

# AEO2020 Renewable Electricity:

## *Policy Assumptions & Key Model Updates*



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*For*

*EIA Renewables Working Group*

*April 23, 2019*

*By*

*Renewable Energy Analysis Team*

*Office of Electricity, Coal, Nuclear, and Renewables Analysis*



# Overview AEO2020 Renewables Working Group

- Preliminary areas of analysis in AEO2020
  - Current laws and regulations, including changes to renewable portfolio standards (RPS)
  - Update to the capital cost assumptions
  - Regional mapping redefinition
  - Increases to the resolution of the ReStore model
- Possible areas of consideration for AEO2020
- Side cases under consideration
- Considerations for future long-term modeling efforts
  - Economic retirement options for renewable technologies
  - Update to capacity factor assumptions for wind and solar
  - Including a solar + storage technology option

# AEO2020 Current Laws and Regulations: Renewable Portfolio Standards

# AEO2019 RPS Updates

- AEO2019 included updates to four state RPS

State	Old policy	Current policy	Legislation
<b>Connecticut</b>	27% renewables by 2020	48% renewables by 2030 w/ 4% solar carve-out and 4% waste-to-energy carve-out	S.B. 9 Public Act No. 18-50
<b>New Jersey</b>	24.4% renewables by 2024	50% renewables by 2030	A 3723
<b>Massachusetts</b>	18% renewables by 2022 w/ an increase of 1 percentage point each year	35% renewables by 2030 w/ an increase of 1 percentage point each year	Acts 2018: Chapter 227
<b>California</b>	50% renewables by 2030	60% renewables by 2030 100% carbon-free by 2045	S.B 100

# AEO2020 Current Laws and Regulations: RPS Updates

- The [District of Columbia enacted](#) legislation in January, 2019 calling for 100% renewables by 2040
- [New Mexico enacted legislation](#) in March, 2019 calling for IOUs and coops to get at least 50% from renewables by 2030 and 80% by 2040. It includes a 100% carbon-free mandate by 2045 for utilities and by 2050 for co-ops
- EIA is tracking 13 additional states that might increase their respective RPS

# AEO2020 Current Laws and Regulations: RPS Updates

## Passed legislation that will be included in AEO2020

State	Current policy	Proposed policy	Legislation	Status
<b>New Mexico</b>	20% by 2020 for IOUs 10% by 2020 for Co-ops Carve-outs for solar, wind, and DG	50% renewables by 2030, 80% renewables by 2040, 100% carbon-free by 2045. Co-ops have until 2050 to reach 100% carbon-free goal	Energy Transition Act SB 489	Signed by Governor Grisham March 22, 2019
<b>Washington DC</b>	50% renewables by 2032	100% renewables by 2040	D.C. ACT 22-583	Signed by Mayor Bowser January 18, 2019

## Pending Legislation

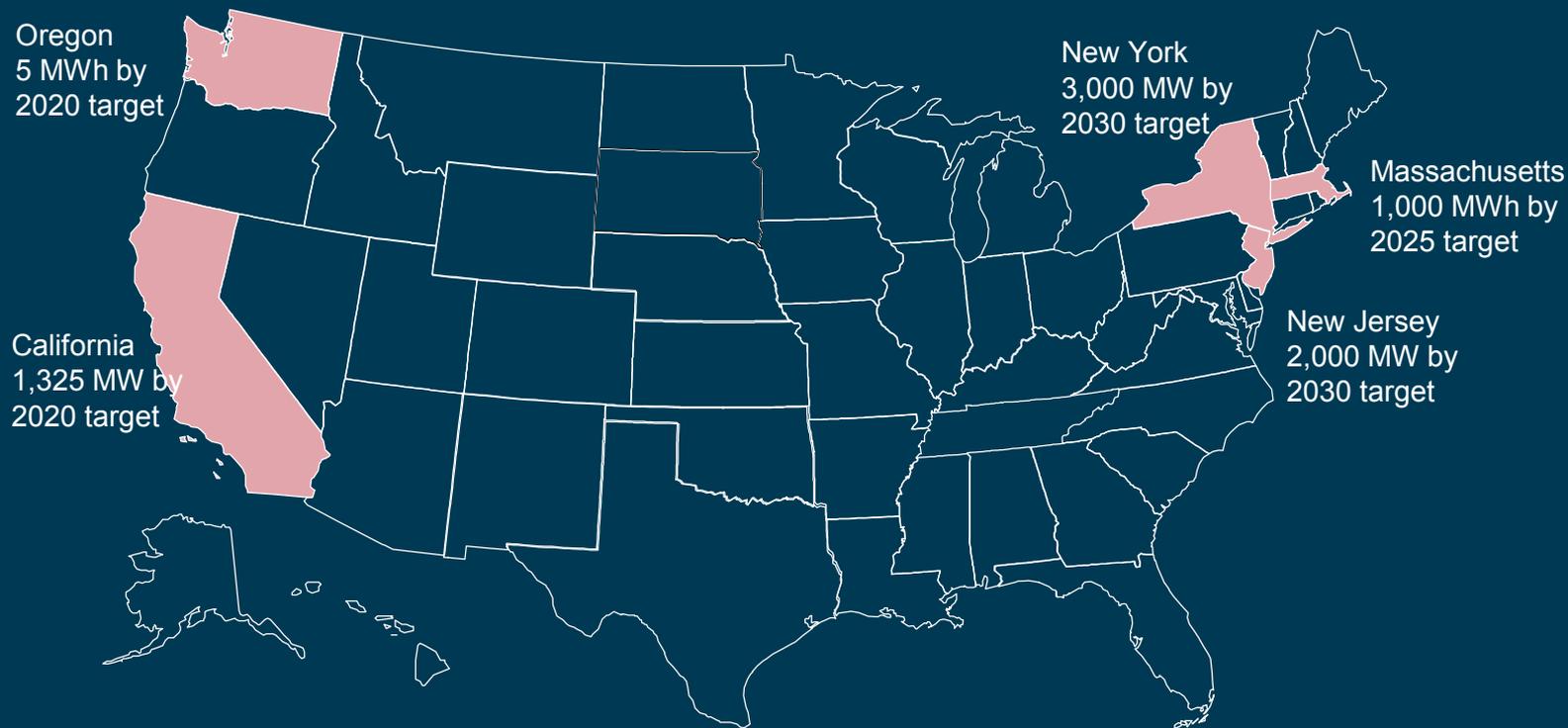
State	Current policy	Proposed policy	Legislation	Status
<b>Arizona</b>	10.5% renewables by 2025	80% clean energy sources by 2050	Arizona's Energy Modernization Plan	Proposed by Arizona Corporation Commission (ACC)
<b>Florida</b>	7.5% renewables by 2015	100% renewables by 2050	State Renewable Energy Goals H.B. 1291 S.B. 1762	Bills introduced
<b>Illinois</b>	25% renewables by 2025	50% renewables by 2030 and 100% renewables by 2050	Clean Energy Jobs Act (S.B. 2132 H.B. 3624)	Still being considered
<b>Maryland</b>	22.5% renewables by 2024 2.5% solar by 2024	50% renewables by 2030 w/ mandated study for 100% by 2040	Clean Energy Jobs Act (S.B. 516, H.B. 1158)	Senate & GA Approved Awaiting Gov signature
<b>Nevada</b>	23.5% renewables by 2025 1.5% solar by 2025	50% renewables by 2030, 100% clean-energy by 2050	S.B. 358	Introduced, if passed still needs voter approval in 2020
<b>Washington</b>	15% renewables by 2020	100% carbon-neutral by 2050 and phase out coal by 2025	S.B. 5116	Awaiting Gov signature

# AEO2020 Current Laws and Regulations: RPS Updates

## RPS update under consideration with no legislation currently

State	Current policy	Proposed policy	Status
<b>Colorado</b>	30% renewables by 2020	100% carbon-free by 2040	Legislation anticipated, governor supported
<b>Maine</b>	40% renewables by 2017	100% renewables by 2045	Legislation anticipated
<b>Michigan</b>	15% renewables by 2021	100% renewables by 2050	Legislation anticipated (Reintroduction of H.B. 6466) 2018
<b>Minnesota</b>	25% renewables by 2025 Excel needs 30% renewables by 2020	100% carbon-free by 2050	Governor proposed
<b>North Carolina</b>	12.3% renewables by 2020 0.2% solar by 2020	100% clean energy by 2050	Resolution on, but not necessarily legislation requiring
<b>Pennsylvania</b>	7.5% renewables by 2021 0.5% solar by 2021	100% renewables by 2050	Legislation anticipated
<b>Wisconsin</b>	10% renewables by 2015	100% carbon-free by 2050	Governor proposed/supported no bill yet

# In addition to RPS policies, EIA has started to capture state-level mandates for energy storage



# AEO2020 Capital Cost Assumptions Update

# Generating technologies proposed for updated capital cost and performance characteristics for AEO2020

Proposed EMM generating technology plant types

\* Denotes new technology from previous studies

## Renewables

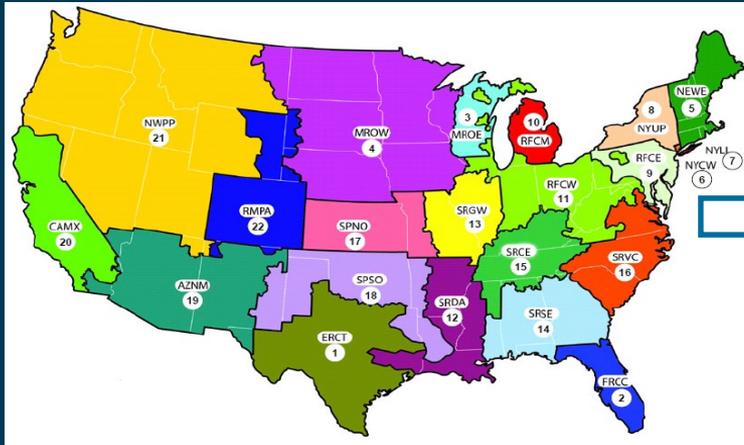
Technology	Proposed Configuration	Details
Battery storage: two hours*	50 MW / 100 MWh	
Battery storage: four hours	50 MW / 200 MWh	A battery energy storage project designed primarily to provide resource adequacy and bulk energy storage.
Concentrated solar thermal plant*	100 MW	Power tower, eight-hour thermal storage
Dedicated biomass plant	50 MW, Wood	
Geothermal	50 MW	Representative plant excluding exploration and production of resource
Hydroelectric	100 MW	Representative plant in new-stream-reach location
Landfill gas	30 MW, RICE (4 x 9.1MW)	Power block, not collection system.
Offshore wind	400 MW, 10 MW WTG	
Onshore wind - Coastal region*	50 MW, 2.3 MW WTG	
Onshore wind - Great Plains region	200 MW, 2.3 MW WTG	
Solar photovoltaic, tracking (with battery hybrid)*	PV w/tracking 150 MW PV 50 MW/200 MWh BESS	1.3 inverter loading ratio
Solar photovoltaic - single-axis tracking	150 MW	1.3 inverter loading ratio

Previous report, completed for AEO2015, can be found [here](#). Cost updates are done each AEO for wind and solar, [AEO2019](#)

# AEO2020 Regional Mapping Redefinition

# AEO2020 Regional Mapping Redefinition

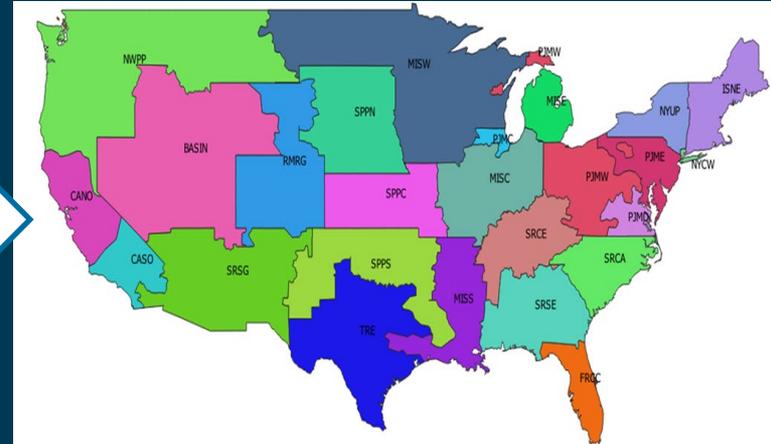
Current EMM regional mapping (22 regions)



## Summary of Regional Changes

- PJM split East/West/Dominion/ComEd
- Expanded MISO split four pricing zones
- Expanded SPP split into three zones
- SERC reduced to three regions

Proposed new EMM regional mapping (25 regions)

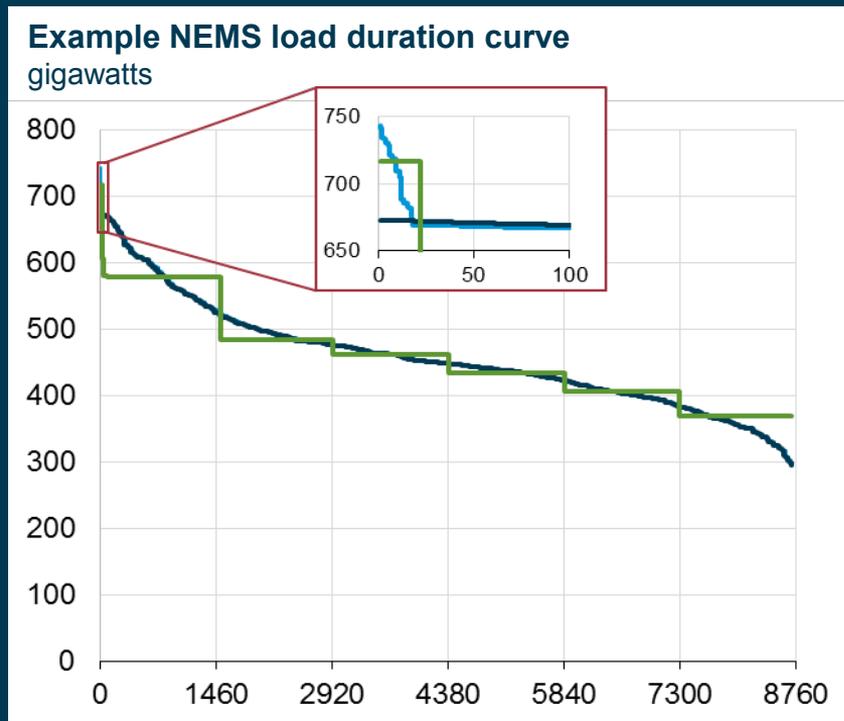


- CA split into North/South regions
- WECC split into six regions
- Unchanged: ISO-NE, FL, TX

# AEO2020 Increase ReStore Model Resolution

# Enhancements to the renewable storage (restore) module, which determines the production of wind, solar, and energy storage

- EIA continues to collaborate with EPA, EPRI, and NREL on sharing modeling approaches related to the electric power sector
- The collaboration's current focus is on how to model battery storage. As a result of this collaboration, we plan to make several updates to ReStore including:
  - Increasing the technological and/or temporal resolution of the model
  - Updating some of the inputs assumptions such as dispatch and value parameters



# Possible Areas of Consideration for AEO2020

## Possible Area of Consideration: Levelized Cost of Energy Updates

- LCOE & LACE for storage
- Incorporating other components to LCOE to reflect risk associated with fuel and carbon emissions costs
- Presenting combustion turbine (CT) in LCOE/LACE report.

# Additional Areas of Consideration

- Adding a new landfill gas fuel supply model
- Including both biogenic and non-biogenic MSW in industrial projection reporting.

# Possible Side-Cases Under Consideration

- AEO2020 will be including regular side cases high/low oil and natural gas resource, high/low macro
- Some other possibilities include
  - High cost/low cost renewables case
  - Offshore wind state mandate case
  - Biomass as Issues in Focus
- Suggestions?

# Long-Term Modeling Considerations

- Include economic retirement options for renewable technologies
- Update to capacity factor assumptions for wind and solar, including capacity factor improvement and performance degradation
- Include a solar + storage technology option
- Incorporate hydro pumped storage capacity additions as an additional storage technology

# AEO2020 Schedule

- Model development: Jun-Oct 2019
- Second Working Group Session: Sep/Oct 2019
- Expected AEO release: Jan 2020

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## For more information

U.S. Energy Information Administration home page | [www.eia.gov](http://www.eia.gov)

Annual Energy Outlook | [www.eia.gov/aeo](http://www.eia.gov/aeo)

Short-Term Energy Outlook | [www.eia.gov/steo](http://www.eia.gov/steo)

International Energy Outlook | [www.eia.gov/ieo](http://www.eia.gov/ieo)

Today in Energy | [www.eia.gov/todayinenergy](http://www.eia.gov/todayinenergy)

State Energy Profiles | [www.eia.gov/state](http://www.eia.gov/state)

# Supplemental Slides

# Generating technologies proposed for updated capital cost and performance characteristics for AEO2020

Technology	Proposed Configuration	Details
Combined-cycle oil/natural gas turbine	1100 MW, H-Class, 2x2x1	
Combustion oil/natural gas turbine	100 MW, 2 x LM6000	
Combustion oil/natural gas turbine	1 x 240 MW, F-Class	
Advanced nuclear AP 1000	2 x 1117 MW, PWR	Brownfield site.
Internal combustion engine	20 MW (4x 5.6 MW)	Natural gas or oil-fired diesel.
New Source Performance Standard compliant ultra-supercritical coal	650 MW Net	With 30% CCS or other compliance technology.
Non- New Source Performance Standard compliant ultra-supercritical coal (NSPS for NOX, Sox, PM, Hg)	650 MW Net	
Combined cycle single shaft	430 MW, H-Class 1x1x1	
Ultra-supercritical coal (with 90% CCS)	650 MW Net	
Combined-cycle natural gas turbine (with 90% CCS)	430 MW, H-Class 1x1x1	
Small Modular Reactor (SMR)	600 MW	
Biomass co-firing retrofit onto existing coal plant	300 MW net with 30 MW of added biomass	
Fuel cell	10 MW (4 x 2.8 MW MCFC)	Molten carbonate or other commercially viable technology.