Electric Grid Outage Trends Make Case for Fuel Diversity

On October 22, 2022, Denice Ross, US Chief Data Scientist at the White House Office of Science and Technology Policy launched a Call To Action for "robust, comprehensive, and transparent power outage data to inform investments in grid resilience and restoration, deliver immediate benefits to our existing emergency response systems, and provide visibility into equity[1]". The need is great: the average US electricity customer has gone from experiencing just over 227 minutes of power outage per year in 2013 to nearly 476 minutes in 2021, with an even higher average outage of 506 minutes occurring in 2017[2]. The overall trend is clearly toward increasing outage durations since 2013 as shown in Figure 1 below.

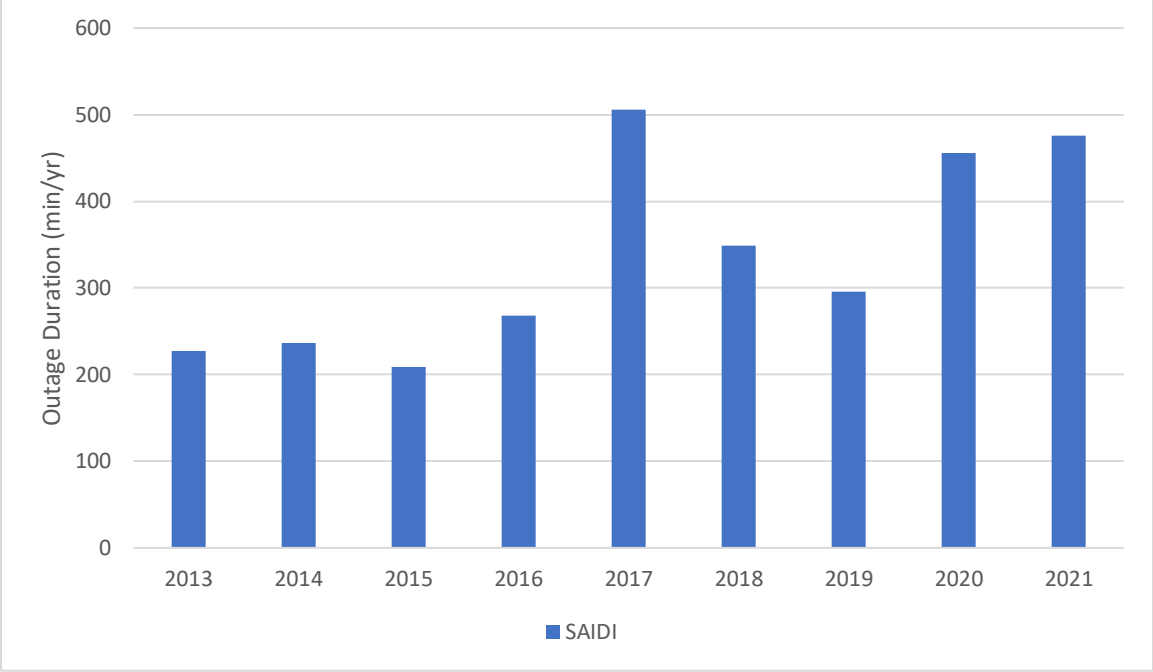

Figure 1: System Average Interruption Duration Index (SAIDI) With Major Event Days (US EIA)

This trend is unsurprising. As noted by Argonne National Laboratory, "[a]dverse weather events (e.g., hurricanes and wildfires) are causing more and more widespread outages in the power grid as climate change continues, resulting in massive economic costs and even casualties in some cases[3]". This fact

[1] White House Office of Science and Technology Policy (2022), "A White House call for real-time, standardized, and transparent power outage data", https://www.whitehouse.gov/ostp/news-updates/2022/11/22/a-white-house-call-for-real-time-standardized-and-transparent-power-outage-data/

[2] US Energy Information Administration (2022), "Table 11.2. Reliability metrics using IEEE of U.S. distribution system by state", https://www.eia.gov/electricity/annual/ .

[33] Argonne National Laboratory (2020), "Outage Prediction and Grid Vulnerability Identification Using Machine Learning on Utility Outage Data", https://www.anl.gov/esia/outage-prediction-and-grid-vulnerability-identification-using-machine-learning-on-utility-outage

presents us with a paradox in that efforts to quickly electrify the entire economy in a bid to mitigate the effects of climate change may actually be exacerbating a core problem occurring due to climate change! Carbon pollution is certainly an important problem to solve, and deploying a diverse set of solutions, including renewable hydrocarbon fuels for home heating and emergency power generation, can be more effective than a one-size-fits-all approach of universal electrification that will place ever more stress on our aging and complex power transmission infrastructure.

While it is certainly possible and desirable to invest in upgraded electrical infrastructure, the needed investments will be large in scope and will take considerable time to complete on a national scale. The National Renewable Energy Laboratory recently made available an online damage calculator that helps to quantify the cost of power outage derived economic disruptions[4]. As we have seen, these disruptions have been steadily increasing in duration since 2013. And those costs pale in comparison to what can be expected in a wholesale refurbishment of the electric grid to support proposed decarbonization efforts.

The cost to completely upgrade US electrical infrastructure has been estimated to be anywhere from $1 trillion (Reuters[5]) to $7 trillion (Oilprice.com[6]). The Biden Administration and Congress have to date only appropriated a tiny fraction of this amount, $12.86 billion, of which—according to reports by CNBC, only $478.7 million had been allocated during the second quarter of 2022[7]. With this in mind, any mandates to eliminate energy sources other than electricity in building codes or standards within the next few years are destined to run up against the extensive and growing limitations of our nation's electrical infrastructure. Only by maintaining the availability of alternative fuel sources can we prevent failure.

Alternative fuels can both provide badly needed energy supply resilience and make progress toward broader decarbonization efforts. For example, propane[8] and dimethyl ether (via methanol[9]) can be synthesized from green hydrogen and captured carbon dioxide. Propane can also be recovered from waste fats and oils[10], or from the recycling of plastics[11]. All of the above can enhance energy security. For more information, contact NPGA's Director of Codes and Standards, Tom Ortiz.

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[4] National Renewable Energy Laboratory (2022), "What's the Damage? New Customer Damage Function Calculator Estimates Costs of an Electric Grid Outage", https://www.nrel.gov/news/program/2022/new-customer-damage-function-calculator-estimates-costs-of-an-electric-grid-outage.html

[5] McLaughlin, T. (2022), "Creaky U.S. power grid threatens progress on renewables, EVs", Reuters, https://www.reuters.com/investigates/special-report/usa-renewables-electric-grid/

[6] Hyman, L. and Tilles, W. (2021), "The $7 Trillion Cost Of Upgrading The U.S. Power Grid", Oilprice.com, https://oilprice.com/Energy/Energy-General/The-7-Trillion-Cost-Of-Upgrading-The-US-Power-Grid.html .

[7] Lee, N. (2022), "Why the U.S. is struggling to modernize the electric grid", CNBC, https://www.cnbc.com/2022/08/12/why-the-us-is-struggling-to-modernize-its-power-grid.html

[8] Myers, A. (2019), "Stanford researchers create new catalyst that can turn carbon dioxide into fuels", Stanford News, https://news.stanford.edu/2019/10/17/new-catalyst-helps-turn-carbon-dioxide-fuel/

[9] Bioenergy International (2021). "Worley to provide pre-FEED services for Canadian DAC-to-fuels project", https://bioenergyinternational.com/worley-to-provide-pre-feed-services-for-canadian-dac-to-fuels-project/

[10] Newman, N. (2020), "Renewable Propane: A Cleaner Energy Source", Propane Education & Research Council, https://propane.com/environment/stories/renewable-propane-a-cleaner-energy-source/

[11] Chandler, D. L. (2022), "New process could enable more efficient plastics recycling", MIT News, https://news.mit.edu/2022/plastics-recycling-cobalt-catalyst-1006