Electricity Matters

Paul A. DeCotis

Leadership and Deliberate Action

The bipartisan *Infrastructure Investment and Jobs Act* (IIJA), signed into law in 2021, includes as much as $65 billion in funding to support the private sector, municipalities, and states in modernizing energy infrastructure, including deploying clean energy at scale, reducing greenhouse gas (GHG) emissions, and creating clean energy jobs. The IIJA aligns well with states' policies and plans as they seek to generate 100 percent of electricity from clean energy resources within the next one to two decades. Plans vary by state, but the goals to decarbonize electric generation, and energy use in buildings and transportation are common among the most aggressive states.[1]

IIJA funding coupled with financial assistance from states through their own clean energy initiatives creates a once-in-a-generation market environment for industry and government to demonstrate leadership and deliberate action toward decarbonization. Regardless of one's belief in climate science and global warming, this funding is being provided to rebuild, repair, and construct new energy and transportation infrastructure to meet state and federal government clean energy and decarbonization goals.

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Specific IIJA opportunities include funding support for improving energy efficiency

[1] IIJA funding is broad and provides financial support for investments in improving and repairing roads and bridges ($110 billion), public transit modernization ($39 billion), passenger and freight rail modernization ($66 billion), ports and airports ($42 billion), clean drinking water infrastructure ($55 billion) and broadband upgrades ($65 billion). Nonetheless, this effort is intended to inform a City-wide and statewide response to prioritizing and coordinating receipt of federal funding to advance clean energy, climate, and social equity goals.

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*The author would like to thank Brandon Swartout and Emily Bablitch for their research support and validation of the data provided in this column.

and decarbonization by retrofitting buildings (including public schools and government buildings), modernizing the electric grid to deliver renewable energy and distributed energy resources, strengthening resilience against extreme weather, purchasing alternative fuel and electric vehicles (including school buses, taxis, ride-sharing vehicles, and ferries), updating building energy codes, and reconnecting neighborhoods and communities by removing barriers of legacy energy infrastructure. An additional round of funding and tax incentives for clean energy and environmental and social justice initiatives might possibly follow in 2022 if Congress finalizes a modified version of the Biden administration's "Build Back Better" reconciliation package. In either case, with or without additional congressional action, the IIJA funding is unprecedented.

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Twenty-three states and the District of Columbia have adopted GHG reduction targets and all but four of the 30 largest US electric utilities have set net-zero GHG emission targets for 2050 in line with states' and regulators' directives. California has a legislated goal of achieving 50 percent zero-emission electricity production by 2030, and 100 percent by 2045. Hawaii has a legislative mandate to become completely energy self-sustaining using 100 percent renewable energy sources by 2045 with a nearer-term goal of 70 percent by 2030. Illinois is considering legislation to mandate a clean energy goal of 100 percent by 2050, as is Minnesota. New York has targeted 2040 as the year in-state electricity production is to be generated 100 percent by clean energy sources, with 70 percent renewables by 2030.

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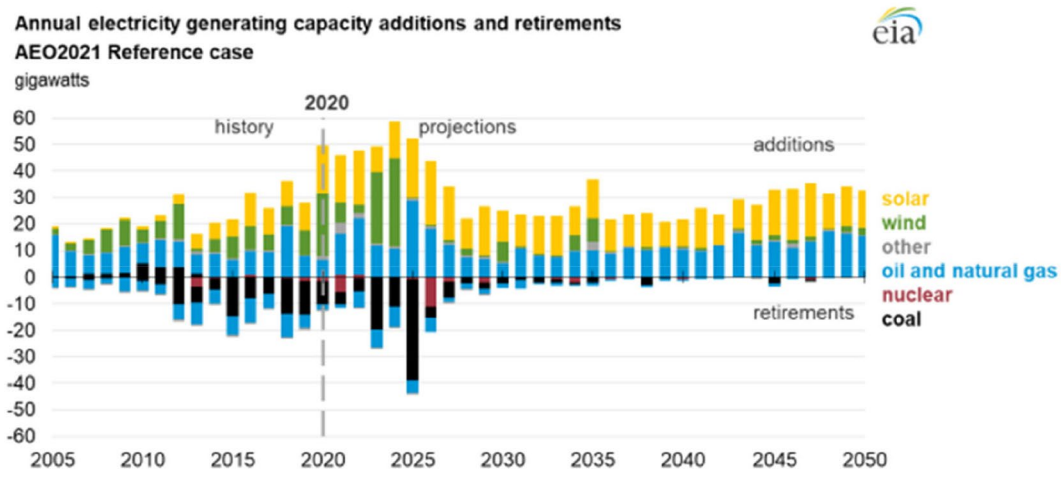
In addition to states that have formally adopted GHG reduction targets, 32 states have released a climate action plan or are in the process of revising or developing one. This includes 23 states that have released plans, eight states that are updating their plans, and one state that is developing a plan. Twenty-nine states and the District of Columbia have adopted a renewable portfolio standard (RPS) requiring a certain percentage of electricity sales coming from renewable energy resources. And seven states have adopted a clean energy standard (CES), requiring electric utilities to deliver a certain amount of electricity from renewable or clean energy resources, including energy efficiency and demand management. Regarding the transportation sector's GHG emissions, 36 states and the District of Columbia have put in place some form of clean vehicle policies. Eleven states are members of the Regional Greenhouse Gas Initiative (RGGI) carbon cap-and-trade program.[2]

PROGRESS TO DATE AND FORECAST ADDITIONS

The US Energy Information Administration (EIA) energy forecasts reported in the *Annual*

[2] *State climate policy maps.* (n.d.) Center for Climate and Energy Solutions. C2ES. https://bit.ly/3Jjhem7

Figure 1. Generation Capacity Additions Through 2050



Source: US Energy Information Administration, *Annual Energy Outlook 2021* (*AEO* 2021) Reference case and July 2020 Form EIA-860M.

Energy Outlook (*AEO*) *2021* paint a dire picture of the ability for renewable energy resources and energy efficiency to reach the penetration levels necessary to significantly reduce GHG emissions and meet GHG reduction goals established by states. EIA models and forecasts short- and long-term energy production and use in the US based on current technologies and costs, and with minimal expectations for large-scale innovations, changes in economic conditions, or supply and demand for electricity. *AEO* projections in its reference case, illustrated in **Figures 1** and **2**, consider existing legislation, tax codes, and energy and environmental trends without predicting future legislative mandates or policy actions and their impact on energy demand and supply.

Figure 1 shows the largest share of new electric generating capacity additions coming from solar photovoltaic and wind power, followed by natural gas and oil, consistent with *AEO* 2019, although percentages differ. Both the *AEO* 2021 and 2019 projections show continued retirement of nuclear and coal generation. As illustrated in Figure 2, natural gas is projected to remain a significant part of the electric generation capacity mix in 2050, at 36 percent, up from 34 percent in *AEO* 2019. Yet, even with natural gas generation projected to represent a larger share of capacity in 2050 in *AEO* 2021 than in *AEO* 2019, the share of capacity from renewable energy resources is projected to be larger, at 42 percent, up from 34 percent in *AEO* 2019. In *AEO* 2021, the share of coal and nuclear capacity is 11 percent for each, compared to *AEO* 2019, which projected 29 percent coal and 19 percent nuclear capacity.

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Although renewable electric generating technologies account for approximately 60 percent of cumulative capacity additions throughout the projection period in the *AEO*

2021 reference case, natural gas-fired generators account for almost the entire remaining balance of additions—approximately 40 percent through 2050. Natural gas-fired capacity additions are almost evenly split between combined-cycle technologies and combustion turbines, both of which can be used to balance the intermittent output from wind and solar generation. Maintaining reliability of the electric grid and electric service remains utilities' top priority, along with safety and resiliency, meaning base load and rapid start-up generation will be needed unless and until renewable resources and storage are sufficient to reliably meet demand.

While growth in natural gas use between 2020 and 2050 is concentrated in exports and industrial use, all sectors in the US are projected to increase natural gas use in 2050 relative to 2020 in the AEO 2021 reference case, except within the residential sector. The industrial sector is responsible for more of the growth in domestic natural gas use in AEO 2021 than any other sector. Natural gas use in the residential sector is projected to remain flat, and commercial buildings show low-to-moderate growth because final demand growth is tempered by energy efficiency improvements (particularly energy management controls and sensors) in space heating.

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PUSH FOR CLEAN ENERGY

States, utilities, energy services, and technology providers have been pursuing clean energy initiatives for decades. Utility industry restructuring in many parts of the country opened the electricity and natural gas industries to competition in the late 1990s, driven largely by federal energy policies. The electricity and natural gas industries today have experienced low-to-moderate growth in demand consistently year over year, due to significant improvements in energy efficiency and demand management. Moreover, new demand management technologies, more energy efficient residential and commercial building codes and appliance standards, higher fuel economy standards for vehicles, and other creative policy approaches have significantly reduced fossil energy use and GHG emissions from the trajectory they would have been on otherwise.

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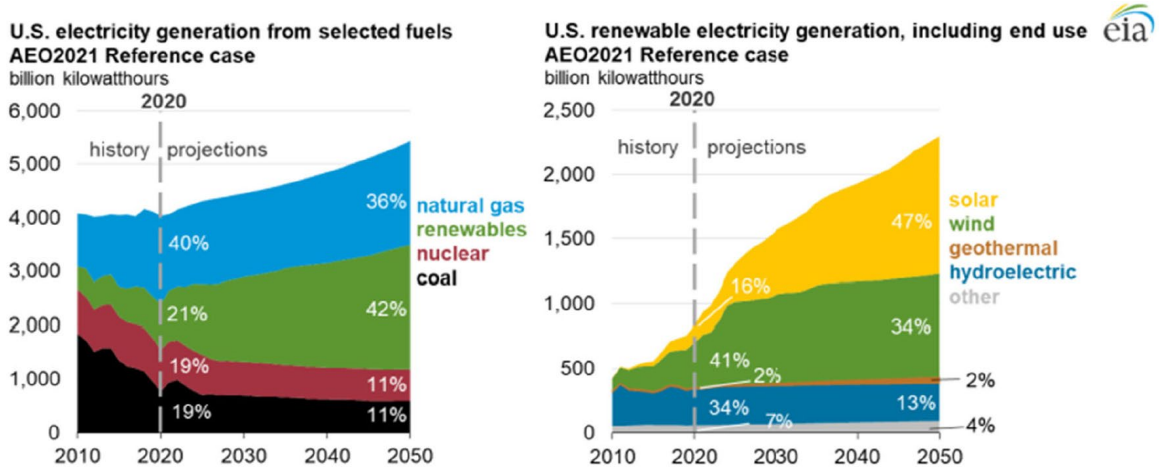
Job creation in clean-tech industries has sky-rocketed, and costs of clean energy technologies, like energy efficiency and demand response, solar and wind power, fuel cells, geothermal, tidal, and biofuels have decreased significantly. In regions of the country with ample clean-tech resources, cost is marginally less for these technologies than that of conventional electricity generation, which is further accelerating investment in clean energy resources. This is a seismic shift in the economics of meeting electricity needs. Job growth in the clean energy sector continues to grow as well, representing a larger share of total employment. For example, the New York City metro region energy sector alone is home to some 222,489 jobs of the total 3,753,700 private sector jobs as

Figure 2. Electric Generation from Selected Fuel Sources



Source: US Energy Information Administration, *Annual Energy Outlook 2021* (*AEO* 2021) Reference case and July 2020 Form EIA-860M.

of December 2021. New York City accounts for about 49 percent of the 7,731,800 jobs statewide,[3] and clean energy jobs represent approximately six percent of jobs in the New York City region.

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Public sentiment favors lower cost, cleaner alternatives to conventional energy across all sectors of the economy, and the benefits are many, including increases in job growth, tax revenues, and reductions in GHG and other pollutant emissions. Given the states' and federal government's aggressive goals and the AEO 2021's 2050 projections of electricity generation mix, significantly more investment is needed if the goals are to be met.

[3] New York State Department of Labor. (n.d.). Labor Statistics for the New York City Region. https://on.ny.gov/3JEhJqZ

The challenge remains. Whether policymakers accept the science tying a changing climate to GHG emissions or not, the fact remains that investments in clean energy and cleaner transportation technologies are contributing to job growth and a commensurate reduction in energy use, energy bills, and GHG emissions. Federal and state governments have subsidized fossil energy exploration, mining, and the use of nuclear power for decades and continue to do so today. Likewise, federal and state governments continue to subsidize clean-tech industries. The economics of competitive markets with subsidies included are driving greater customer interest in and the use of clean energy resources.

MOMENTUM IS BUILDING

IIJA and state funding for clean energy initiatives support the following goals (among others):

- building resiliency against climate change-related disasters, such as extreme weather

- repairing and upgrading infrastructure in the US, including by reducing GHG and other pollutant emissions
- meeting 100 percent of the power demand in the US through clean, renewable, and zero-emission energy resources
- building or upgrading to energy-efficient, distributed, and "smart" power grids, and working to ensure affordable access to electricity
- upgrading existing buildings in the US and requiring new buildings to achieve maximum resource efficiency, including for energy and water efficiency
- improving the safety, affordability, comfort, and durability of buildings and physical infrastructure
- spurring growth in clean manufacturing in the US of new and innovative energy technology, leading the world
- improving transportation systems and transitioning to alternative fuel vehicles to eliminate pollution and GHG emissions from the transportation sector

If any of these goals are to be met, a significant shift is required in the way we plan, build, and operate our energy and transportation systems—requiring leadership and deliberate action.

CONCLUSION

The government's clean energy and decarbonization aspirations are laudable and necessary to drive private sector investment toward achieving goals. Plans and goals are also laudable and necessary for driving change. Public policy and government support coupled with private investment are necessary to implement initiatives to put such aspirational goals on a successful trajectory.

It is clear that to achieve the states' climate goals, significantly more public and private investment is needed. Alignment among diverse stakeholders, whether climate change believers or deniers, and a clear call to action is necessary to bring about the positive economic, environmental, and social change the US and like-minded countries are already benefiting from through investments in clean energy.

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Estimates of the capital investment needed to pursue decarbonization goals vary greatly. Many states have goals for a zero-carbon or carbon-neutral economy across all sectors by 2050. To meet these goals, utilities and energy companies must invest in infrastructure, including new transmission and distribution infrastructure, new electricity generation among a variety of sources, new and advanced building heating and cooling technologies and appliances, and electric vehicle and alternative transportation fueling stations and infrastructure. Policymakers and regulators alike need to provide the necessary support and regulatory framework for these investments.

To meet ambitious state and federal government goals, decarbonization advances in technology are needed. The US Department of Energy and the national laboratories partnering with the private sector have been instrumental in innovating and commercializing new and advanced technologies. The portfolio of strategies, technologies, and investments needed to meet clean energy and decarbonization goals while addressing and meeting socioeconomic and equity needs requires a carefully developed, balanced, and executed plan. All options that strive to meet federal and state emissions goals while providing investors with incentives and reasonable returns to support their investments need to be considered.

