U.S. Renewable Energy: Increasing Capacity- Reducing Costs

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Douglas Arent, Ph.D.

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US Wind Resources

US Wind Power Technical Potential

- Onshore – 11,000 GW
- Offshore – 4,200 GW
US Wind Generation Trends

US Wind Power Technical Potential
• Onshore – 11,000 GW
• Offshore – 4,200 GW

Source: EIA and LBNL
Geographic Spread of Wind Projects in the United States Is Reasonably Broad

Note: Numbers within states represent cumulative installed wind capacity and, in brackets, annual additions in 2014.
US Offshore Wind Projects

Project Status
- Under Construction
- Approved
- Permitting
- Planning—Site Control
- Planning—Early Stage

Project Size
- 0–50 MW
- 51–250 MW
- 251–500 MW
- 501–1,000 MW
- >1,001 MW
Wind Power PPA Trends

Levelized PPA Price (2014 $/MWh)

- Interior (20,611 MW, 212 contracts)
- West (7,124 MW, 72 contracts)
- Great Lakes (3,620 MW, 48 contracts)
- Northeast (1,018 MW, 25 contracts)
- Southeast (268 MW, 6 contracts)

PPA Execution Date

- Interior
- West
- Great Lakes
- Northeast
- Southeast

75 MW
150 MW
50 MW
U.S. Solar Energy Resource

Photovoltaic Solar Resource of the United States

US Solar Power Technical Potential
• PV – 154,000 GW
• CSP – 38,000 GW
U.S. Solar Deployment Trends

US Solar Power Technical Potential
- PV – 154,000 GW
- CSP – 38,000 GW

Sources: SEIA/GTM, Larry Sherwood/IREC
U.S. Solar Deployment

Sources: GTM/SEIA and IREC
PPA prices have continued to decline due to intense competition among solar developers

- Several projects have signed PPA’s for approximately $0.05/kWh

A lag between a project’s PPA “signing date” and its “commissioning date” can lead to conflicting information regarding “current” pricing for PV

- The weighted capacity lag between the above projects averaged over 3 years

Note: Commissioning date data from NREL internal database.
Drivers for Renewable Energy

• Federal
  o Investment Tax Credit
  o Production Tax Credit
  o Clean Power Plan (final rule)
  o 1603 Treasury Grant
  o Modified Accelerated Cost Recovery System Depreciation Schedule (MACRS)
  o DOE Loan Program

• State
  o Renewable Portfolio Standards
  o Renewable Energy Certificates (RECs) or Performance Based Incentives
  o Net Metering & VOS
  o Carbon Markets
  o State Tax Credit
  o Property Assessed Clean Energy (PACE) Programs
  o Property Tax Exemptions
  o State Sales Tax Exemptions
  o Grants
  o Clean Energy Financing Program
  o Subsidized Loans
  o On-Bill Financing

• Business
  • 3rd Party Ownership & Leases
  • Services Platforms
  • Community Renewables
  • Solar Bonds & Individual Investors
Exploring Possibilities: Renewable Electricity Futures Study

Key Findings:

• Renewable electricity generation from technologies that are commercially available today, in combination with a more flexible electric system, is more than adequate to supply 80% of total U.S. electricity generation in 2050—while meeting electricity demand on an hourly basis in every region of the country.

• Increased electric system flexibility, needed to enable electricity supply-demand balance with high levels of renewable generation, can come from a portfolio of supply- and demand-side options, including flexible conventional generation, grid storage, new transmission, more responsive loads, and changes in power system operations.

• The abundance and diversity of U.S. renewable energy resources can support multiple combinations of renewable technologies that result in deep reductions in electric sector greenhouse gas emissions and water use.

• The direct incremental cost associated with high renewable generation is comparable to published cost estimates of other clean energy scenarios. Improvement in the cost and performance of renewable technologies is the most impactful lever for reducing this incremental cost.

Methodology: ReEDS and SolarDS capacity expansion models used to develop high RE scenarios in the U.S. (and estimate associated cost/benefits); GridView production cost model used to evaluate hourly operability of 80%-by-2050 scenarios.


www.nrel.gov/analysis/re_futures
Transforming Power Systems: Enabling Flexibility

Low capital cost options, but may require significant changes to the institutional context.

Option costs are system-dependent and evolving over time.
Thank You.
doug.arent@nrel.gov