEA, GWEC
Despite a weak year in 2010, US market is expected to return to a new build rate of 7 - 8 GW per annum

- Lower installed capacity driven by lower electricity demand and low natural gas prices
- Credit markets are stabilizing
- US now trails China as the leader in annual capacity
- Growth within national and state markets can be very volatile
- Impacted by local drivers

THE MACRO VIEW

Figure 3: Annual wind build versus annual asset finance, 2004-2014e

<table>
<thead>
<tr>
<th>Year</th>
<th>New installations</th>
<th>US wind annual asset finance</th>
</tr>
</thead>
<tbody>
<tr>
<td>2004</td>
<td></td>
<td></td>
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<tr>
<td>2005</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>2014</td>
<td></td>
<td></td>
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</table>

Source: Bloomberg New Energy Finance

<table>
<thead>
<tr>
<th>Installed MW</th>
<th>Cumulative Installed Capacity</th>
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<tbody>
<tr>
<td>2010</td>
<td></td>
</tr>
<tr>
<td>China*</td>
<td>18,923</td>
</tr>
<tr>
<td>United States</td>
<td>5,600</td>
</tr>
<tr>
<td>Germany</td>
<td>1,551</td>
</tr>
<tr>
<td>Spain</td>
<td>1,527</td>
</tr>
<tr>
<td>India</td>
<td>1,258</td>
</tr>
<tr>
<td>Italy</td>
<td>950</td>
</tr>
<tr>
<td>France</td>
<td>1,086</td>
</tr>
<tr>
<td>Great Britain</td>
<td>1,112</td>
</tr>
<tr>
<td>Canada</td>
<td>690</td>
</tr>
<tr>
<td>Denmark</td>
<td>309</td>
</tr>
<tr>
<td>Portugal</td>
<td>345</td>
</tr>
</tbody>
</table>

* Only 31,070 MW are in operation

Source: World Wind Energy Association
PROJECT ECONOMICS

- Drivers
  - Wind regime (capacity factor of the facility)
  - Price for power
  - Turbine prices
  - Turbine performance (availability and power curve)
  - Balance of plant costs / O&M costs
  - Cost of financing

- Potential killers
  - Real estate complexity
  - Permitting regime
  - Transmission
  - Regulatory regime
  - Misconceptions of “market” for prices charged by capital providers
PROJECT ECONOMICS

- Development Profit = Capital cost minus NPV of developer’s ownership interest in operational cash flows
  - NPV will vary based on the stage of project development
- No fuel cost, low O&M cost so cash flows primarily driven by two factors:
  - Wind resource
  - Power price
- No industry standard level of profit, varies greatly from project to project, but generally the value of a project will depend on its:
  - Stage of development - operating assets bear a lower discount rate than development projects
  - Relationship between projected revenues and expected costs
## REVENUE

- **Wind Resource**
  - P-50 is a statistical construct with describes an amount of annual wind intensity that will be exceeded in 50 out of 100 years; similarly, wind resource is expected to exceed P-90 levels in 90 out of 100 years
  - Install 50-60 m towers for preliminary assessment followed by 80 m after proving project viability
  - Correlation with long-term data sets from government sources

- **PPA pricing**
  - Contracts starting through Q4 2010 had average prices of $60 / MWh
  - May separately contract for RECS depending on market
  - Importance of contracted revenue: output that is contracted is financeable
- Economic conditions and lower natural gas prices have resulted in low power prices
- Demand for renewable generation continues to be driven by compliance with RPS mandates; demand in the absence of RPS is soft
- Significant variation by region: recent reported prices range from $.027 to nearly $.09

Figure 1: Wind PPA and offtake prices, 2004-10

Source: Bloomberg New Energy Finance, FERC Note: Average offtake prices includes all projects commissioned before 2004 and merchant and banded sales. PPA prices do not include banded structures because of inherent offtake price variability. Small sample size causes some variability in first few years.
State-level RPS mandates are the primary driver of demand for renewable generation.

States that have fallen behind their RPS goals strike PPA prices significantly higher than merchant.

**RPS Policies**

**www.dsireusa.org / April 2011**

- 29 states + DC and PR have an RPS (7 states have goals)

- Renewable portfolio standard
- Renewable portfolio goal
- Solar water heating eligible

Extra credit for solar or customer-sited renewables
Includes non-renewable alternative resources

- WA: 15% x 2020*
- MT: 15% x 2015
- MN: 25% x 2025 (Xcel: 30% x 2020)
- WI: Varies by utility; 10% x 2015 statewide
- MN: 10% & 1,100 MW x 2015*
- MI: 10% & 1,100 MW x 2015*
- VT: (1) RE meets any increase in retail sales x 2012; (2) 20% RE & CHP x 2017
- ME: 30% x 2000 New RE: 10% x 2017
- NH: 23.8% x 2025
- MA: 22.1% x 2020 New RE: 15% x 2020 (+1% annually thereafter)
- RI: 16% x 2020
- CT: 23% x 2020
- PA: 18% x 2021†
- NJ: 22.5% x 2021
- DE: 25% x 2026*
- MD: 20% x 2022
- DC: 20% x 2020
- PR: 20% x 2035
- OR: 25% x 2025 (large utilities)* 5% - 10% x 2025 (smaller utilities)
- CA: 33% x 2020
- CO: 30% by 2020 (IOUs) 10% by 2020 (co-ops & large munis)*
- AZ: 15% x 2025
- NM: 20% x 2020 (IOUs) 10% x 2020 (co-ops)
- TX: 5,880 MW x 2015
- HI: 40% x 2030

29 states + DC and PR have an RPS (7 states have goals)
While prices generally are down, PPA pricing strength relative to wholesale rates is expected to continue in western states as a result of stronger RPS driven demand.
CAPACITY FACTORS

Figure 12: Average wind project capacity factor, 2010

Source: Bloomberg New Energy Finance, FERC Note: Sample sizes are small for some state and should not represent general wind resources. Capacity factors are averaged over the life of a project. Only includes projects operating for at least one year.
**INDICATIVE DEVELOPMENT COSTS**

- Project development in the US takes 2 to 3 years
- Met towers are required which have minimal cost but long lead time
  - Usually install 50 - 60 m towers for preliminary assessment followed by 80 m after proving project viability
  - More reliable wind resource data provides greater comfort to financiers
- Site and transmission costs vary by geography and utility/ISO
  - Projects on critical habitats or state/BLM lands could add significant costs of purchasing additional environmental land

**Wind Project Development Budget**

<table>
<thead>
<tr>
<th>Year</th>
<th>Met Towers</th>
<th>Site Studies</th>
<th>Transmission Studies</th>
<th>Legal Expenses</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>200</td>
<td>100</td>
<td>50</td>
<td>100</td>
</tr>
<tr>
<td>2</td>
<td>300</td>
<td>150</td>
<td>75</td>
<td>150</td>
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<td>3</td>
<td>400</td>
<td>200</td>
<td>100</td>
<td>200</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>1,000</strong></td>
<td><strong>550</strong></td>
<td><strong>225</strong></td>
<td><strong>550</strong></td>
</tr>
</tbody>
</table>
**INDICATIVE CONSTRUCTION COSTS**

- Turbine costs comprise the bulk of the construction costs.
- 1603 expiration puts pressure on swift funding and execution of construction before year-end.
- For larger projects, a more substantial BoP budget may be required to fund the upgrade of transmission facilities.
- Pre-construction deposits for turbines, PPA and interconnection = higher development equity.

![Construction Costs Table]

(a) Reflects midpoint of estimated range for projects built in 2011.
TURBINE COST

- Contracts signed in late 2010 for delivery in 2011 were struck at a 7% discount to contracts signed in 2009
- Low PPA prices have put pressure on turbine pricing
- Prices expected to stabilize around current levels

Source: BNEF February 2011 Wind Turbine Price Index.

Note: Contract prices include turbine plus towers and transport to site, and they exclude VAT and installation costs.
Wind is increasingly cost-competitive among generation technologies, but is intermittent (i.e., can’t be dispatched) and may be weighted toward off peak hours.

Source: EIA Annual Energy Outlook.
Note: EU-ETS 10-yr market horizon forecast from September 2010.
Wind is increasingly cost-competitive among generation technologies at ~$1.9 / W installed.
SENIOR SECURED DEBT

- Active market- 25+ active lenders
- Debt is sized at Debt Service Coverage Ratio ("DSCR") of ~1.4x at P50, 1.0x at P99
  - \(\frac{\text{Revenue} - \text{Operating Costs}}{\text{Interest Expense} + \text{Scheduled Amortization}}\)
- Tenor up to 17 years post COD from banks; longer tenor from life insurance cos
- Pricing for banks is LIBOR plus 225 with step ups; for life cos Treasuries plus 325
- Debt Service Reserve Account is 3-6 months of scheduled debt service
- Distribution Blocks trap cash at project if DSCR drops below 1.2x in any period
- Restrictive covenants on action by the Borrower
- Upfront fees for banks are ~2% of loan value
- Transaction costs are ~0.5% - 1.0% of total deal value, and cover admin agent, independent engineer report, insurance, legal and accounting
Tax equity investors are large corporates with stable taxable income

- Enables Project to monetize tax credits and depreciation, subject to tax rules
- Favors large projects in terms of minimum investment
- Market volume is around $6 billion

Structures for wind projects include partnership flip ("partnership") and sale leaseback ("lease")

- Tax equity owns either a partnership interest or is Lessor in lease
- Tax equity is allocated the tax benefits plus some portion of cash
- In partnership, preferred return to tax investor; relative interests “flip” when a target return is achieved

- Lease = fixed payments over life of lease
- Purchase options to sponsor at higher of FMV at stipulated amount
- Inter-creditor issues arise with senior debt
COST OF CAPITAL

- Senior debt capital is least expensive because it takes the least risk in the project
  - May be difficult to source in small amounts
- Construction and bridge loans will price at a discount to term loans
- Tax equity prices like a debt product, and its required return increases if senior debt is placed ahead of it
  - Role of tax equity to increase in the event 1603 is not extended

![Debt & Equity Rates for US Renewable Energy Projects 2010-1Q2011](chart.png)
COST OF CAPITAL (cont’d)

- Tax equity investors have made a resurgence in 2010 and 2011
- 1603 Cash Grant in lieu of tax credits expires in 2011
  - IRC Section 45 Production Tax Credit
  - IRC Section 48 Investment Tax Credit
- Tax equity returns are measured on an after tax basis
  - Pre-tax equivalent is higher
Ed Feo is a founder and managing partner of USRG Renewable Finance and USRG Clean Energy Capital. USRGRF provides long term financing to renewable energy projects. USRGCEC provides mezzanine and senior debt to smaller projects and companies. Previously, Ed was a partner in the international law firm of Milbank, Tweed, Hadley & McCloy LLP and headed the Firm’s Power & Energy practice.

Mr. Feo was named in 2010 by the National Law Journal as one of “The Most Influential Lawyers of the Decade” for his work on energy and environmental transactions. He has been named in the California Lawyer magazine as an “Attorney of the Year” in the Energy category and by The American Lawyer as a “Deal Maker of the Year.” He was named as one of the Top 100 Lawyers in California by The Daily Journal for five consecutive years, and was named one of the “Five Most Influential People in Renewable Energy” in 2008 by Institutional Investor.

Mr. Feo is a well known speaker at renewable energy conferences, including at the American Wind Energy Association annual conference, the European Wind Energy Association annual conference, the National Renewable Energy Laboratory Growth Forum, Solar Power International, the American Council on Renewable Energy annual conference, the Geothermal Resources Council, the World Renewable Energy Conference, the Renewable Energy Finance Forum, and numerous other industry events. He is also a frequent writer on renewable energy topics, including as a columnist for North American Clean Energy and as a contributor to Reuter’s/PFI Clean Energy Finance. He is on the board of editors of The Journal of Structured Finance.
US Renewables Group ("USRG") is a private equity firm specializing in renewable energy. USRG includes debt funds called USRG Renewable Finance ("USRG RF") and USRG Clean Energy Capital ("USRG CEC").

USRG RF successfully launched in 2010 with a $1.5 billion commitment from a global investment bank to fund Department of Energy Loan Guarantee Deals.

USRG CEC is aimed at small and middle market companies in the renewable energy space spanning power projects (both non-recourse and project hold co), equipment manufacturers, fuels and chemicals projects and energy efficiency companies.
QUESTIONs?