A sustainable future for the global power industry

SUMMARY
North America Power Reference Case
Spring 2020

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– North America Power Reference Case

A sustainable future for the global power industry

There is no frame of reference for the current economic downturn driven by COVID-19, but we know that it has an extreme impact on healthcare, heightened risks of commercial inactivity in many parts of the economy, along with supply chain disruptions. Emergency support packages, monetary stimulus, as well as successful measures taken to contain the spread of the virus, should reduce the economic impacts.

The unprecedented shock driven by COVID-19, as well as the extraordinary uncertainty, are stressing the global energy sector, and particularly the oil and gas industry, in ways not seen before. The consequences of social distancing and stay-at-home orders have had enormous impacts on energy demand, especially oil.

Almost simultaneously, an oil price war erupted between Saudi Arabia and Russia in early March, which fanned the deep uncertainty and further complicated the oil market. Saudi Arabia and Russia reached a tentative agreement in early April to cut OPEC+ production. However, this agreement alone will not be enough to balance the market in the coming months and further declines in price are likely until additional production cuts are made, likely through a combination of market forces and the potential extension of OPEC+ agreements.

Despite the volatility brought on by recent unforeseen events, the North American energy market – and the world in general – continued its march toward greater integration of renewable generation, which is expected to steadily increase as coal plants are taken offline and renewables construction costs drop.

This summary is based on the Energy Market Advisors' (EMA) spring 2020 North America Power Reference Case (S20) release. The Power Reference Case is a 25-year forecast (2020 through 2044) focused on the North American market. EMA also produces Power Reference Case reports that cover other regions of the world. Highlights from two of those areas, Europe and Japan, are included at the end of this document.

Jump to highlights for Europe and Japan

North American market summary

Driven by declining capital costs and a plethora of state, utility, and corporate clean-energy goals, solar, wind, natural gas and energy storage are expected to dominate investment in the power generation space across North America (NAM) over the next 25 years. Several key factors that currently influence NAM power markets include:

- the continuing evolution of the resource mix
- the impact of COVID-19 and oil price shock on electricity demand
- the pipeline of renewable projects, including the growing competition between wind and solar resources
- technology improvements
- favorable clean energy policies
- the availability of low-cost natural gas

Additional market fundamentals are considered including changes in load growth, state and federal policies, fuel prices, environmental policies, and scheduled plant additions and closures.

Key findings

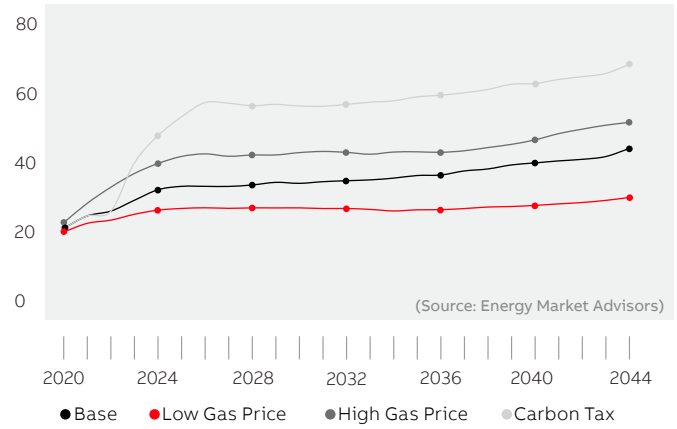
For the short term, electric demand is expected to be suppressed due to a high penetration of behind-the-meter distributed solar power resources, energy efficiency gains, and the global economic slowdown. The S20 forecast indicates an economic rebound that starts modestly in 2021 but doesn't reach full recovery until 2023.

The continued closure of coal-fueled power plants, lower natural gas prices and declining cost of renewable resources opens the door for continued growth in natural gas, wind, and solar capacity. Over the forecast period, 107 gigawatts (GW) of coal generation is anticipated to be shut down. Over 37 GW of the shutdowns will be based on economics alone, as renewable generation becomes more competitive.

Scenario analysis

The price of natural gas is the key driver of electricity prices in the United States. The S20 forecast studied four scenarios: a base case using current natural gas pricing trends, scenarios for low and high natural gas prices, and the carbon tax scenario with the influence on power prices if a federal "carbon tax" is introduced. All scenarios considered the effects of the COVID-19 pandemic. The S20 base forecast for Henry Hub (HH) is for prices to stay under $4/MMBtu until the early 2030's, making natural gas an attractive long-term power generation fuel.

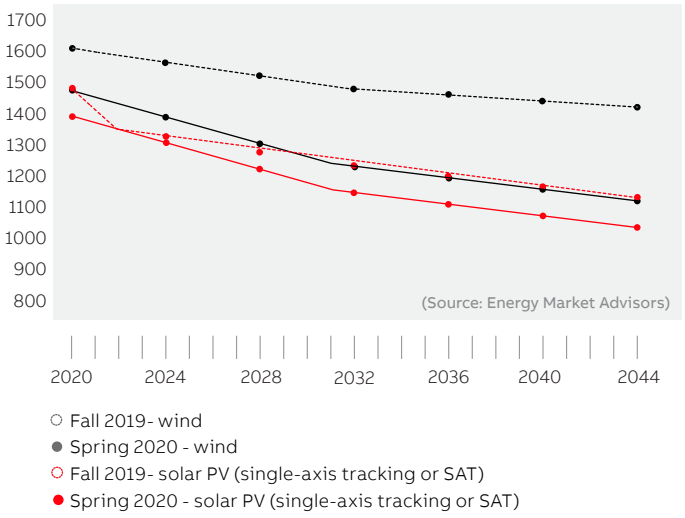
US all hours power prices (2020$/MWh)



S20 release considerations

Significant changes between the fall 2019 (F19) report and the S20 report include a reduction in solar PV construction costs of 5% for fixed and 13% for single-axis tracking technologies over the study period. For onshore wind, construction costs are anticipated to be 13% lower in 2044 with the assumption that costs will decline at 2% year-on-year through 2030 and then 1% per year thereafter. The following figure compares EMA's wind and solar capital costs between the F19 and S20 release.

Wind and solar capital costs forecast (2020$/kW)

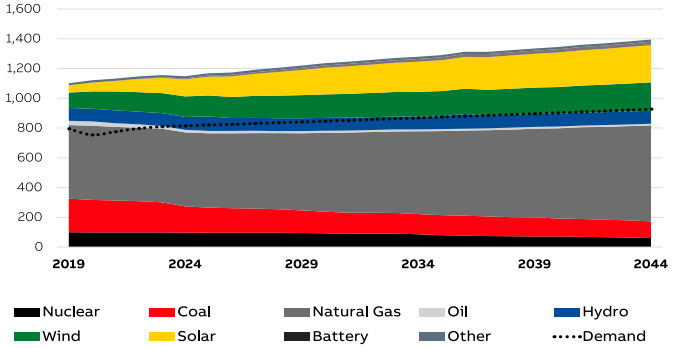


The 2020 capital cost estimate for a four-hour, 100 MW lithium-ion battery storage system is expected to decline by about 4.5% while efficiency remains the same at 87.4%. With declining capital costs and other operating parameters considered, the S20 report forecasts battery storage to expand from around 7.9 GW in 2025 to roughly 21 GW in 2040.

Capacity build and generation forecast

Driven primarily by declining cost curves and state, local, utility, and corporate clean-energy goals, most new capacity construction (over 60% by 2044) in North America will be solar and wind. Natural gas, which will continue to dominate capacity and generation volumes, will account for most of the rest of the new capacity additions (about 34% by 2044). Solar capacity is expected to grow more than 4x, from 60 GW in 2020 to about 250 GW in 2044, with the largest gain in the Midwest and Western Electricity Coordinating Council (WECC) regions. Wind is expected to reach 191 GW by 2044; in 2020, operating wind farms total about 115 GW. Considering the decline in coal capacity from about 218 GW operating today to only 111 GW by 2044, the natural gas fleet is expected to continue to grow, from 499 GW in 2020 to 646 GW in 2044.

Installed generating capacity and demand forecast (GW) - United States and Canada



(Source: Energy Market Advisors)

Electricity production has shifted dramatically during the past decade. As recently as 2010, coal contributed 1,915 terawatt-hours (TWh) accounting for about 44% of all generation. This year, coal is expected to contribute 646 TWh or about 17% to the power generation mix.

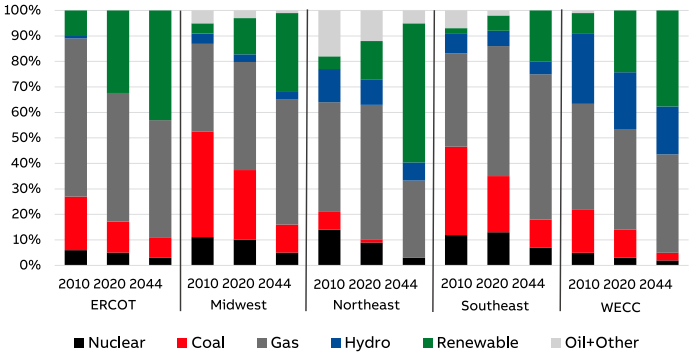
Natural gas is by far the dominant energy resource, accounting for about 41% (1,560 TWh) of the energy fuel mix in 2020. With unprecedented low gas prices and adequate future supply, natural gas is expected to remain the largest power supply source in 2044, contributing over 43% (2,089 TWh), while solar, wind and other renewable resources more than double from 517 TWh in 2020 to over 1,221 TWh – that's an increase in power contribution from approximately 14% to over 25%.

Regional dynamics

The 2020 load growth is expected to be about 5% lower on average across all regions compared to pre-economic downturn forecasts but is expected to rebound beginning in 2021. Overall, the annual growth rate in the peak-demand is 0.86% over the 25-year forecast. The one notable exception is the ERCOT (Texas) region where load growth, driven by industrial expansion and population increases, is expected to be moderate (1.35%) over the period.

Regionally, the jump in non-hydro renewables, primarily wind and solar is significant. Only in the Midwest do we see a marked increase in natural gas generation.

United States and Canada, operating capacity forecast by year, by fuel (percentage within region)



(Source: Energy Market Advisors)

Electric Reliability Council of Texas (ERCOT). The fuel mix from renewables, primarily wind capacity, will grow from about 32% today to 43% by 2044 – about the same level that natural gas is expected to contribute (46%).

Midwest. Over the study period, generating capacity from renewables will more than double to reach 31% and natural gas will grow from 42% to 49%.

Northeast. The majority of coal-fueled power plants have shuttered, and the New York NO_x Peaker Rule will result in closure of up to 650 MW of natural gas and oil burning power plants by 2025. By 2044, renewable resources are expected to account for roughly 54% of all operating capacity with natural gas shrinking to 30%.

Southeast. By 2044, natural gas is expected to expand from about 51% to 57% while renewables triple in contribution, reaching roughly 20% of the capacity portfolio. There are over 12 GW of announced retirements across the Southeast, including 9 GW of coal and 2.5 GW of older natural gas units.

WECC. By 2044, non-hydro renewables will represent about 38% of the capacity mix, while natural gas stays level, continuing to represent roughly 39% of generation supply. There are 18 GW of announced coal plant capacity expected to retire by 2044. The region is expected to build 11.5 GW of battery storage starting in 2022, with California accounting for nearly 80% (9 GW) of the new build out.

Conclusion

The long-term impacts of the economic downturn related to COVID-19 are unknown. While the short- and long-term demand impacts will affect the magnitude of future solar, wind, energy storage and natural gas capacity additions, the economics of renewable generation and storage will continue to improve relative to natural gas generation. The gains in battery storage, solar, wind and natural gas are expected to grow steadily while coal declines precipitously over the period along with nuclear retirements.

About Energy Market Advisors

Energy Market Advisors (EMA) is part of the Hitachi ABB Power Grids Energy Market Intelligence solutions group that provides tools and analysis to support investment decisions. This includes market and transmission modeling, price forecasting, regulatory compliance analysis, power and gas market trading, operations, and the integration of new resources.

Developed using powerful and proven modeling capabilities, the full North America Power Reference Case provides an assessment of trends in power, fuels, renewables and environmental markets. Most importantly, the report includes a long-term forecast based on market fundamentals covering demand and supply.

The forecast is based on data compiled by the widely used intelligence service, Velocity Suite, along with modeling from our proprietary capacity expansion model, and the long-established PROMOD production cost model.

For more information on Energy Market Advisors, https://bit.ly/PG-Energy-Market-Advisors.

To purchase the full report, please email us at info.pges@abb.com

International coverage

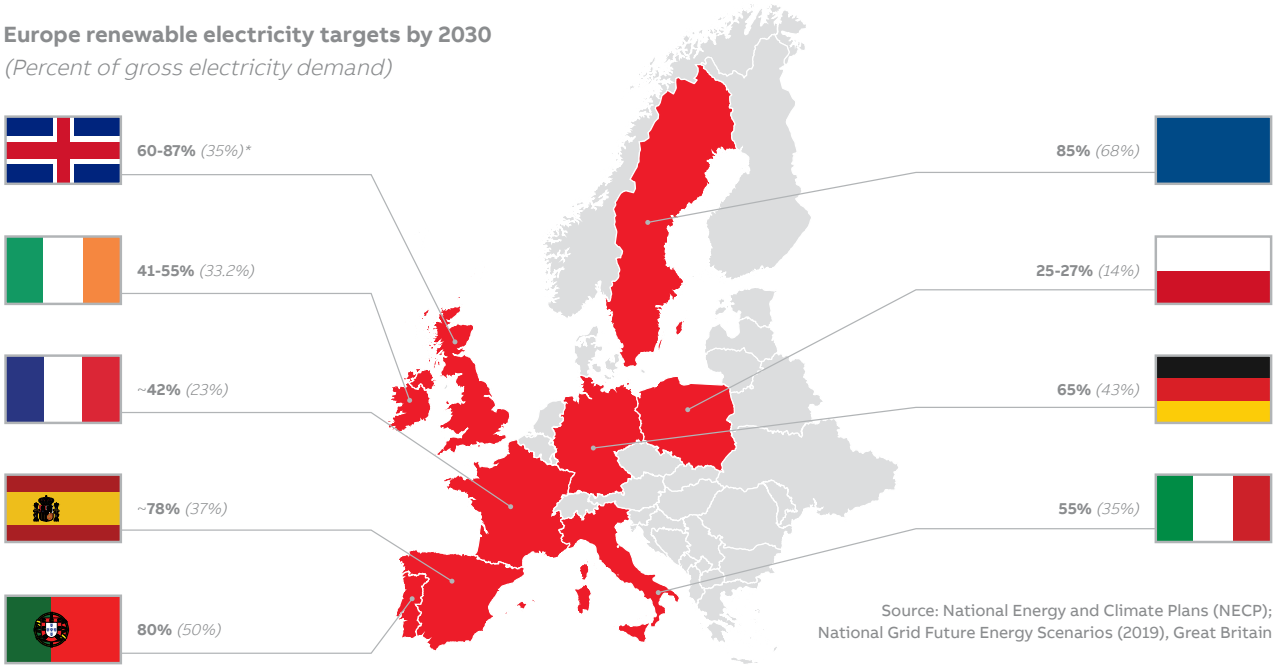
In addition to North America, Energy Markets Group provides analysis of other regions including Europe and Japan. Highlights from those regions are shown below.

European highlights

Europe continues to ensure that EU 2030 targets are met in greenhouse gas (GHG) emissions, renewable energy, energy efficiency, reliable energy supply, internal energy market, research, innovation and competitiveness. Germany is targeting a complete phase-out of coal by 2038. This represents about one-third of the coal and lignite plans in Europe. The figure below highlights some of the countries' 2030 renewable energy targets.

Europe renewable electricity targets by 2030

(Percent of gross electricity demand)



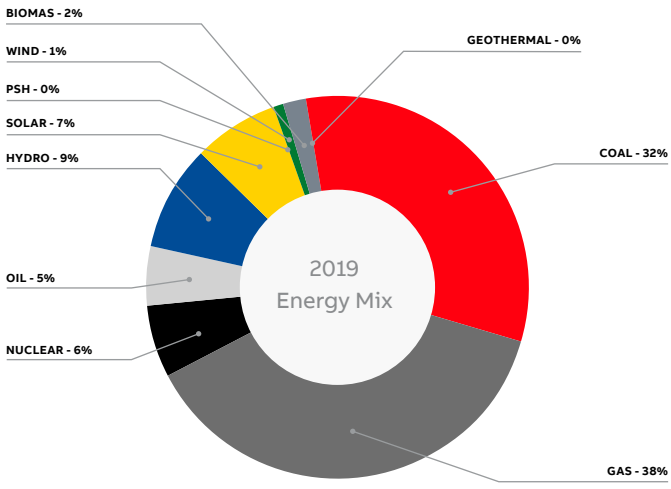
Source: National Energy and Climate Plans (NECP); National Grid Future Energy Scenarios (2019), Great Britain

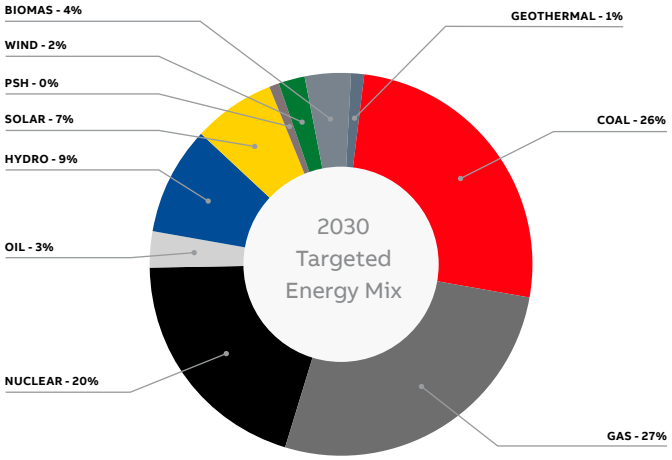
Japan highlights

Japan has multiple energy policy goals. It wants to increase its energy self-sufficiency ratio from 9.6% in 2017, to over 25% by 2030, while minimizing the impact on electricity rates. This will be accomplished by a renewable energy target of 24% in 2030, completing existing and developing new offshore wind farms, and, if possible, restarting all nuclear reactors. Japan is also targeting an emission reduction of 26% of 2013 levels by 2030 and an emission market is expected to start in 2021.

For additional detail on international markets, please contact us at: https://software.response.e.abb.com/EPM_Contactus_form

Japan 2019 actual and 2030 targeted energy mix





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