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Beyond Resilience

Resilience Solutions that also Decarbonize and Enhance Business-as-Usual

by Steve Hoffman
President

ABSTRACT

The electric utility industry worldwide faces a significant challenge to enhance its resilience to wildfires, extreme weather, and other threats. Yet, beyond resilience, is there a solution that helps electric utilities enhance resilience, decarbonize, AND improve their operation and customer service during normal operation? Would this be a “no regrets” solution for electric utilities, because of its three sets of benefits? This white paper describes not one, but six distinct solutions that meet all three of these criteria.

THREE CHALLENGES

Electric Power Resilience to Wildfires and Extreme Weather. The electric utility industry worldwide faces a significant challenge to enhance its resilience to wildfires, extreme weather, and other threats. To help address this challenge, each individual electric utility typically considers a broad range of solutions. These may include improved vegetation management (tree pruning along transmission and distribution [T&D] rights of way), selective T&D undergrounding, modified operating procedures, planned outages[1], expanded local weather data gathering and forecasting, training and drills, improved storm response practices, elevated substations, and many others. These resilience solutions harden against, or enhance response and recovery to, wildfires and extreme weather.

The question of whether climate change increases the frequency and intensity of wildfires and extreme events is addressed in the scientific field of "climate attribution." With regard to wildfires, a recent study confirms the connection between wildfires and climate change. As the "bushfires" raged in Australia in January 2020, a research team completed a review of 57 peer-reviewed papers published since 2013 on wildfires and climate change. The review concluded that "human-induced climate change promotes the conditions on which wildfires depend, increasing their likelihood" [1]. With regard to extreme weather, the climate attribution literature is extensive, and a detailed review is beyond the scope of this paper. One recent article from the Union of Concerned Scientists concludes that "strong evidence suggests that extreme heat waves, coastal flooding resulting from storm surge and regular high-tide events, and extreme precipitation – including hurricane downpours –bear a strong climate change signature" [2].

Hence, it is probably fair to say that resilience solutions harden against, and enhance response and recovery to, the effects of global climate change – wildfires and extreme weather.

Decarbonization. While electric utilities address the resilience challenge, many of them are simultaneously taking on a second challenge – decarbonization. Utilities typically do this by working towards emission of less carbon in power generation, and by encouraging their customers to adopt carbon neutral or carbon free end uses (e.g., via efficient electrification powered with renewable energy). The fundamental premise underlying this work, as well as the Paris Agreement within the United Nations Framework Convention on Climate Change (UNFCCC), is that reducing emissions of carbon (i.e., decarbonizing) will ultimately address the causes of global climate change.

Hence, while resilience solutions address the effects of climate change (e.g., wildfires and extreme weather), solutions for this second challenge of decarbonization address the causes of global climate change[2].

Business as Usual. A third challenge that most utilities also tackle is improvement in operation and customer service for normal, business-as-usual conditions. In contrast to resilience solutions, which address less common extreme events (e.g., wildfires and extreme weather), solutions to this third challenge address improvement in everyday utility service.

1. The California Public Utility Commission and the California utilities call these controversial practices "public safety power shutoffs. (PSPSs)."

2. One can also argue that decarbonization is a very long-term resilience solution. Viewed this way, decarbonization eventually reduces the cause of the problem (climate change) to help solve the immediate problem (wildfires and extreme weather). By decarbonizing, a utility essentially commits to addressing long-term resilience.

CAN ONE SOLUTION MEET ALL THREE CHALLENGES?

This discussion of electric power resilience to wildfires and extreme weather, decarbonization, and business-as-usual operation begs the following question:

Can a single solution address all three of these challenges?

To do that, this illustrious solution would need to enable a utility to:

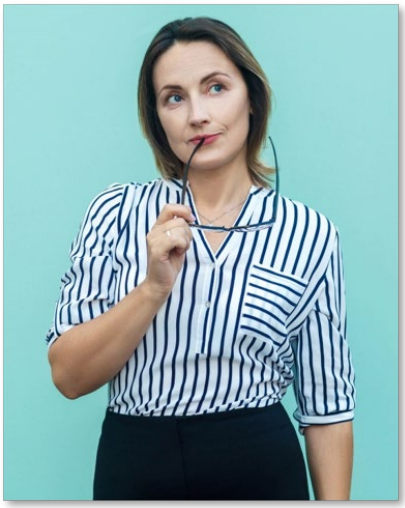
- Enhance resilience to wildfires and/or extreme weather (address the effects of climate change)

  and

- Reduce carbon combustion and emissions (address the causes of climate change)

  and

- Enhance the everyday provision of electric power to customers in significant ways[3]



Would this be a "no regrets" solution for electric utilities, because of its three sets of benefits? Can one solution achieve all three of these challenges?

None of the solutions listed in the first paragraph meet this three-part criterion, because none of them reduce carbon consumption or carbon emissions. Neither do early detection of wildfires, sectionalizing distribution lines, hardening of any type of central station power generation or T&D assets (because it cannot aid resilience if it is offline or T&D lines are down), and myriad other tactical hardening and response solutions.

So what is the no-regrets solution? Here are not one, but six distinct solutions that meet these three criteria.

Energy Efficiency

The first is enhanced energy efficiency in buildings and industrial facilities. Here's how it meets the three criteria:

- Energy efficiency aids resilience to wildfires and extreme weather because it delays the depletion of customer on-site fuel supplies, delays the maximum severity of failures (e.g., due to reduced air leakage rates in energy efficient buildings), uses decentralized technologies (e.g., weather stripping and heat pumps) that are less vulnerable than centralized ones, and several other reasons [3][4].
- Energy efficiency decarbonizes because it reduces end use energy consumption (electricity or natural gas) for a given load, thus reducing either local carbon emissions, central station carbon emissions, or both.
- Energy efficiency aids business-as-usual operation because utility customers that adopt it can save money over the life of their investment and utilities can benefit from lower on-peak demand.

3. Even if the apparent strong connection between climate change and wildfires/extreme weather is not convincing, the case for the benefits of a solution that meets these three criteria remains strong. This is primarily due to the broad interest among many U.S. utilities, communities, and organizations 1) to enhance electric power resilience to wildfires/extreme weather in light of recent tragic occurrences of these, 2) to decarbonize to achieve various benefits, including reduced transportation costs, improved air quality, reduced water usage, and improved human health, and 3) to enhance everyday provision of high-value electricity to increase productivity and provide myriad other benefits.

4. In their 1982 book on resilience, authors Amory Lovins and L. Hunter Lovins characterize end-use efficiency as the "most resilience per dollar" [3].

Distributed Renewable Generation

Energy efficiency works synergistically with a second no-regrets solution: distributed renewable generation, such as rooftop solar (photovoltaics, PV). Utility customers with PV systems are more resilient because they can continue to generate power to meet a portion of the electric load for their home or business during lengthy power outages (assuming their PV system is undamaged and the sun shines). PV decarbonizes because it can displace combustion of fossil fuels, and PV helps customers during business-as-usual operation for the same reason as energy efficiency.

Distributed Electricity Storage

A third no-regrets solution is distributed electricity storage (DES). Although not yet economical in many areas, the number of DES implementations is growing. The International Renewable Energy Agency (IRENA) reports that "40% of recent rooftop solar photovoltaic systems in Germany have been installed with BTM (behind the meter) batteries" and that "21,000 BTM battery systems were installed by 2017 in Australia" [4]. DES can further enhance PV's resilience value by storing energy for a few hours, facilitating use of the solar power gathered when needed. DES decarbonizes by further extending the practical use of fossil-fuel-displacing PV and easing the limitations of PV's intermittent nature. Once economical, DES will aid business-as-usual operation for the same reason as energy efficiency.

Electric Transportation

Electric transportation is a fourth solution that meets the criteria. An electric vehicle (EV) aids resilience by providing a home or business a mobile rechargeable electricity storage device (i.e., "vehicle-to-building" resilience) [5,6]. It can replace or augment DES. During an extended power outage, in some situations, homeowners may be able to drive their EVs to undisrupted areas, recharge them, and return home to power some portion of their critical loads for a period of time, increasing their resilience.

Electric transportation decarbonizes by displacing gasoline and diesel-fuel-consuming vehicles, assuming that the electricity generated to power them uses non-carbon emitting resources. EVs are beneficial in everyday use by reducing the overall vehicle cost of ownership for customers and by building load for electric utilities.

Community Microgrids

The fifth solution integrates the previous four solutions in the form of a community microgrid. Incorporating energy efficient homes and businesses, distributed renewable generation, DES, and EVs, these microgrids can operate independent of the grid (i.e., in "islanding mode") during some extreme events. This makes them a promising community-level resilience solution. Via their consolidation of decarbonizing technologies into local grids, community microgrids can extend decarbonization to the neighborhood level. Their benefits extend to everyday operation, as many universities and enterprises have found, and a growing number of communities are finding [7,8,9].

Demand Response

Due to a recent advancement, demand response now joins this illustrious group of solutions. Demand response aids resilience by reducing stress on the grid during extreme events. It can reduce emissions (decarbonize) via "automated emission reduction" (AER), according to nonprofit WattTime. AER enables online end-use appliances and devices to reduce emissions using real-time grid data on plant emissions and online control of these devices. WattTime also claims that AER can boost participation in distributed energy resource programs. In business-as-usual operation, demand response smooths electricity consumption peaks – its original *raison d'etre* [10].

DO UTILITIES AND REGULATORS RECOGNIZE THE RESILIENCE VALUE OF THESE SOLUTIONS?

Most electric utilities already operate energy efficiency, distributed renewable generation (e.g., PV), and demand response programs. Many encourage adoption of EVs and are working with customers to form microgrids. Some utilities are beginning to encourage distributed storage implementation to enhance the value of rooftop solar systems.

But how many electric utilities are aggressively expanding these programs explicitly to help enhance their customers' resilience? How many public utility commissions are requiring utilities to consider this?

A comprehensive assessment of utility and regulatory activities in this area is beyond the scope of this paper. Briefly, a review of the Wildfire Mitigation Plans (WMPs) that the three California investor-owned utilities (IOUs) submitted to the California Public Utility Commission (CPUC) in February 2019 and February 2020 reveals few mentions of these solutions (except significant discussion of microgrids) [11][5]. The CPUC template for the 2020 utility WMP submittals does not require discussion of these solutions – again, except for microgrids [13]. Also, in 2018 California passed Senate Bill SB-1339 that called for the CPUC to take actions by December 1, 2020 to facilitate commercialization of microgrids [14]. In late 2019 and early 2020, the CPUC initiated efforts to fast-track short-term solutions for microgrids and resilience in California [15, 16], and the three CA IOUs submitted proposals in this regard on January 27, 2020 [17, 18, 19].

California is only one state, and wildfires are only one type of threat, so these omissions by no means prove a definitive lack of awareness of these solutions' resilience value. But given the tragic consequences of the 2017-2019 fire seasons in California, consideration of all reasonable measures for enhancing resilience to wildfires would seem to be prudent.

5. California Senate Bill 901 (2018) requires the three investor-owned utilities in California (Pacific Gas and Electric Company, San Diego Gas and Electric Company, and Southern California Edison Company) to submit WMPs "assessing the level of wildfire risk and outlining their plans to address this risk" [12].

POTENTIAL BENEFITS OF EXPANDING IMPLEMENTATION OF THESE SOLUTIONS

A related question is whether electric utilities and regulators realize the strategic value of these solutions. Do they realize that expanding implementation of energy efficiency, distributed renewable generation, distributed storage, EVs, demand response, and microgrids have the potential to:

- Enhance customer resilience?
- Enhance utility infrastructure resilience in some cases (e.g., reduces stress on the system during extreme event outages due to demand response, to the extent that the two-way communication with customers remains operable)?
- Further reduce carbon emissions (decarbonize) due to decreased electricity consumption in buildings and industrial facilities?
- Provide even more of the business-as-usual benefits that these programs were designed to deliver?
- Provide these benefits by significantly ramping up existing customer programs, as a complement to adopting new programs, technologies, approaches, and operating procedures, etc.?

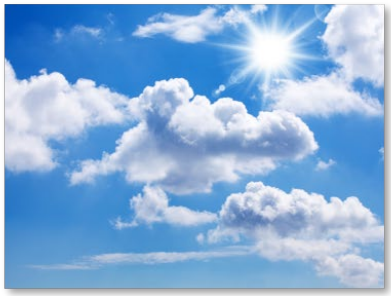
CONCLUSION

For most utilities, some combination of tactical solutions that focus on enhancing resilience to wildfires and extreme weather, such as those listed in the first paragraph of this paper, is necessary. However, sometimes-overlooked ways to enhance resilience to these events may be worthy of utility consideration, including the six solutions described here, due to their triple whammy of benefits. Energy efficiency, distributed renewable generation, distributed electricity storage, electric vehicles, community microgrids, and demand response can provide:

- "Black sky" benefits (via enhanced extreme weather or wildfire resilience) and
- "Blue sky" benefits (via business-as-usual operational advantages) and
- "Future sky" benefits (via decarbonization that will benefit society in the future)

Implementing or expanding implementation of this set of approaches and technologies can form a "no regrets" *strategy* for utilities – a strategy that utilities are unlikely to regret due to its extensive benefit set.

Black Sky Benefits: Resilience



Blue Sky Benefits: Business-as-Usual

Future Sky Benefits: Decarbonization

SEND US FEEDBACK

What other no-regrets solutions meet this three-part criterion? Send suggestions and comments on this paper to steve@crisis-content.com or call Steve Hoffman at 408-710-1717.

ABOUT THE AUTHOR

Steve Hoffman is president and founder of Hoffman Power Consulting, a 12-person agency that specializes in providing writing, content marketing, and marketing communications for various stakeholders in the electric power industry. Steve has authored more than 500 technical and marketing documents in the electric power industry. His firm has written hundreds of white papers for leading clients around the world over the last 30 years. For more information and to view sample content that implements the practices in this paper, visit www.hoffmanpowerconsulting.com.

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