Electricity Matters

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Planning Challenges to Grid Reliability

The Inflation Reduction Act (Act) passed by the United States Congress and signed into law by President Biden reaffirms the role of the United States as a world leader in advancing clean energy development and decarbonizing the US economy. The legislation contains $369 billion in funding for clean energy technology manufacturing, development, and use, and includes tax incentives for electrifying transportation. The Act itself is the largest climate and energy bill in US history. And the Act, together with the Bipartisan Infrastructure and Investment Jobs Act of 2021, represents the largest investment in industrial and manufacturing policy in US history. Energy policy support and financial incentives provided in the two pieces of legislation address: (1) energy affordability; (2) domestic energy supply diversity and security; (3) improved energy system efficiency, reliability, and resiliency; (4) decarbonization of the economy; and (5) expanded and enhanced environmental stewardship.

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Continued support for the fossil fuel industry in the Act, in the form of expanded drilling on federal lands and support for pipeline infrastructure, recognizes that fossil fuels still play an important role in supporting economic growth and advancing social and economic well-being. The Act acknowledges that a transition away from fossil fuel needs to be gradual and planned not to cause economic deterioration or dislocation.

There is $4.6 trillion[1] of investment worldwide in the fossil fuels industry, and over 2 million people[2] in the United States alone are employed in the fossil fuel industry. Not

[1] Casella, C. (2018, June 4). *When the fossil fuel industry pops, it will be way bigger than the 2008 financial crisis.* Science Alert. Retrieved from https://bit.ly/3p9ARVA.

[2] Gaille, B. (2019, February 12). 31 *Fossil Fuel Industry Statistics, Trends & Analysis.* BraindonGaille; The Blogging Millionaire Podcast. Retrieved from https://bit.ly/3SJn5X9.

something to take lightly and not something that can be eliminated too quickly without severe economic, social, and geopolitical impacts. The Act does levy financial penalties for carbon emissions exceeding allowable levels and provides incentives for more efficient use of fossil fuels and cleaner fuel alternatives as substitutes for fossil fuels, like green hydrogen and heat pumps to name a few. The Act also provides tax incentives for nuclear power generation in the form of a production tax credit to address the high up-front cost of nuclear power and to encourage investment in small modular nuclear reactors (SMRs).[3]

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In a very meaningful and symbolic way, the Act is setting in motion the transition to a decarbonized and cleaner energy economy while balancing many competing interests with very clear intentions. The Act will solidify the Biden Administration's climate and energy agenda transitioning the economy away from reliance on fossil fuels, tax fossil fuel companies for methane emissions, and financially support environmental remediation.

The bill uses tax credits and other incentives to encourage consumers to buy electric vehicles, install electric heating, ventilation, and air conditioning (HVAC) systems, and other forms of cleaner energy technology, to replace fossil fuels use in buildings, which would lead to fewer emissions from transportation and electricity generation. Incentives are included to support domestic manufacturing of cleaner energy technologies in the United States. "It also includes money for a host of other climate priorities, like investing in forest and coastal restoration and in resilient agriculture. These investments, spread out over the next decade, are likely to cut pollution by around 40 percent below 2005 levels by 2030."[4]

The Act provides more liquidity in the tax equity market including transferability of credits, provides incentives to support domestic manufacturing and industrial policy across clean energy technologies and transportation with additional incentives to build assets in the United States and buy products made in America—recognizing national security concerns and benefits to domestic labor and industry sectors. A goal of these incentives is to reduce costs and add value to businesses and consumers that might otherwise be unavailable.

ENERGY SYSTEM RELIABILITY, CLEAN ENERGY, AND DECARBONIZATION

With federal funding now available and with certainty of funds being available well into the future, the time is ripe for public–private partnerships to work together to solve current and pending challenges to electric system and grid reliability and resiliency.

The Federal Energy Regulatory Commission (FERC) earlier this year released its 2022 summer assessment outlook for North American energy markets and electric system reliability. FERC notes in the report that electric markets are expected to have sufficient capacity to maintain reliable operations over the summer months under normal conditions, with the caveat that extreme weather events could pose

[3] Read more about SMRs in DeCotis, P. A. & Cartwright, E. D. (June 2022). "The role of small modular reactors in decarbonization," *Climate and Energy*, 38(11).

[4] Leber, R. (2022, August 7). *The Senate just passed one of the biggest bills to fight climate change, ever.* Vox. Retrieved from https://bit.ly/3zNk0Ne.

key challenges. While summer is over, some of the key findings of the FERC study will continue to linger and likely carry over into the summer of 2023, including:

1. As demand for natural gas and liquefied natural gas (LNG) exports increases, demand is expected to outpace supplies, causing natural gas prices to be higher as a result.
2. Hotter temperatures and increased electricity demand due to economic growth and electrification of buildings and transportation, and higher natural gas prices suggest higher wholesale prices for electricity.
3. Despite higher demand in 2022, FERC predicted electric markets to have sufficient capacity to maintain reserve margins and electric grid reliability under normal conditions. However, FERC cautioned that extreme operating conditions caused by heat waves, wildfires, hurricanes, and other severe weather events can stress operations beyond that caused by more normal and predictable weather events. These risks are particularly acute in the West, Texas, and parts of the Midwest.

Effects of world events on energy prices, beyond those already internalized by the markets, depends in large part on how the war in Ukraine progresses, how market participants across the globe adjust to supply and demand changes, and how plan progress to ensure adequate energy supplies in 2023.[5]

Similarly, the North American Electric Reliability Corporation's (NERC) summer study 2022 expected challenging summer conditions, including persistent and extreme droughts and other weather patterns out-of-the-ordinary that can stress electricity grid operations and supply and demand of electricity. NERC suggested that system planners need to keep potentially abnormal weather conditions in mind to sufficiently plan to maintain a reliable and resilient bulk power system.[6] The assessment's other key findings include:

1. Supply chain issues and commissioning challenges on new resource and transmission projects are a concern in areas where completion is needed for reliability during summer peak periods.
2. The electricity and other critical infrastructure sectors face cyber-security threats from Russia, in addition to ongoing cyber risks.
3. Some coal-fired generator owners are facing challenges obtaining fuels as supply chains are stressed.
4. Unexpected tripping of solar photovoltaic resources during grid disturbances continues to be a reliability concern.
5. Active late-summer wildfire season in Western United States and Canada is anticipated, posing some risk to bulk power system reliability.[7]

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As states and the federal government seek to decarbonize the economy, attention turns to expanding electricity production and delivery to electrify buildings, industry, and transportation. This is no small feat. In fact, doing so would require trillions of dollars in new infrastructure

[5] (2022, May 19). *FERC Staff Issues 2022 Summer Assessment.* News Releases. Retrieved from https://bit.ly/3vWh5kf.

[6] (2022, May 24). *NERC: Extreme Weather Heightens Reliability Risks this Summer.* T&D World. Retrieved from https://bit.ly/3dqyVFK.

[7] Ibid.

investment. And current worldwide economic and geopolitical conditions present a near-term challenge. Federal funding, in concert with private capital to spur domestic manufacturing of clean energy technologies and support new supplies and demand for new technologies through financial and tax incentives and penalties for polluting, provides a once in a generation and perhaps lifetime opportunity to bring about lasting change.

The war in Ukraine has compounded already challenging equipment and materials supply shortages for utilities and service providers. Supply chain equipment and materials shortages and logistical issues resulting from the COVID pandemic still linger. When the workforce across the globe went remote and manufacturing and production facilities were shuttered, causing supply issues of basic commodities, and goods and services, utilities started facing shortages of electrical equipment including transformers, meters, and related grid equipment. Now still in the summer hurricane season, a single severe event could strain the ability for a speedy recovery from service disruption.

Sharing equipment and supplies among utilities and providers continues to be at risk, as inventories continue to fall and production lags with continued supply disruptions.

According to several media outlets, wait times for transformers increased fourfold and are now averaging over 12 to 18 months. While utilities and service providers often carry inventories of critical equipment, sufficient to cover one or two planned and weather-related outage events, production has slowed, inventories have fallen, and the threat of more frequent and severe weather events is a cause for concern. Sharing equipment and supplies among utilities and providers continues to be at risk, as inventories continue to fall and production lags with continued supply disruptions. Sharing equipment and supplies among utilities and providers continues to be at risk, as inventories continue to fall and production lags with continued supply disruptions.

To address the industry's need for equipment and for sharing among members, Grid Assurance was formed in 2018 and has 31 transmission-owned affiliates with operations across 23 states. American Electric Power, Berkshire Hathaway Energy, Duke Energy, Edison International, Eversource Energy, and Great Plains Energy are founding member companies of Grid Assurance, offering cost-effective and timely solutions for maintaining and enhancing transmission system grid resilience following a catastrophic event. More interest in domestic manufacturing as supported by the Inflation Reduction Act and sharing of equipment and materials among market participants will prove helpful. Couple this with funding for more domestic manufacturing and creating domestic supply chains, and we will see positive effects on energy reliability, resiliency, and security.

CURRENT STATE

A recent analysis of Department of Energy (DOE) data conducted by the Associated Press (AP) revealed that power outages in the United States have doubled over the past two decades as the country experiences warmer weather, and more frequent and intense storms cause significant damage to the electric grid.

According to the analysis nearly half of the country's states are experiencing extended power outages related to severe weather, with these outages increasing significantly each year over the last two decades. "Forty states are experiencing longer outages—and the problem is most acute in regions seeing

more extreme weather, US Department of Energy data shows. The blackouts can be harmful and even deadly for the elderly, disabled, and other vulnerable communities. Power grid maintenance expenses are increasing as utilities upgrade decades-old transmission lines and equipment. And that means customers who experience more frequent and longer weather outages also are paying more for electricity. The number of outages tied to severe weather rose from approximately 50 annually nationwide in the early 2000s to more than 100 annually on average over the past 5 years. The frequency and length of power failures are at their highest levels since reliability tracking began in 2013—with US customers on average experiencing more than 8 hours of outages in 2020. Maine, Louisiana, and California each experienced at least a 50 percent increase in outage duration even as residents endured mounting interruption costs over the past several years. In California alone, power losses have affected tens of thousands of people who rely on electricity for medical needs."[8]

Federal funding and research support being provided through the Act and the Bipartisan Infrastructure Investment and Jobs Act will unleash the creativity of competitive markets through public–private partnerships, which have been shown to deliver ground-breaking innovations likely not possible without government support.

Take, for example, how funding for research and development in support of decarbonization can change the world. Cement production, including energy used, is reportedly responsible for about 8 percent of global carbon emissions, more than double the emissions from the airline industry. Cement production requires the heating of limestone, composed of calcium carbonate, that when heated releases carbon dioxide (CO_2).

A recent article published by Adele Peters, a world-wide solution-oriented writer, highlighted two companies, Brimstone Energy and Biomason, finding alternative solutions to this problem. Peters stated that "several startups are working to reduce emissions in cement and concrete in different ways. Brimstone Energy replaces limestone with a different rock that doesn't emit CO_2. Another company, Biomason, uses bacteria and other materials to form calcium carbonate. Others partially replace cement with different materials or embed captured CO_2 into concrete. If this type of 'biogenic' limestone is used along with other changes in cement production, including a switch to clean energy and carbon capture, making cement could actually be carbon negative, meaning it could capture more CO_2 than it produces."[9]

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CONCLUSION

The wildcard threatening reliability and resiliency is extreme weather. The more frequent and severe weather events are straining our energy systems. Most regions of the

[8] (2022, April 6). *US power outages from severe weather have doubled in 20 years.* The Guardian. Retrieved from https://bit.ly/3SKJgw6.

[9] Peters, A. (2022, August 10). *This startup is using microalgae to make carbon-neutral cement.* Fast Company. Retrieved from https://bit.ly/3vWsl0a.

country, based on the NERC and FERC studies, are not falling particularly short on the capacity needed to meet traditionally considered "normal" summer weather patterns. There is sufficient generating capacity and sufficient reserves and transmission capability to move power between grid regions. And NERC is not projecting risks of catastrophic grid failure like what happened in Texas last year, but rather we might expect some rolling brownouts as grid operators work to contain damages to the grid and outages.

The problem is that increasingly abnormal weather is raising the risk that these deliberate outages will happen more often. That's not something that can be blamed on the shift from fossil fuels to renewable energy. While coal plants have been closing at a more rapid pace over the past few years, and solar and wind power have become the primary type of new generating capacity being added to the grid, this isn't an underlying cause of grid instability.

The ability of the United States to be an exporter of clean tech and innovation would position the United States well as a global leader once again in industry and policy.

Grid planners' short- and long-term outlooks incorporate forecasts of the weather patterns used to determine how much solar and wind power will be produced during any given 24-hour period of time. While some of the weather patterns can lead to grid challenges—for example, the "duck curve" of solar power that floods California's grid during the day and fades away as the sun goes down, these are becoming more predictable events. And the more predicable the event and its implications for the grid, the greater the probability that grid reliability and resiliency can be maintained.

If the Act succeeds in reducing inflation, supporting and creating new job growth in clean tech, and expanding domestic manufacturing of clean energy technology, the United States can once again be a beacon for other countries, demonstrating that the challenges we confront can be successfully addressed. The ability of the United States to be an exporter of clean tech and innovation would position the United States well as a global leader once again in industry and policy. The weather-related grid outages now more common as a result of severe weather events will be less frequent and severe as the grid and our energy system are hardened with the funding being made available by government.

In closing, it is important to reflect again on the role of public–private partnerships in spurring innovation. Public–private partnerships time and again have proven most successful in large bringing about transformational change in business and infrastructure.

"Most large infrastructure projects and commercial innovations were brought to life with private investment, labor, and government support. The allocation of private capital with supportive fiscal and tax policies built the agricultural economy, brought about the industrial revolution, constructed the interstate rail and highway systems, developed the water and sewage public works projects that facilitated the development of urban centers, and developed the energy infrastructure supporting the high-tech, clean energy economy."[10]

Government has articulated its vision, provided the funding and policy infrastructure necessary to harness the power of competitive markets to bring that vision to life. Now is the time for transformative change to take hold.

[10] Ibid.