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Description:	Erin Boedecker, U.S. Energy Information Agency (via WebEx)
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EIA Perspective on Photovoltaic Adoption



For

Workshop on Demand Forecast Methodological Issues

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By

Erin Boedecker, Team Leader

Buildings Energy Consumption & Efficiency Analysis



U.S. Energy Information Administration

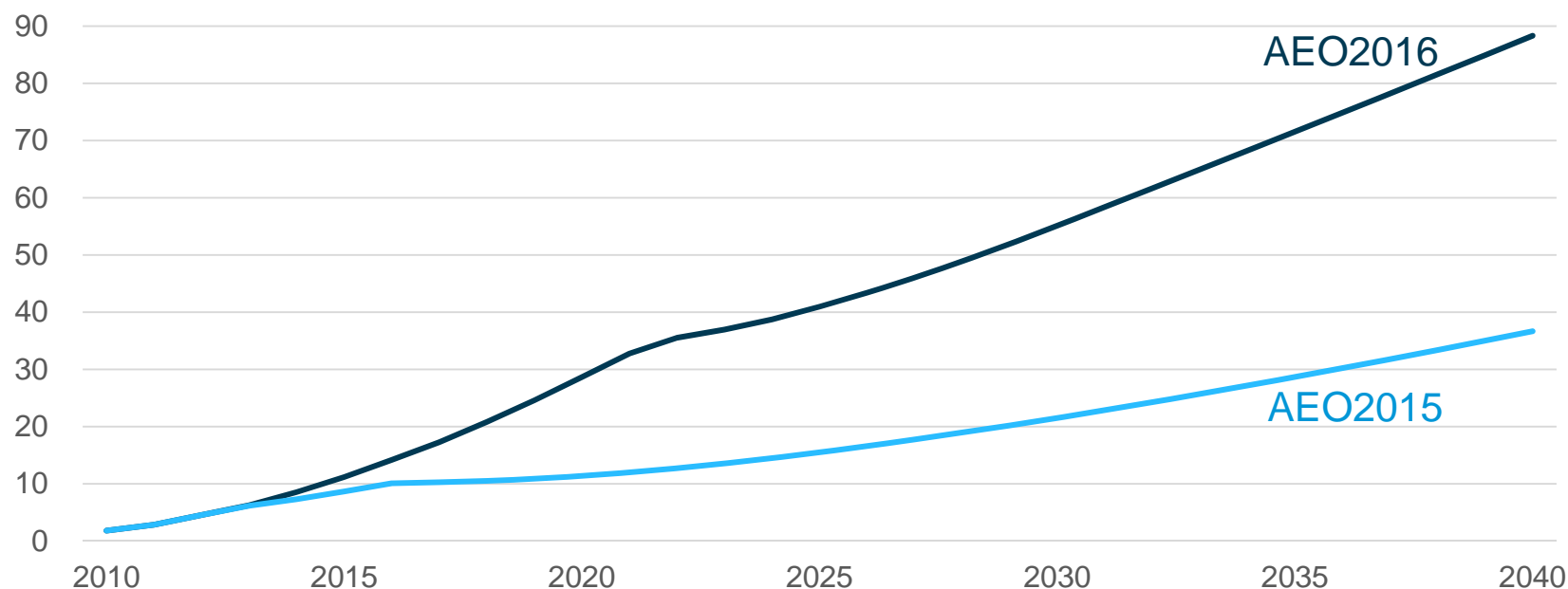
Independent Statistics & Analysis | www.eia.gov

Overview

- *Annual Energy Outlook 2016* (AEO2016) distributed solar photovoltaic (PV) projections
- Current methodology for PV adoption
- Modeling issues

Extension of investment tax credits, combined with decreasing solar photovoltaic costs, leads to greater adoption of PV in buildings

distributed solar PV capacity, gigawatts



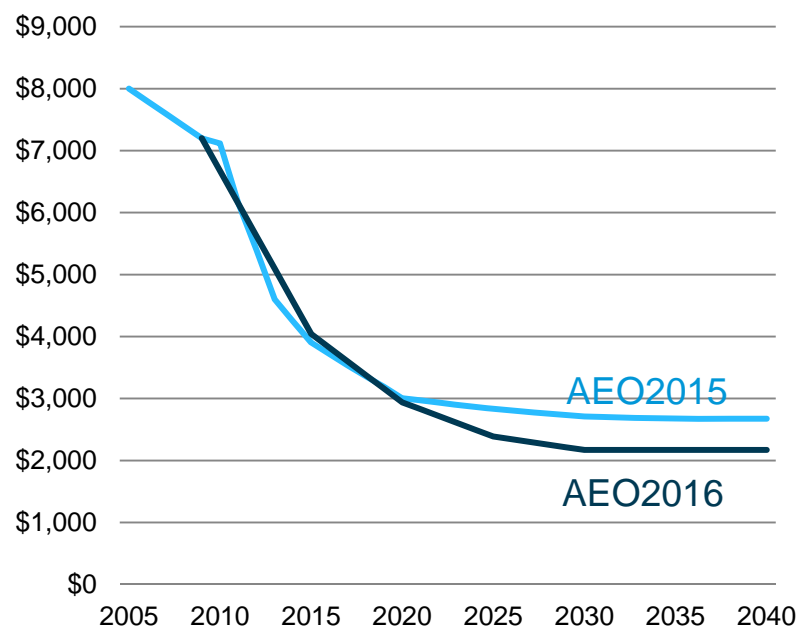
Source: EIA, Annual Energy Outlook 2016, Annual Energy Outlook 2015

Current distributed photovoltaic (PV) methodology for development of *Annual Energy Outlook* (AEO) projections

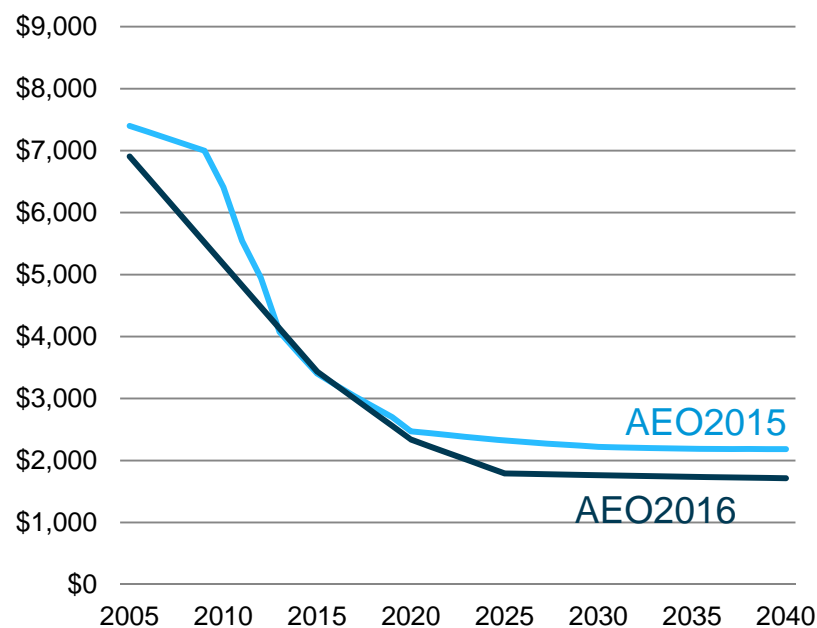
- Residential and commercial projections developed at Census division level
- AEO projections are currently based on a 30-year cash flow determinants-based model considering:
 - PV costs
 - federal subsidies
 - financing parameters
 - solar insolation
 - average electricity load
- Residential adoption depends on years to cumulative positive cash flow
- Commercial adoption depends on internal rate of return

Cost and performance assumptions are reviewed annually

residential installed cost (\$2015/kWdc)



commercial installed cost (\$2015/kWdc)



EIA's National Energy Modeling System (NEMS) uses a niche approach to reach beyond Census division level

- Residential niches based on 2009 RECS and marginal price approach
 - confidential RECS data with zip codes used to map solar insolation for more accurate representation of solar resource
 - monthly electric bills used to develop marginal electricity price estimates; marginal prices higher than average prices in some areas but not all
 - includes consideration of average roof area per unit of floorspace area
- Commercial niches based on 2003 CBECS
 - solar resource, Census division, electricity rate multiplier overlay
 - square footage as share of division and roof area as percent of building square footage
 - wind resource and natural gas cost rate multiplier also included

Technical potential and available roof area are considered

- Technical potential increases as projected PV module efficiency increases
 - there is a limited amount of residential roof area available for PV installations
 - 50% of HH have PV compatible orientation
 - 50% of the PV compatible orientation area is typically well-enough oriented for panel installation
 - 60% of this roof area is appropriate for PV (not shaded, not impeded by inappropriate angles or other roof structures, etc.)
 - 40% of commercial roof area is assumed suitable for PV
 - derived from CBECS floorspace area and number of floors
 - orientation effects not as important for flat roof installations; shading from other buildings assumed to be included in the 60% of unsuitable roof area.
 - as the electrical conversion efficiency of PV systems improves (as is projected), the installed wattage that can be installed onto this specific area increases, and technical potential increases

Some “real world” features are not fully captured at the level of regional detail in EIA’s models

- Rooftop: rate structures
 - tiered rates
 - net metering terms and conditions
 - time of use/critical peak pricing/demand response rates
 - applicability of specific rates
 - interactions with incentive programs (e.g. SGIP, CSI)
- Macroeconomic and social factors are not currently included in the purchase decision

EIA represents several key PV-related policies, but cannot capture all due to the granularity of policy specification

Included

- Federal production tax credit
- Federal investment tax credit
- Accelerated depreciation
- State renewable portfolio standards (RPS) – power sector only

Not Included

- State/municipal tax credits
- State/municipal/utility rebate or grant programs
- Loan or financing programs
- Solar-specific targets within a state RPS

Not Explicitly Included

(but not totally inconsistent w/NEMS representation)

- Net metering policies
- Residential sector third-party ownership

Alternative methods for residential PV adoption are being considered

- Use statistical models, with data from some states, to estimate effects of macroeconomic and microeconomic variables on households' decisions to adopt solar PV.
 - Use the model coefficients, along with projected covariates from the NEMS, to project new solar PV installations by zip code, and aggregate the projections to higher levels.
 - Retain NEMS methodology for estimating PV capacity and generation, given the projected numbers of adoptions.
- The statistical models do not explicitly account for roof area.
 - Population density is used as a proxy for roof area.
- Calibrate the model-based estimates to historical estimates; calibration is needed to adjust for policy differences between states.

For more information

U.S. Energy Information Administration home page | www.eia.gov

Annual Energy Outlook | www.eia.gov/aeo

Short-Term Energy Outlook | www.eia.gov/steo

International Energy Outlook | www.eia.gov/ieo

Monthly Energy Review | www.eia.gov/mer

Today in Energy | www.eia.gov/todayinenergy

Analysis of the Impacts of the Clean Power Plan |
<http://www.eia.gov/analysis/requests/powerplants/cleanplan/>

International Energy Portal | www.eia.gov/beta/international/?src=home-b1

Supplemental slides

U.S. Census Regions and Divisions

