



Generation and Storage Capacity Update

June 2020

The goal of the Generation and Storage Capacity Update is to provide information about the U.S. electric industry's generation capacity, additions, and retirements, as well as energy storage installed capacity, and to discuss other new developments that affect electric generation power plants. This document offers highlights from 2010-2019 and focuses on generation capacity additions and retirements in 2019.

TREND HIGHLIGHTS

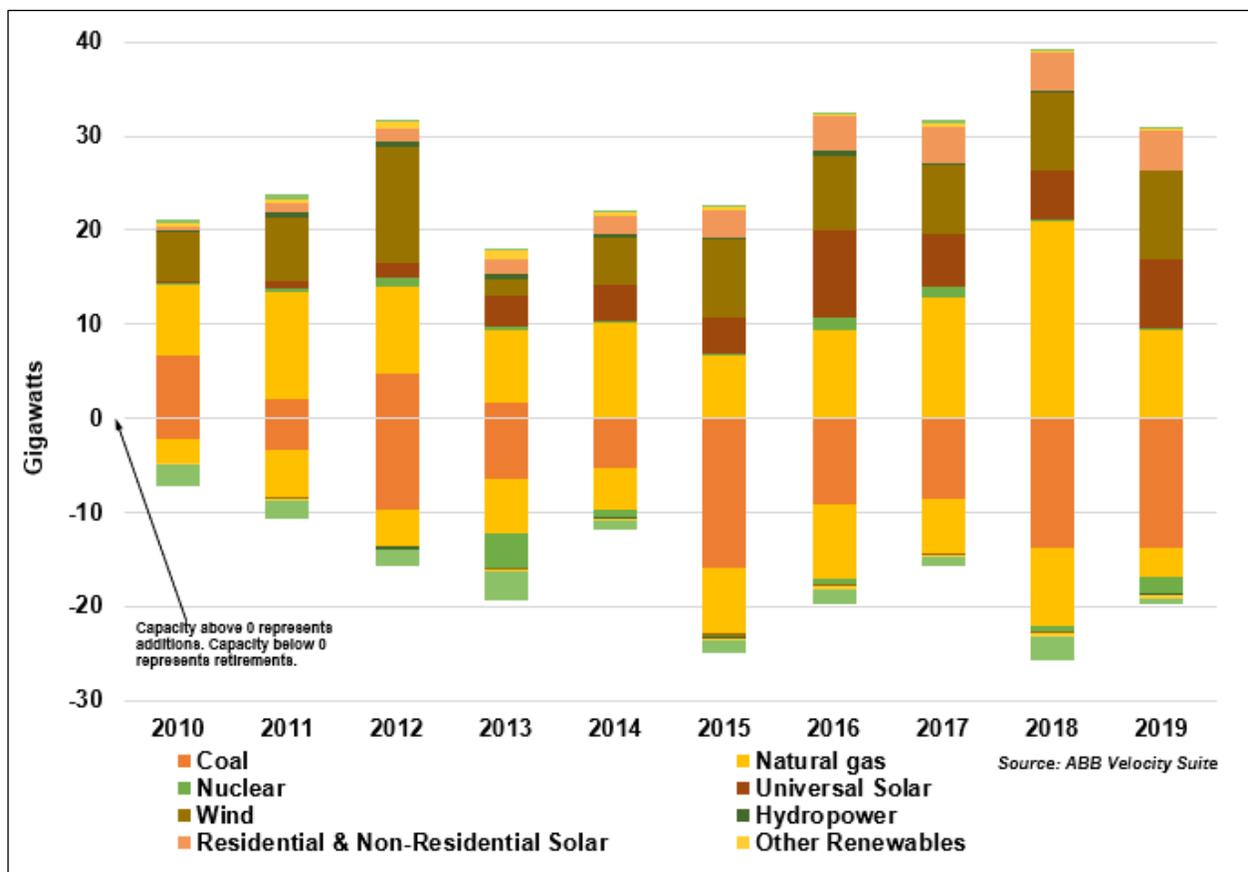
- **Natural gas** comprised 38 percent – most of the total capacity additions from 2010 to 2019. Added wind capacity contributed the second largest amount – 72.2 gigawatts (GW) or 26 percent of total capacity added in the last decade.
- 2019 marked the first year in which annual wind capacity additions exceeded annual natural gas capacity additions. In 2019, annual wind additions were 9.4 GW, or 31 percent of total annual additions, and were 141 megawatts (MW) greater than natural gas additions at 9.3 GW, or 30 percent of total annual additions.
- In 2019, solar, wind, and hydropower capacity comprised 276 GW, or 22 percent of total installed capacity – and, together, the capacity of the three categories surpassed coal's capacity of 252 GW, or 20 percent of the total.
- Offshore wind is a segment of the renewables' industry to watch. Between 2020-2025, 21.6 GW of offshore wind capacity is expected to come online, or 19 percent of announced capacity additions.
- Installed solar capacity from 2010-2019 saw astounding growth from a cumulative 2.3 GW installed in 2010 to 68 GW in 2019. By 2025, Wood Mackenzie expects solar installed capacity to more than double from 2019 levels to 169.4 GW.
- Universal (or large-scale) solar is the underlying driver of solar installations. In 2019, universal solar represented 63 percent of total installed solar capacity for the year. Non-residential sector (i.e., C&I customer) installations contributed 18 percent of the total, and residential solar capacity was at 20 percent of the total solar installed that year. Wood Mackenzie forecasts that universal solar capacity will be the driving force of solar capacity growth into 2025, increasing to 69 percent of the cumulative total solar capacity installed.
- Coal capacity led retirements during the past decade at approximately 88.5 GW, or 52 percent of total retirements.
- Grid flexibility is being supported by natural gas capacity and various types of energy storage. Electric companies own, procure, or utilize 97 percent of all energy storage in the United States and 73 percent of energy storage deployed since 2013. In the past seven years, deployed battery storage capacity has increased eightfold, from just under 200 MW in 2013 to 1,597 MW in 2019. Between 2020-2025, 14.6 GW of pumped hydro capacity additions alone are expected to come online.

IN-DEPTH ANALYSIS

Additions

- Figure 1 shows 2019 additions were down from 2018 but on par with 2017, with 31 GW or 11 percent of the decade’s total capacity being added. Coincidentally, 2019 retirements also comprised 19.7 GW or 11 percent of total retired capacity of the decade.
- 2019 marked the first year in which annual wind capacity additions exceeded annual natural gas capacity additions. In 2019, annual wind additions were 9.4 GW, or 31 percent of total annual additions, 141 MW more than natural gas additions, which were at 9.3 GW or 30 percent of total annual additions.

Figure 1: Annual Capacity Additions and Retirements 2010-2019



- In 2019, solar capacity additions of both universal and distributed generation solar amounted to 11.5 GW or 37 percent of total capacity installed that year. Universal solar capacity additions comprised 23 percent of total capacity additions in 2019 and led solar additions with 63 percent of all solar capacity additions in 2019.
- From 2010-2019, 15.6 GW of coal-based generating capacity was added – only 6 percent of total added capacity for the decade, driven by rerates and expansions. In 2019, only 62 MW of coal capacity was added, all of it through rerates of existing facilities.

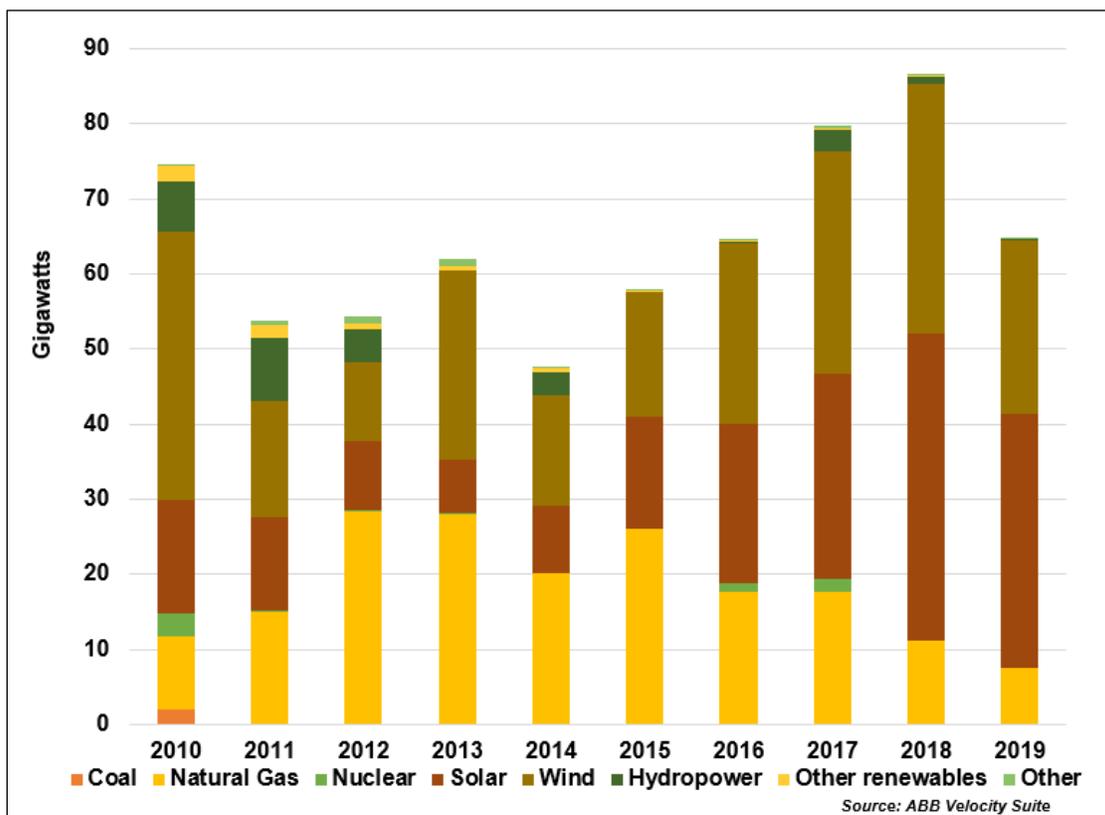
Retirements

- Coal capacity retirements comprised the largest portion – 88.5 GW or 52 percent of total retirements, and the coal fleet shrunk by 27 percent during the last decade. Natural gas retirements came in second at approximately 53.6 GW, or 31 percent of total retirements for the decade. Wind and solar saw minimal retirements – only 93 MW of universal solar and 819 MW of wind were retired. Only 7,225 MW, or 4 percent, of nuclear, and 1,528 MW, or 1 percent, of hydropower generation were retired during the decade.

Announcements of New Capacity

- During the last decade, electric company announcements for new capacity were comprised primarily of natural gas, wind, and solar. Note that not every project that is announced is built, but it is a good indicator of capacity trends. Therefore, we use it in our analysis to demonstrate how the electric generation fleet evolves over time.
- Renewables – wind and solar – were the leaders in announced capacity, with natural gas coming in third by GW of announced capacity. Figure 2 shows 2019 capacity announcements amounted to 64.7 GW, or 10 percent, of the 646 GW of total capacity announced from 2010-2019, about 3 percent less than in 2018 when the largest amount of new capacity was announced in the decade.
- In 2019, solar capacity additions led at 52 percent of total for the year, wind was second at 36 percent, and natural gas third at 11 percent of the year’s total.

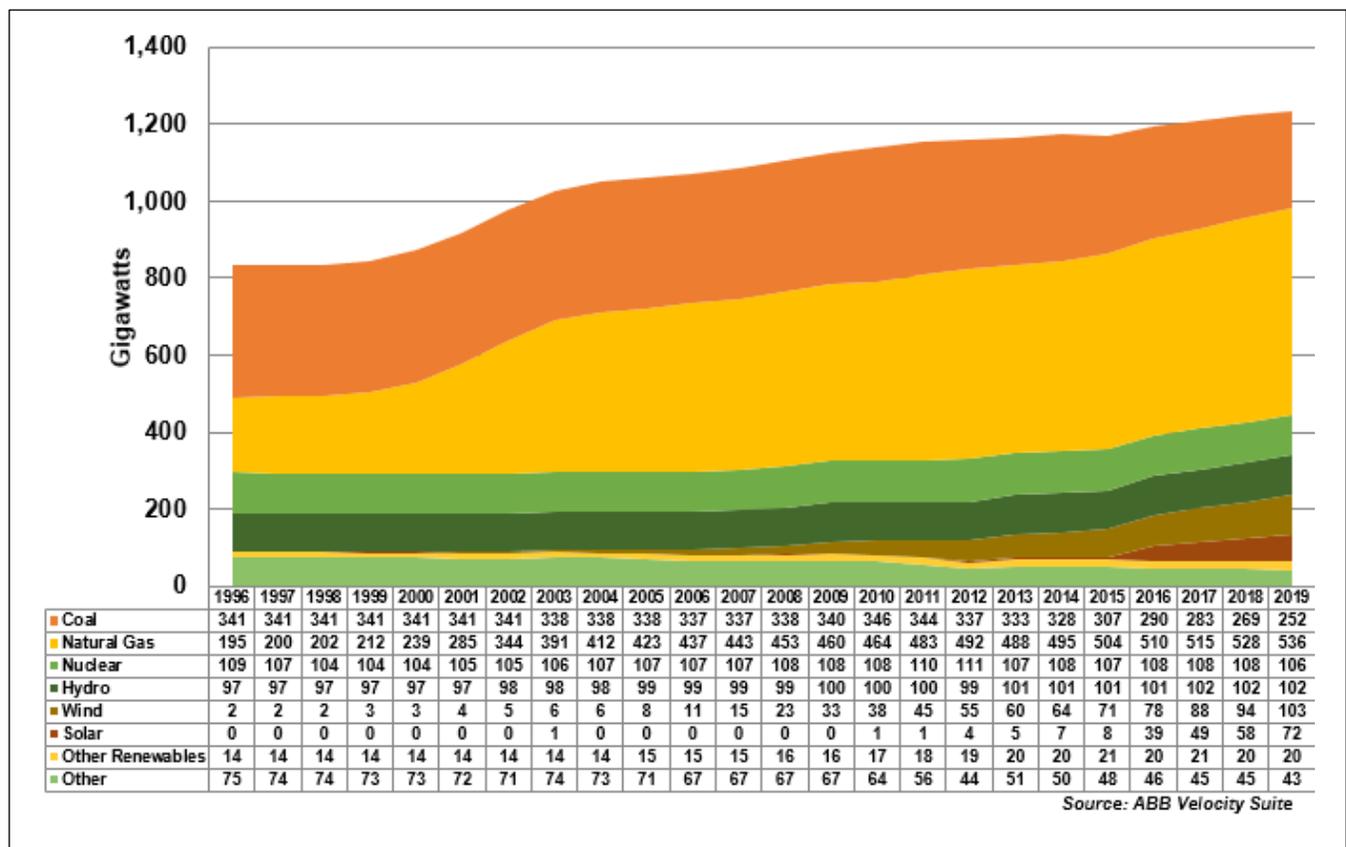
Figure 2: Announcements of New Capacity 2010-2019



Installed Capacity

- Figure 3 shows that at the end of 2019, cumulative installed capacity of the U.S. generation fleet was 1,234 GW, up from 832 GW in 1996. During the last 23 years, coal ceded its dominance to natural gas, decreasing 26 percent from 341 GW in 1996 to 252 GW in 2019, while the natural gas portion of installed operational capacity increased 20 percentage points to 536 GW.
- In 2019, natural gas dominated electric generating capacity at 536 GW, or 43 percent of the total, while coal comprised 252 GW, or 20 percent of the total. Nuclear capacity comprised 106 GW, or 9 percent of the total while both wind and hydro capacity were 8 percent of the total. Solar trailed with 6 percent, and other renewables, as well as other fuels, represented the remaining 5 percent.
- In 2019, solar, wind, and hydropower capacity comprised 276 GW, or 22 percent, of total installed capacity – and have together surpassed coal’s capacity of 252 GW, or 20 percent of the total.

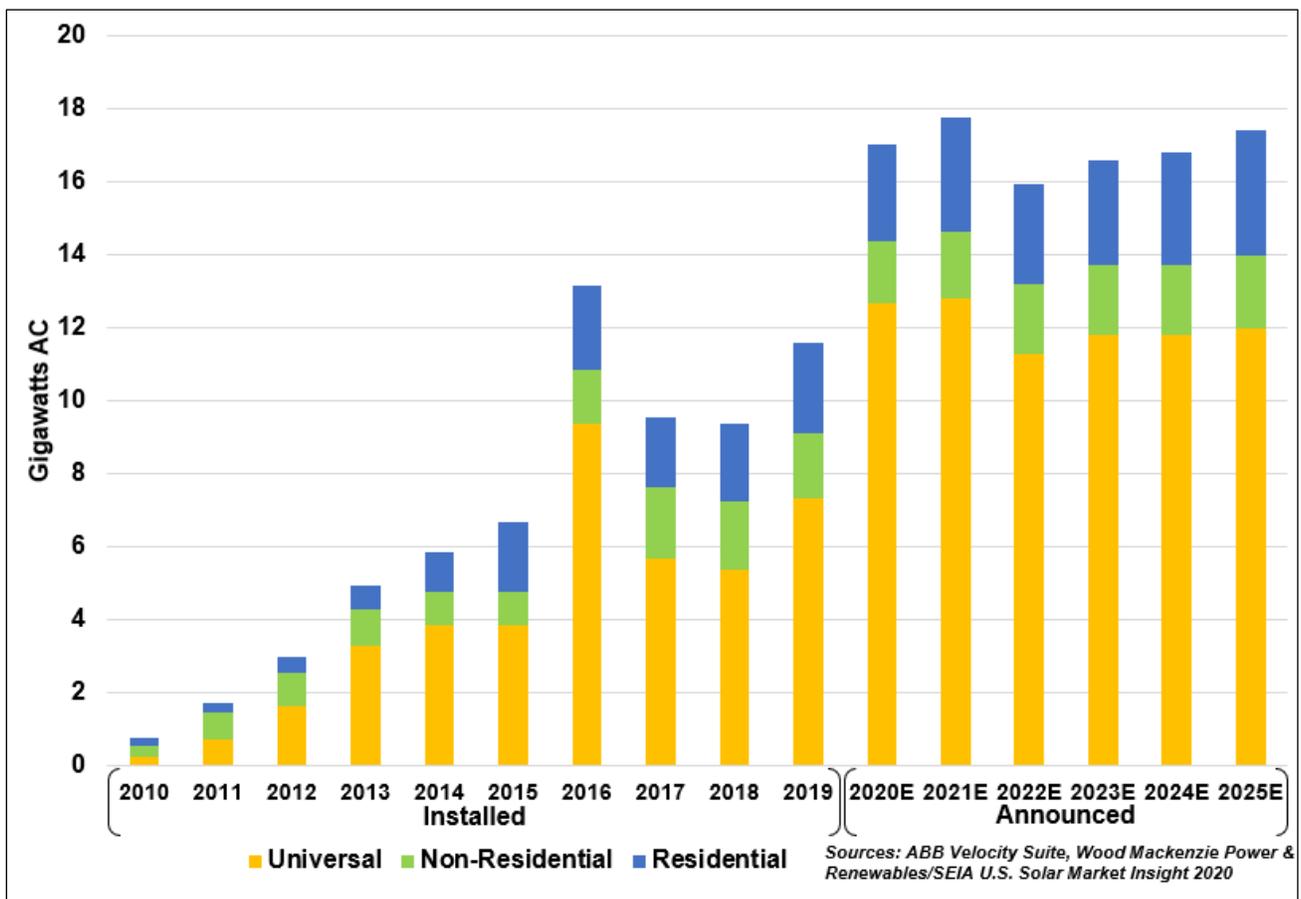
Figure 3: Cumulative Installed Operational Capacity 1996-2019



Annual Solar Capacity Additions

- According to SEIA/Wood Mackenzie data, installed solar capacity saw astounding growth from 2010-2019, from a cumulative 2.3 GW in 2010 to a total of 68 GW installed in 2019. By 2025, Wood Mackenzie expects solar installed capacity to more than double from 2019 levels to 169.4 GW.
- Figure 4 shows that, in 2019, universal solar’s cumulative contribution was 61 percent of total installed solar capacity, the non-residential sector contributed 18 percent of the total, and residential solar capacity was 20 percent of the total.
- Wood Mackenzie forecasts that universal solar capacity will be the driving force into 2025, increasing to 67 percent of the cumulative total solar capacity, while non-residential capacity is expected to drop to 14 percent, and residential will drop just one percent to 19 percent of the total solar capacity installed.
- Annual solar capacity additions are expected to range from 17 to 17.8 GW between 2020-2025. Universal solar will lead installations at between 69-74 percent annually.

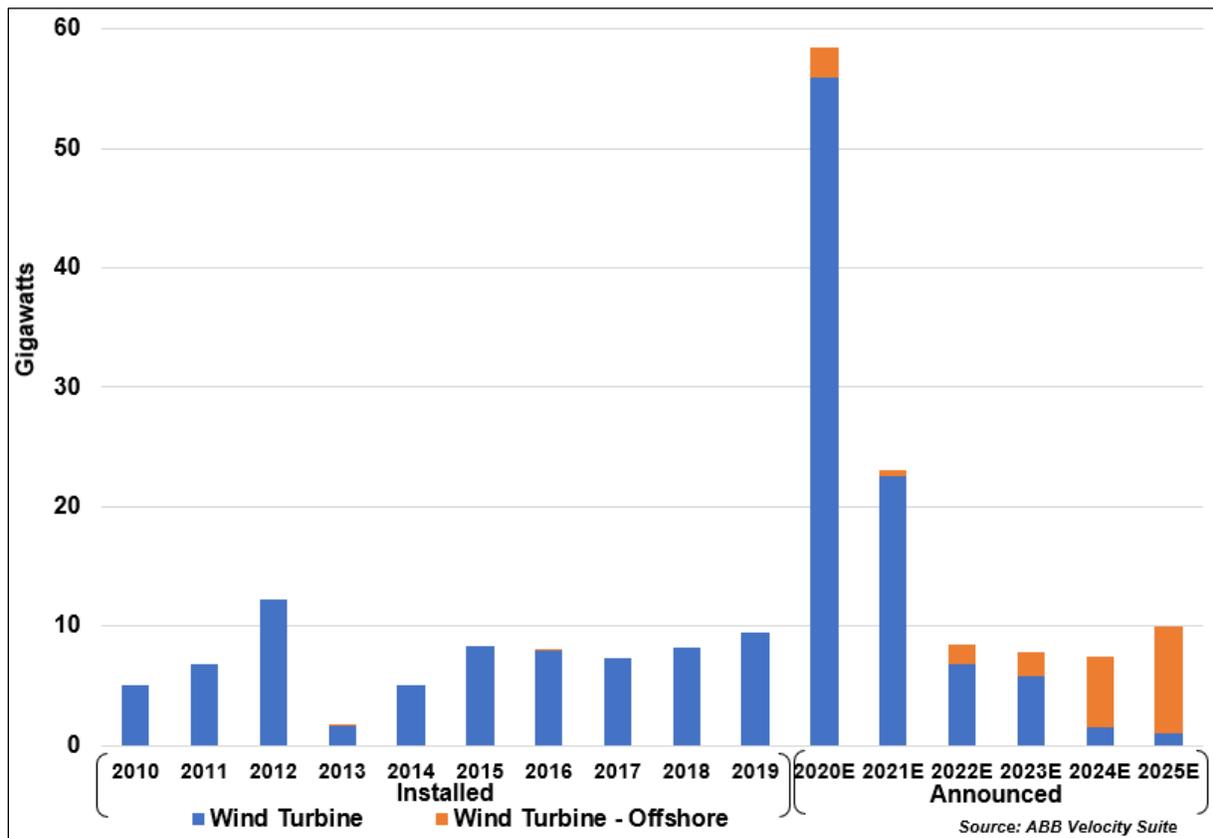
Figure 4: Annual Solar Capacity Additions 2010-2025



Annual Wind Capacity Additions

- Figure 5 shows that, from 2010-2019, approximately 72.2 GW of wind capacity was added in the United States.
- The first offshore wind farm, totaling 30 MW capacity, was installed off of Block Island, Rhode Island, in 2016, paving the way for growth in offshore wind capacity.
- Approximately 115.4 GW – twice as much as was installed from 2010-2019 – are in the wind project pipeline, with online dates between 2020-2025. In 2020, a spike in wind capacity additions is expected from approximately 56 GW of onshore projects, with 49 GW, or 89 percent, comprised of new build in proposed, permitted, application pending, and under construction stages. The spike is likely attributable to the 2020 expiration of the Investment and Production Tax Credits for wind (note that due to the COVID-19 pandemic, in May 2020, the Internal Revenue Service extended the PTC to 2021 for wind projects that started construction in 2016 and 2017).
- Offshore wind is expected to contribute a sizeable portion of the growth through 2025, comprising 21.6 GW, or 19 percent of the wind capacity additions with online dates from 2020-2025.

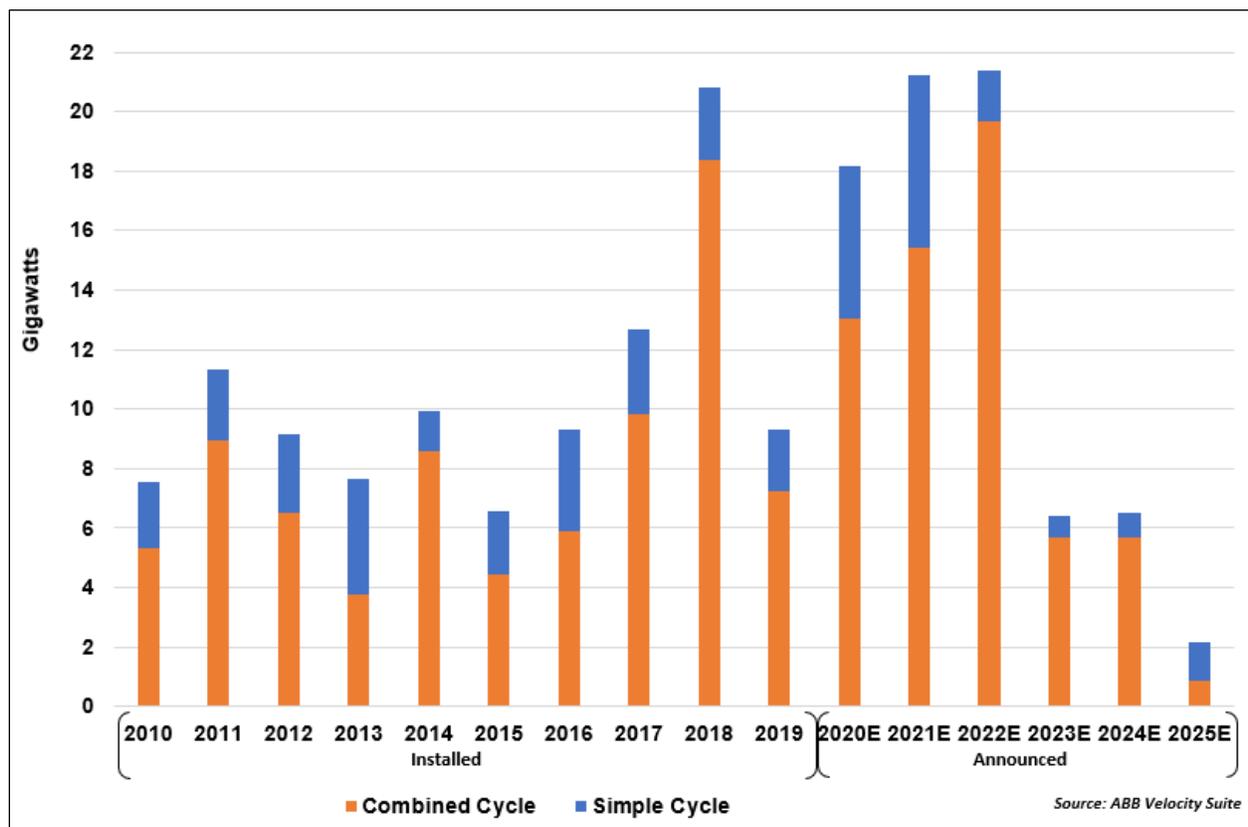
Figure 5: Annual Wind Capacity Additions 2010-2025



Annual Natural Gas Capacity Additions

- Approximately 104.5 GW of natural gas generation capacity was added from 2010-2019, with combined cycle contributing 78.9 GW, or 76 percent of total added gas capacity during the decade. Natural gas-powered simple cycle capacity of 25.4 GW, or 24 percent of total gas capacity was added during the decade. Gas-powered fuel cells comprised only 202 MW through new build or expansions at existing plants.
- Figure 6 shows that, between 2020-2025, natural gas capacity additions are projected to amount to 75.9 GW, or 72 percent of the capacity added from 2010-2019. Combined cycle natural gas capacity is expected to lead the additions with approximately 60.4 GW, or 80 percent of total natural gas due online by 2025. Simple cycle capacity will comprise 15.4 GW, or 20 percent of the total expected online from 2020-2025.

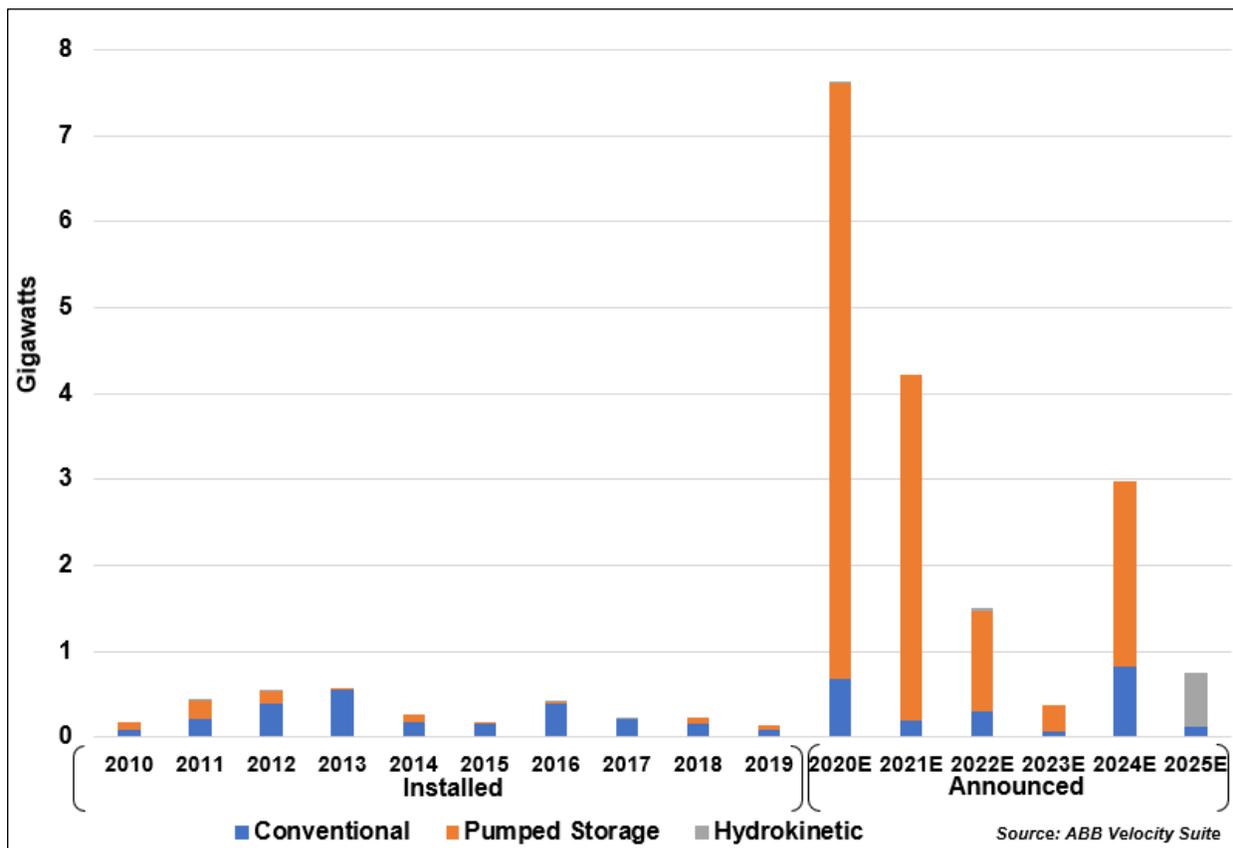
Figure 6: Natural Gas Capacity: Annual Installed 2010-2019 and Announced 2020-2025



Annual Hydropower Capacity Additions

- From 2020-2025, the electric power industry plans to add approximately 17.4 GW of hydroelectric capacity, with 14.6 GW, or 84 percent of that being pumped hydro additions. This demonstrates increased interest by the industry to add flexible resources to the energy grid to help integrate increasing amounts of variable wind and solar generation.

**Figure 7: Hydropower Capacity: Annual Installed 2010-2019
and Announced 2020-2025**

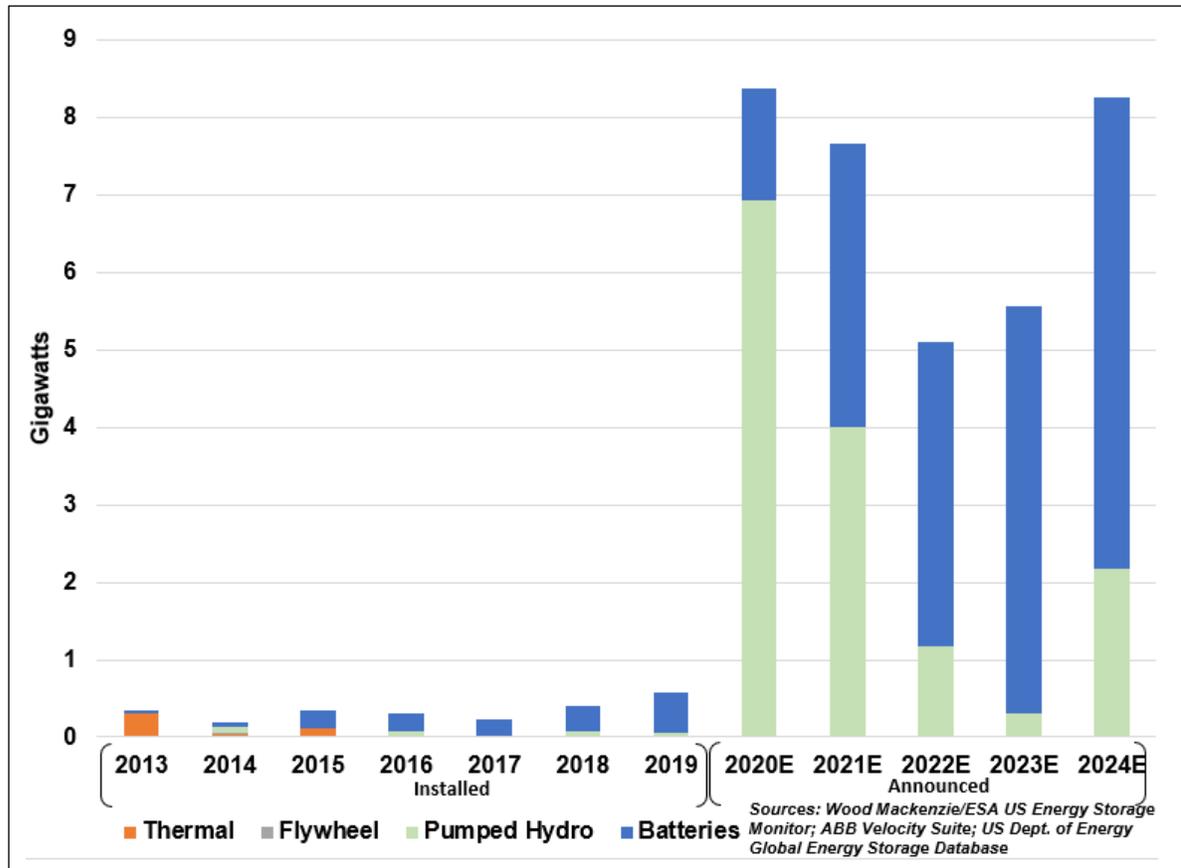


Annual Energy Storage Additions

- Electric companies own, procure, or utilize 97 percent of all energy storage in the United States and 73 percent of energy storage deployed since 2013.
- Pumped storage hydropower comprises 89 percent of all installed storage capacity. Meanwhile, battery storage continues to be the most popular energy storage technology installed today and is responsible for driving the growth in energy storage deployment.
- Figure 8 shows that, in the past seven years, deployed battery storage capacity has increased eightfold, from just under 200 MW in 2013 to 1,597 MW in 2019.
- Wood Mackenzie forecasts that, by 2025, total installed battery storage capacity will increase eleven-fold compared to 2019, to 7,317 MW.
- There are approximately 14.6 GW of planned pumped storage hydropower capacity additions in the pipeline for online years 2020-2025. If all these projects are built, the pumped storage hydropower capacity will double the amount built from 2010-2019.
- Of the total planned pumped storage hydropower capacity additions, approximately 8.7 GW of pumped storage hydropower is expected in the Western Energy Coordinating Council (WECC) region. New build in WECC comprises 7.7 GW, or 88 percent of the planned pumped storage hydropower in the region through 2025. The second largest portion of approximately 3.2 GW of

the planned new build pumped storage hydropower capacity through 2025 will be in Pennsylvania.

Figure 8: Annual Energy Storage Additions, 2010-2025



- The other notable pumped storage hydropower additions from 2020-2025 include 1,500 MW of new build by New Summit Hydro in Ohio expected online in 2021, and 600 MW of new build by Nevada Hydro in Arkansas by 2022. Approximately 230 MW are expected from rerates at Duke’s Bad Creek Pumped hydro station in South Carolina, and Emera is adding 66 MW through a rerate of its Bear Swamp station in Massachusetts in 2020-2021.

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