

Annual Energy Outlook 2021 (AEO2021)

Working Group for Electricity, Coal, and Renewables Analysis : Preliminary Results



For

*EIA Joint Working Group for Electricity, Coal, and Renewables
October 22, 2020*

By

Office of Electricity, Coal, Nuclear, and Renewables Analysis

EIA Joint Working Group for Electricity, Coal, and Renewables Analysis, AEO2021: Overview of Second Teleconference

- Review of energy markets workshop
- Review of key developments and current laws and regulations
- Preliminary results for AEO2021
 - Photovoltaic-battery storage hybrid technology option
 - Coal production and exports

AEO2021 Cases

- Reference case
 - Only being discussed for this Working Group
- Core side cases
 - High/Low Oil Price
 - High/Low Economic Growth
 - High/Low Oil and Gas Resource and Technology
 - High/Low Renewables Cost Case

Review of Energy Markets Workshops

EIA Held a Series of Workshops to Consider Near- and Long-Term Impacts of Energy Markets

- Near-term impacts are significant across markets, but they may be significantly reduced when looking over the 30-year projection period of the AEO
 - Electricity demand is down slightly, and load patterns shifted as more people worked from home and commercial demand decreased
 - Overall impacts on the power sector are modest, and are not likely to greatly affect long-term projections
 - Global oil and natural gas trade was significantly disrupted, further depressing natural gas prices in the United States, but these prices could rebound significantly before restabilizing
- The current economic down-turn has the greatest potential for effects beyond the one- or two-year forecast
 - Potential impacts on investment as capital becomes more scarce
 - Energy demand in general may be depressed until the economy recovers

Review of key developments and current laws and regulations

Key Developments for AEO2021 in Electric Sector Modeling

•Electricity and nuclear

- Dynamic regional capability – implemented for future use
- High-voltage direct current (HVDC) transmission – evaluate regional cost data
- Small modular reactors (SMR) – added as a capacity expansion option
- Change in treatment of distributed generation

•Renewables

- Added solar photovoltaic plus battery storage as an option for capacity expansion
- Revised Landfill Gas (LFG) Submodule to be solved outside of the capacity expansion model
- Updated long-term resource multiplier for wind in the recent 25-region-model

•Coal

- Implemented a new coal transportation rate escalation methodology based on a rail cost adjustment factor approach (RCAF) used by the Surface Transportation Board
- Linked fuel costs used to calculate international seaborne coal freight rates based on fuel prices modeled in National Energy Modeling System (NEMS)
- Revised coal model base year parameters included

Updated Legislation and Regulations

- Ohio HB 6
 - Legislative action in Ohio (Ohio HB 6) does not appear likely until sometime after the November elections, so AEO2021 will continue to assume the Ohio zero emissions credits (ZEC) program will be continued, barring immediate action
- Virginia Clean Energy Economy Act (Senate Bill 851/House Bill 1526)
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 - 2021: carbon dioxide (CO₂) allowance of \$27.16 per metric ton (mt)
 - Allocation decreases each year by \$0.84/mt CO₂
 - 2030 and beyond: CO₂ allowance of \$19.6/mt CO₂
 - Dominion Energy and Appalachian Power required to retire carbon-emitting electric generating units by Dec. 31, 2045
- Potential entrant: Pennsylvania (legislative roadblock House Bill 2025)
 - Legislative action in Pennsylvania regarding HB 2025 does not appear likely until sometime after the November elections, so Pennsylvania will continue to remain a potential entrant to Regional Greenhouse Gas Initiative (RGGI) in AEO2021, barring immediate action

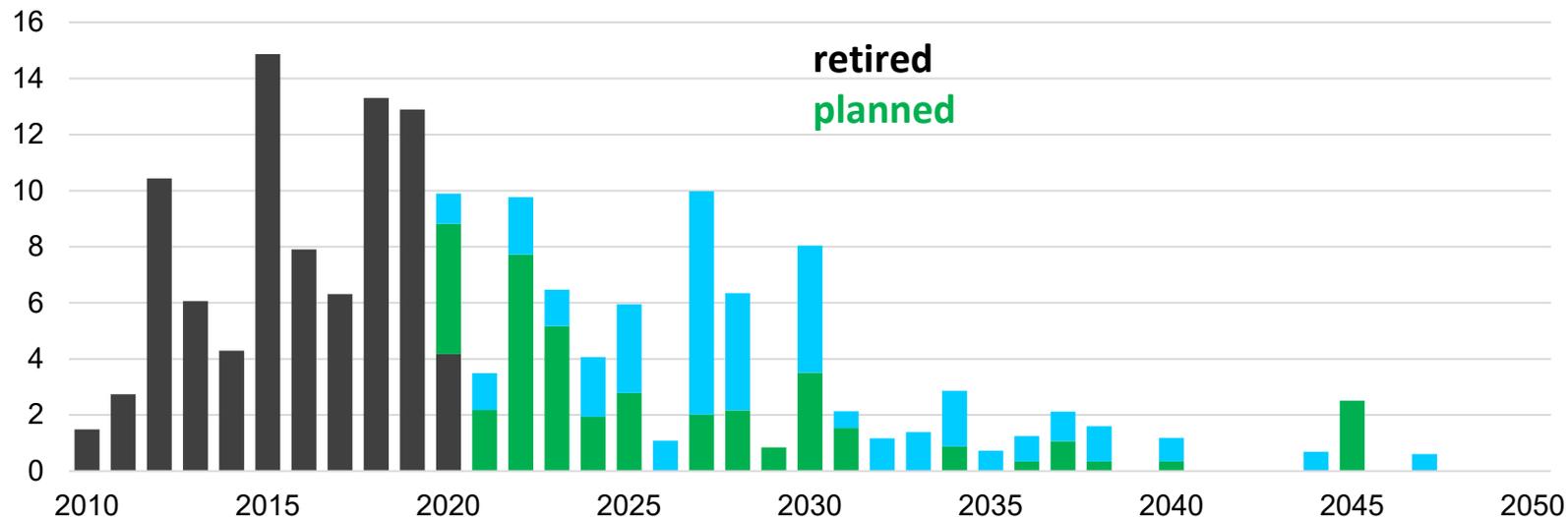
Other Policy and Regulatory Considerations

- Because the Reference case only includes current laws and regulations, the Federal Energy Regulatory Commission (FERC) Minimum Offer Price Rule (MOPR), has not been finalized into an actionable policy yet.
- We have conducted a review of utility-level integrated resource plans (IRP) and other corporate statements for voluntary reductions in carbon emissions.
 - IRPs are not binding policy documents, and their execution will be shaped by future market developments
 - Similarly, voluntary carbon commitments are largely aspirational in nature, and are subject to future market pressures
 - **No change in EIA precedent:** “current laws and regulations” will remain the basis for input assumptions to Reference Case

Wave of coal retirements will likely continue based on review of already planned or announced retirements

Coal plants retirements, planned, and announced (2010-2050)

net summer capacity in gigawatts (GW)



Source for actual and planned retirements: Survey Form EIA 860-M data as of May 2020 and analyst research on specific announcements. Announced retirements are based on analyst research and have not been classified as a planned retirement included in the AEO2021 Reference case.

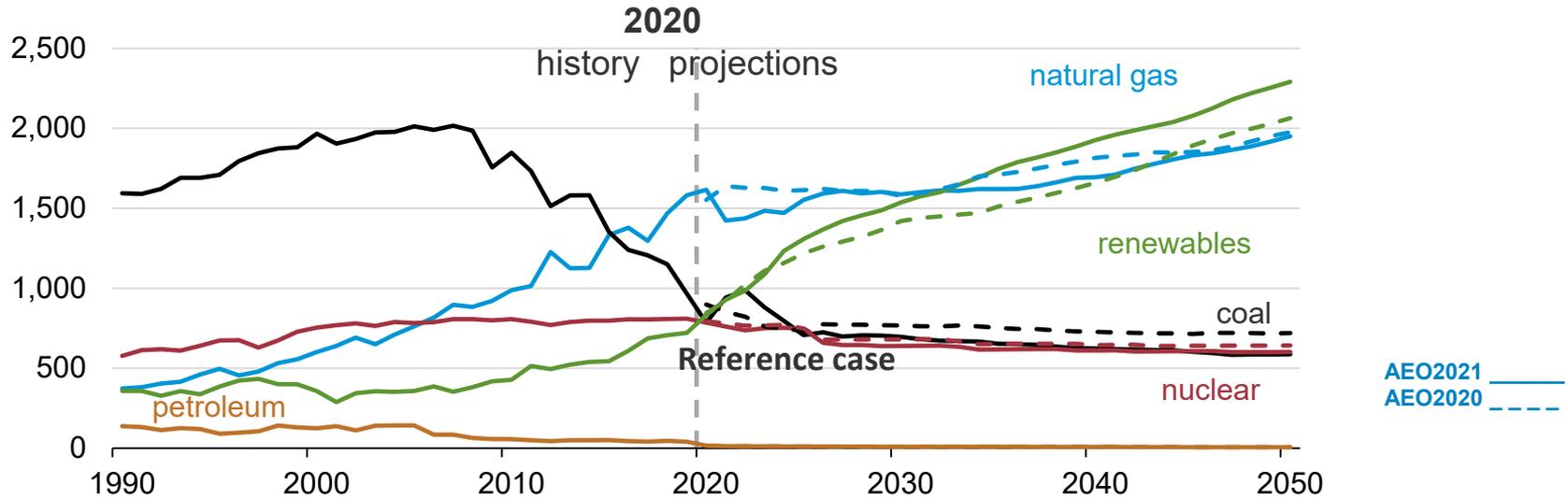
Preliminary results for AEO2021

Summary of Preliminary Results

- Slower recovery by the industrial sector through the projection period leads to lower electricity demand overall.
- Natural gas generation remains largely unchanged from AEO2020 despite lower natural gas prices
- More coal and nuclear units are expected to retire than in AEO2020, as a result of lower electricity prices and higher renewables capacity additions.
- Wind capacity additions increase, especially in the near term, as a result of the extension of the production tax credit for another year.
- The solar-battery hybrid technology option increases overall solar additions while keeping the stand-alone storage level similar to AEO2020.

Projected levels of generation by fuel

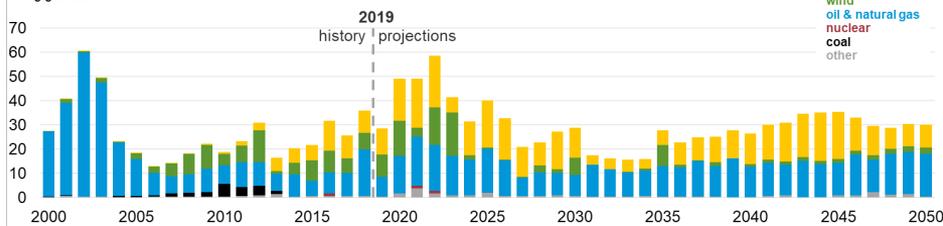
Electricity generation from selected fuels
billion kilowatthours



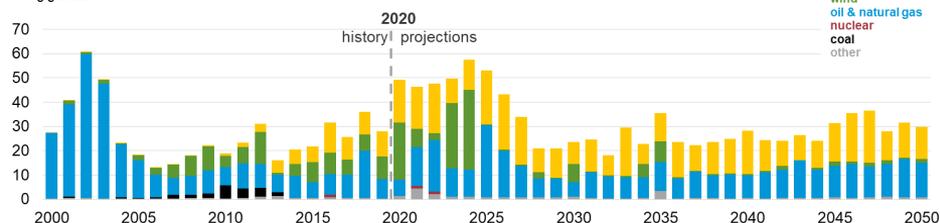
Source: ref2020.1121a, ref2021.1018a

Capacity additions and retirements by fuel type, 2010-2050

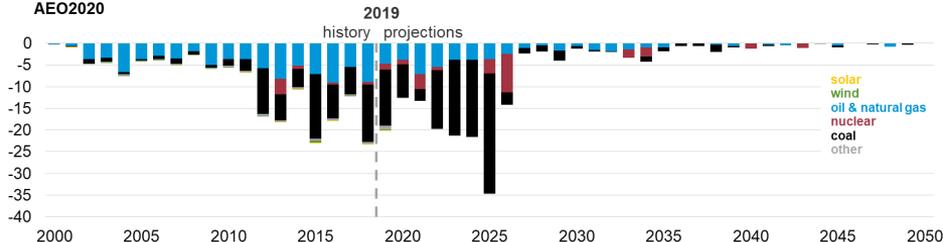
Electricity generating capacity additions, AEO2020
gigawatt



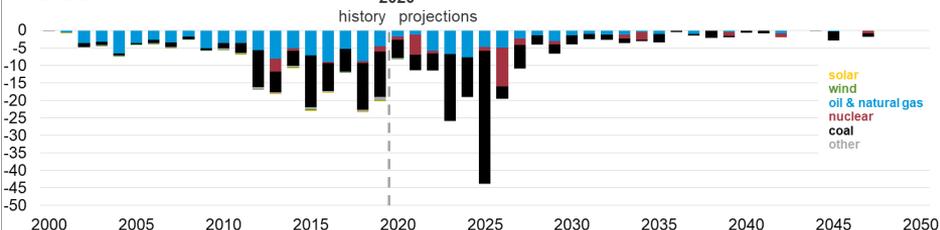
Electricity generating capacity additions, AEO2021
gigawatt



Electricity generating capacity retirements, AEO2020



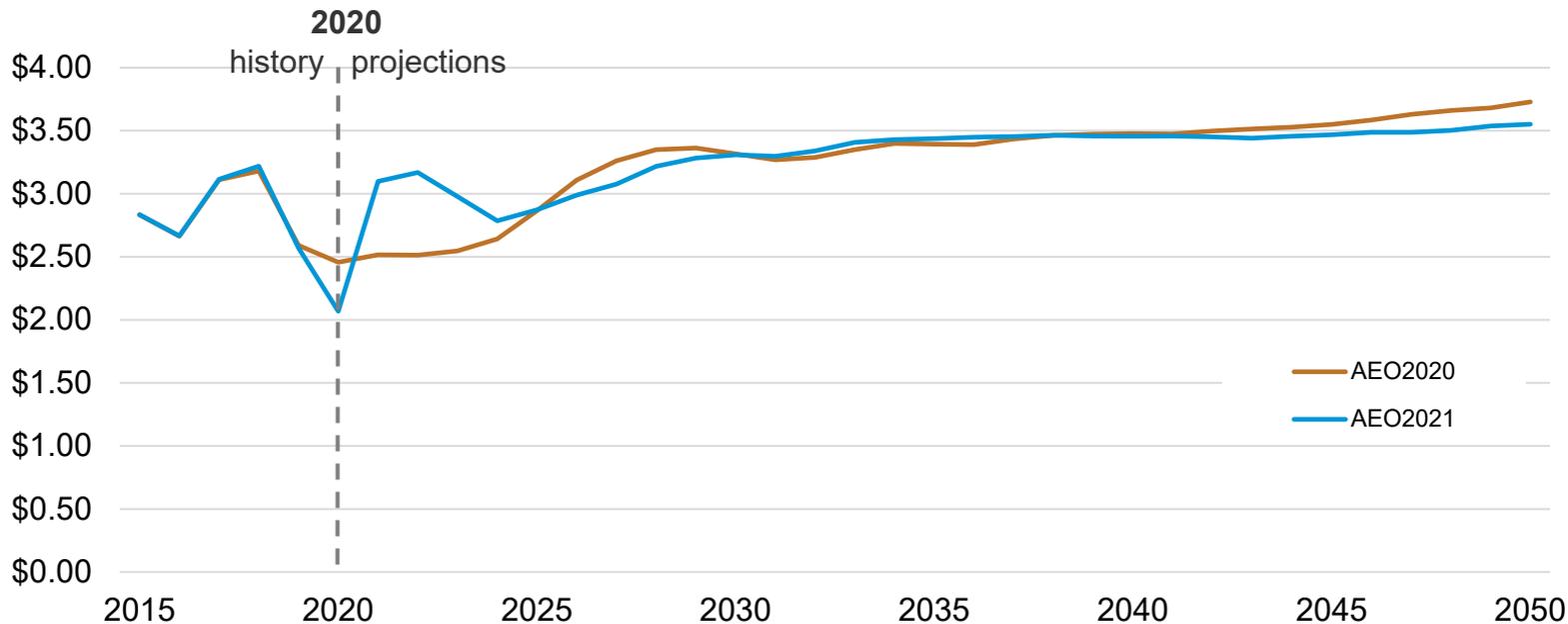
Electricity generating capacity retirements, AEO2021



Source: ref2020.1121a, ref2021.1018a

Natural gas prices continue to trend lower over the long term

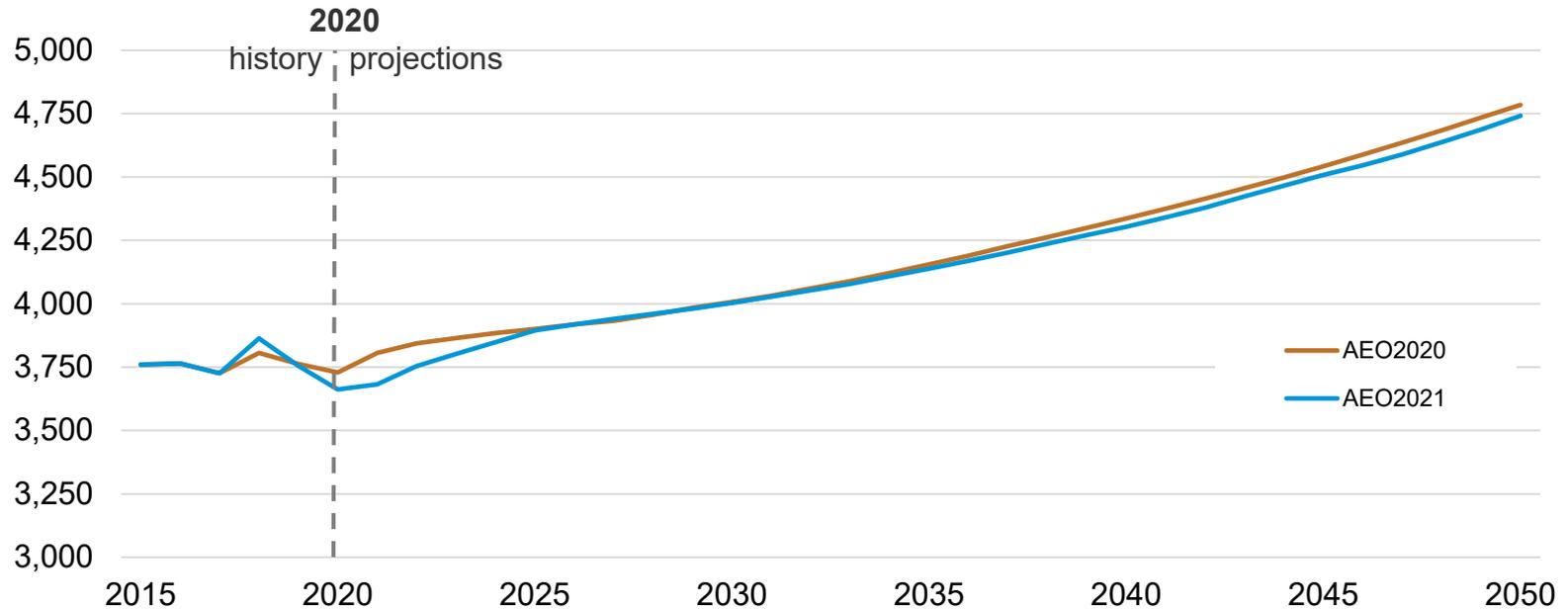
Natural Gas: Henry Hub spot price
2019\$ per million British thermal units (MMBtu)



Source: ref2020.1121a, ref2021.1018a

Total electricity sales

Total electricity sales
billion kilowatthours (kWh)



Source: ref2020.1121a, ref2021.1018a

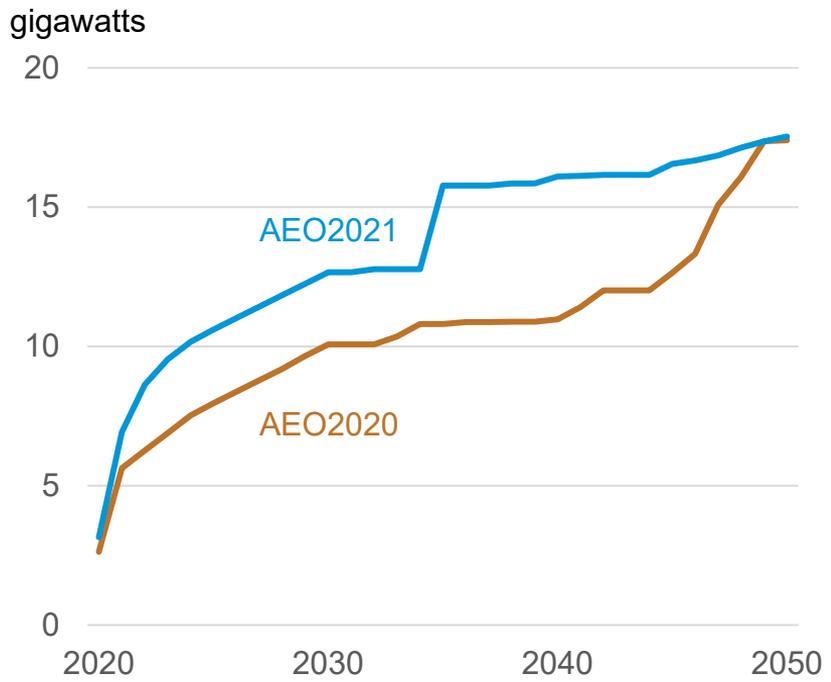
Photovoltaic-battery storage hybrid technology option

EIA Has Introduced a Solar Photovoltaic-Battery Storage Hybrid System as an Option for Capacity Expansion

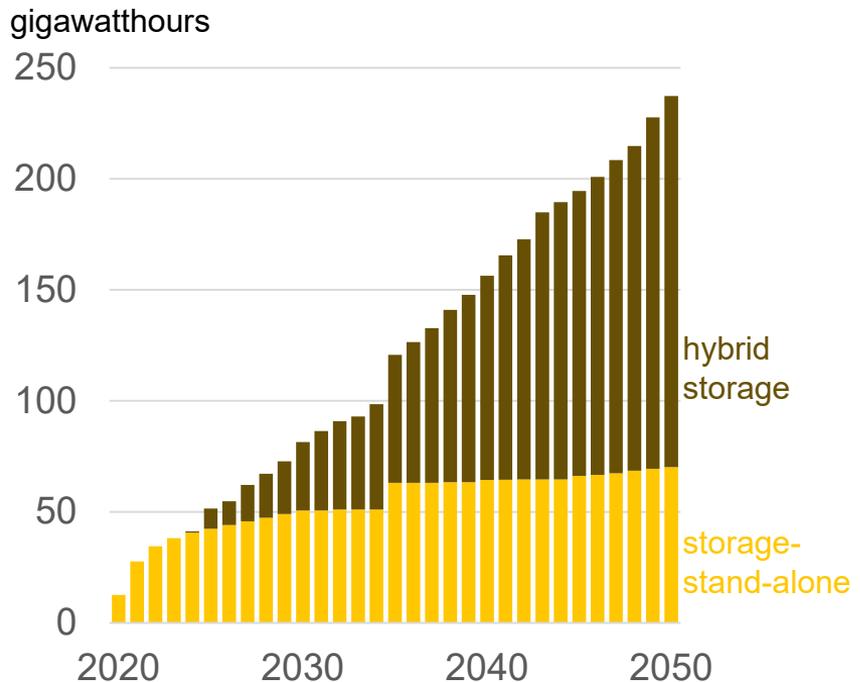
- Direct current (DC) plus 150 megawatts of PV plus a 50-megawatt storage system with a four-hour duration
- Receives full investment tax credit (ITC)
- Only generates value through energy and capacity markets, like stand alone storage
- Forced to dispatch to a predetermined daily pattern that optimizes production during high-value periods in each region
 - Dispatch pattern is not sensitive to model pricing and demand changes
 - We determined high value periods by the later year results from running the REStore model in a high renewable penetration scenario. We then fed these results were then fed into National Renewable Energy Laboratory's (NREL) System Advisory Model (SAM) to generate the dispatch patterns in each region

Adding hybrid systems results in less endogenous stand-alone storage, but significantly higher amounts of projected total storage capacity

Stand alone storage power capacity additions



Total storage (energy) capacity additions (2020)

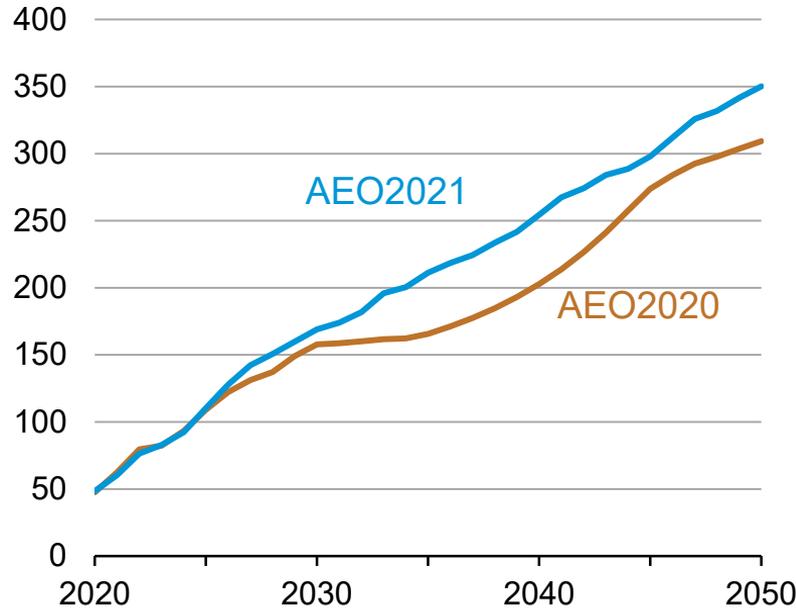


Source: ref2020.1121a, ref2021.1013a

Preliminary results indicate hybrid systems displace some standalone PV systems, but expands the total market reach

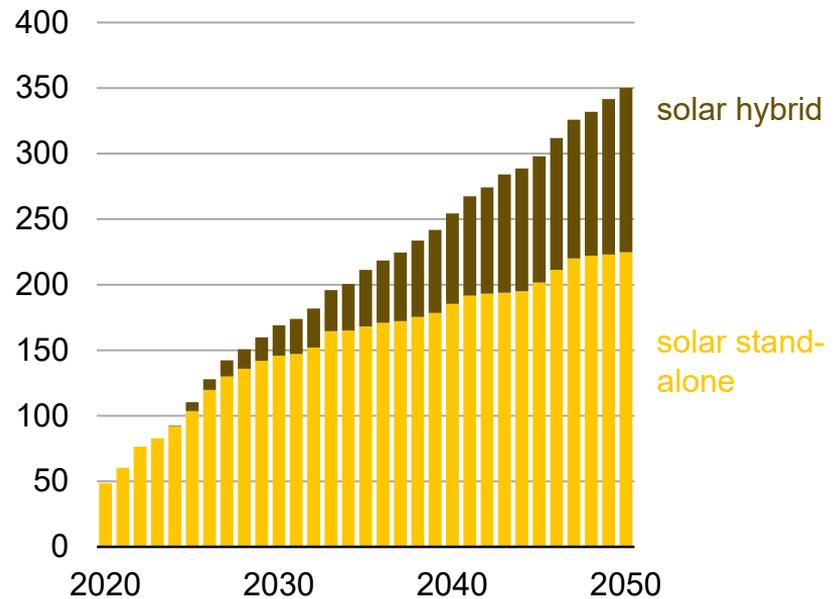
Total power sector solar capacity additions

gigawatts



Solar capacity additions by type (2020–50)

gigawatts

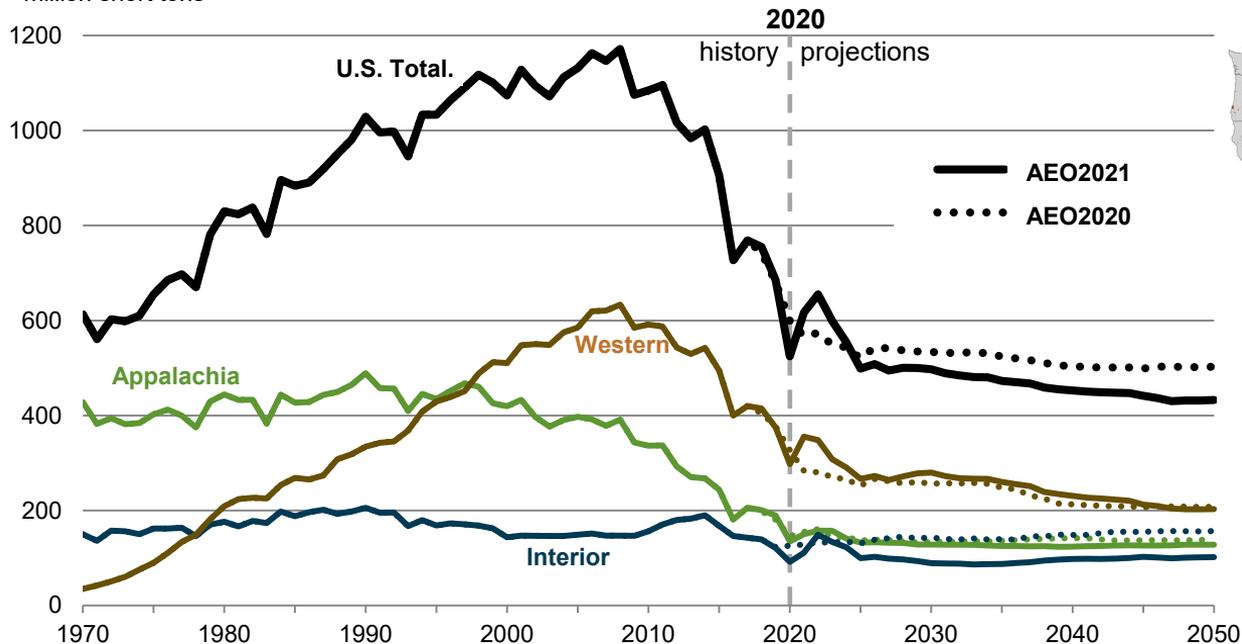


Source: ref2020.1121a, ref2021.1013a

Coal production and export

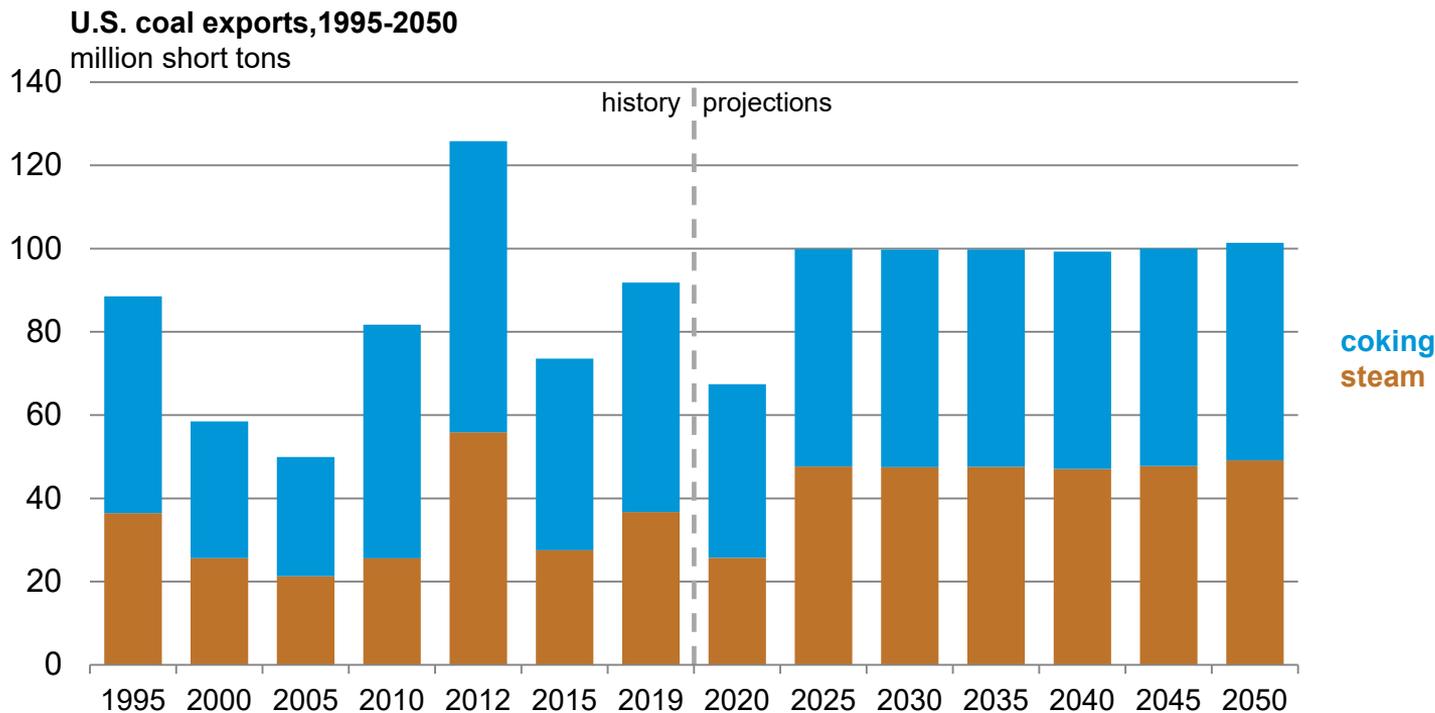
Coal Production by Region, 1970-2050

Regional coal production, 1970-2050
million short tons



Source: ref2020..112120a, ref2021.101820a *2020 - 2021 data are estimated based on the Short-Term Energy Outlook forecasts

U.S. Coal Exports are Expected to Recover Only Gradually Through 2050



Source: ref2021.101820a *2020 data are based on the Short-Term Energy Outlook forecast

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For More Information

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Annual Energy Outlook | www.eia.gov/aeo

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

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U.S. Energy Mapping System

