

AEO2018 Renewable Electricity Working Group Meeting



EIA Renewable Electricity Working Group

August 1, 2017

Washington, DC

Overview of Annual Energy Outlook 2018 (AEO2018)

- Unlike AEO2017, which was a limited release, AEO2018 will be a full report and will include additional side cases beyond the standard set
 - Reference (existing law and policy)
 - High/low oil and gas resource and technology
 - High/low oil price
 - High/low economic growth
 - Other potential side cases:
 - Extended Policies
 - Energy Storage
- This presentation will focus on the changes to the renewable electric power sector portion of the model.

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Renewable Electric Power Sector Updates for AEO2018

- **Renewable generation:** Include improved representation of renewable generation resources.
- **Variable renewable integration:** Assess parameters that are impacted by increased generation of non-dispatchable (i.e., variable) generation, such as wind and solar.
- **Curtailement and energy storage:** Integrate energy storage as a capacity expansion option.
- **Potential hydro builds:** Reassess data sources of potential hydro builds.
- **State-level renewable policy:** Enhance representation of Renewable Portfolio Standards (RPS).
- **Utility rate structure:** Reconsider representation of electric power price with increasing deployment of distributed generation to adequately address the ability to recover system costs
- **Project Financing :** Reevaluate cost of capital to finance new generating capacity by owner type.
- **Additional data updates:** Update standard input assumptions as needed.

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Additional Electric Power Sector Updates

- For more information on the electric power sector updates contact Kenny Dubin (Kenneth.Dubin@eia.gov) to be added to the Electricity Working Group invite for Thursday, August 10, 2017 (11:00AM-12:30PM).
 - Key policy issues to be addressed:
 - Clean Power Plan
 - Illinois and New York state subsidies for plants at risk of early retirement (e.g., “Zero Emission Credits”)
 - Updates/improvements/ongoing efforts at updating electric sector modeling
 - Assess the vintage of the electric generation fleet and potential for future retirements and life extension for all technologies, including existing nuclear, coal, natural gas, and renewables.

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Additional End-Use Sector Updates

- For more information on End-Use sector updates, contact Erin Boedecker (Erin.Boedecker@eia.gov) to be added to the Buildings Working Group invite for Thursday, August 3, 2017 (1:30PM-2:30PM).
 - Update contagion effect for residential PV, which uses a ZIP code-level econometric penetration model.
 - Update sub-Census division niches for commercial distributed generation modeling.
 - Update regional representation of interconnection limitations/ distributed generation policies affecting distributed generation adoption.
 - Update historical PV system costs and installed capacities.

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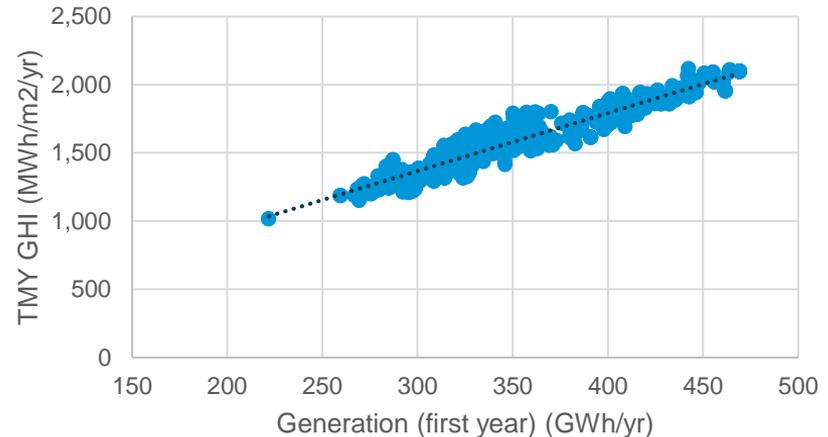
Renewable Generation: wind and solar technology options

- This AEO, EIA would like to integrate a second technology type for both onshore wind and solar photovoltaic to capture the tradeoffs between performance and cost.
- Potential technology options include looking at:
 - Solar PV:
 - thin film vs. monocrystalline
 - single axis vs. fixed tilt
 - Onshore wind:
 - different hub heights and/or blade lengths
 - different IEC class turbines

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Renewable Generation: solar resource supply curves

- Similar to the representation of regional wind resource supply curves at a regional level, this year EIA will integrate solar resource supply curves.
- This means that at each of the 22 regions the available resource will be broken out into steps instead of an average resource for the entire region.
 - Resource Data Source:
 - Typical Meteorological Year (TMY)
Global Horizontal Irradiance (GHI)
Physical Solar Model (PSM)
National Solar Radiation Database
 - Six supply steps by each NEMS region
 - System Advisory Model (SAM) to relate GHI data to capacity factors

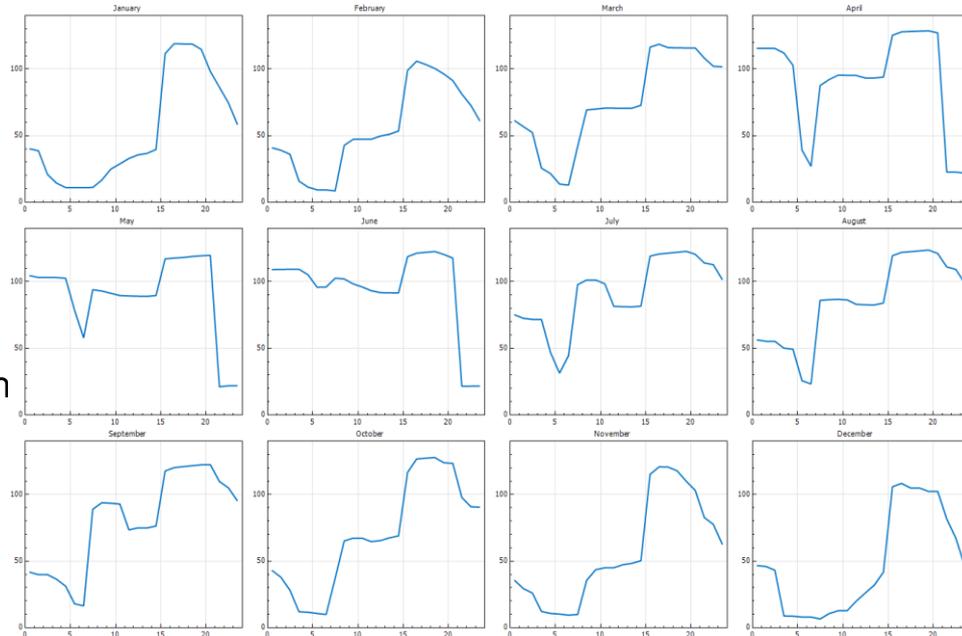


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Renewable Generation: solar thermal with energy storage

- Currently, EIA models solar thermal as a central-receiver tower without integrated energy storage.
- EIA is changing the existing technology to a power tower with molten salt energy storage.
 - System Advisory Model (SAM) dispatch optimization method to develop static, regional, hourly-generation profiles

Example CSP power tower with storage generation profiles generation (MWh)

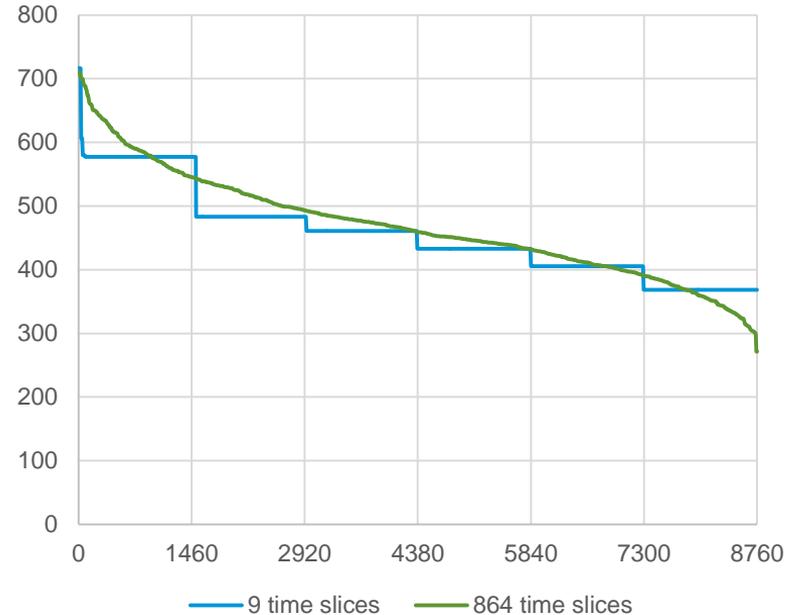


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Curtailments and Energy Storage

- In AEO2017, EIA introduced energy curtailments for solar PV technologies using an 864-hour simulation.
 - Consisting of 12 months by three 24-hour day-types.
 - For AEO2018, EIA will modify wind curtailments to use a similar approach.
- EIA will use the same 864-hour model to determine a value for the stored curtailed energy which it will use to integrate energy storage as a capacity expansion option.

Example load duration curve
gigawatts



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Flexibility Parameters

- EIA has participated in a multi-model comparison effort focused on modelling of non-dispatchable (i.e., variable) technologies such as wind and solar.
 - Coinciding with this effort, EIA has been working on updating the flexibility parameters to ensure that the impact these technologies have on the grid is accurately reflected.
- In addition to adding curtailments and energy storage technologies, EIA plans on potentially adjusting these flexibility components:
 - Regional limit on annual variable renewable energy generation.
 - Share of variable renewable energy contribution to the operating reserves.
- In addition, EIA will begin to examine the potential for DC transmission enhancements to mitigate regional effects of high levels of wind and solar.

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Potential Hydro Builds

- This year EIA is reassessing the data sources of potential hydro builds
- Evaluating compatibility and impact of using:
 - Non-powered Dam Resource Assessment (2012) - http://nhaap.ornl.gov/sites/default/files/NHAAP_NPD_FY11_Final_Report.pdf
 - New Stream-reach Development Resource Assessment (2014) - http://nhaap.ornl.gov/sites/default/files/ORNL_NSD_FY14_Final_Report.pdf

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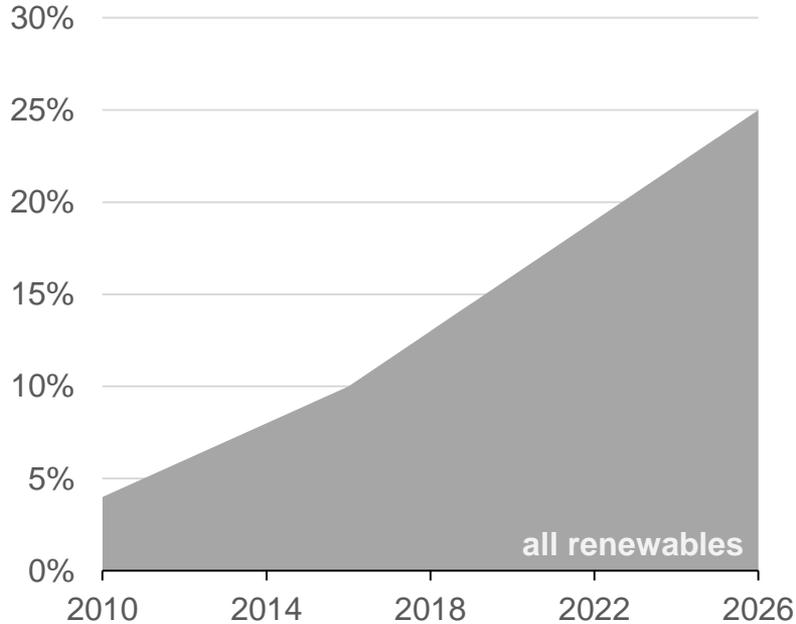
Renewable Portfolio Standards

- In addition to EIA's standard policy update to reflect continued changes in RPS policies, EIA is updating the methodology for representing RPS targets.
- Previously, EIA used preprocessing efforts to estimate a single overall target for each of the 22 EMM regions.
- The new approach will allow for multiple targets within each region and include more specificity in relation to:
 - Set-asides or carve-outs for specific technologies (for both end-use and utility-scale)
 - Limitations on *regional* trading
 - Alternative compliance payments
 - Credit multipliers
 - Type of utility participating

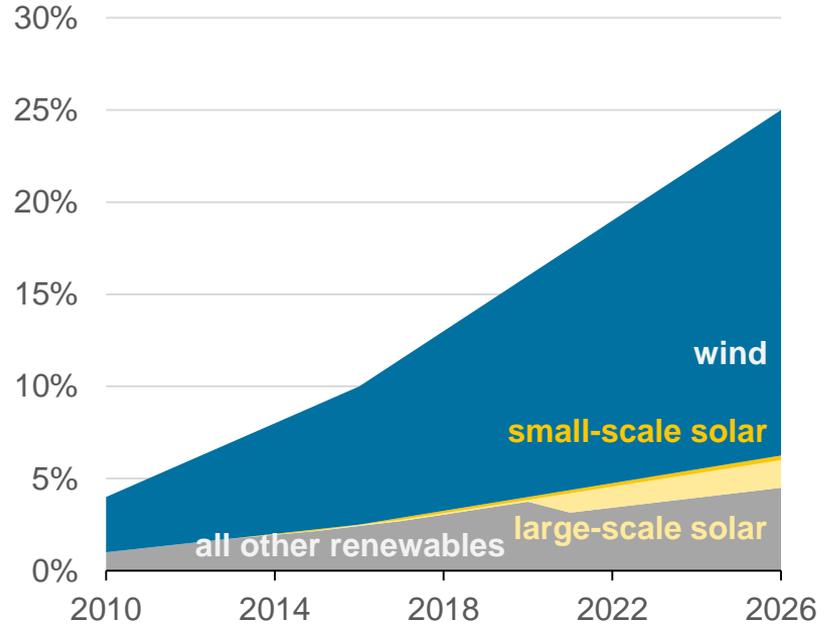
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Renewable Portfolio Standards

Illinois RPS representation in AEO2017
percent of sales



Illinois RPS representation in AEO2018
percent of sales



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Utility Rate Structure

- For AEO2017, EMM started treating end-use PV generation as if from utility-generators to allow for PV impacts on grid planning and operating constraints to be fully seen by EMM.
- With increasing penetration of distributed generation, EMM lacks effective price-signal feedback with end-users as well as how utilities and generators would recover their costs.
- Three possible pricing schemes to investigate: time-of-use pricing signal in the wholesale generation prices, compensation at wholesale price rather than at all-in retail price of electricity, or a fixed annual charge in lieu of per-kWh charge.

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Project Financing

- In Fall 2016, EIA commissioned an external consultant to examine the impact of weighted average cost of capital (WACC) and its components, allowing for better representation of investment decisions of companies operating in the U.S. power markets in NEMS.
- The study finds notable variations in WACC across different ownership types: lower WACC for traditional utilities, while higher WACC for merchant generators or renewable generators.
- Future modeling efforts: testing whether separately accounting for differences in the types of generators that are limited to a particular market structure has a notable impact on NEMS projections.

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Contact Information

Chris Namovicz

Team Leader for Renewable Electricity Analysis

Chris.Namovicz@eia.gov

202-586-7120

The Renewable Electricity Analysis Team:

Fred Mayes, 586-1508

Michelle Bowman, 586-0526

Cara Marcy, 586-9224

Manussawee Sukunta, 586-0279

Richard Bowers, 586-8586

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