NARUC

The National Association of Regulatory Utility Commissioners

Regional Mutual Assistance Groups: A Primer

Miles Keogh
Sharon Thomas
NARUC Grants & Research

November 2015

With support from the U.S. Department of Energy

Acknowledgements and Disclaimers

The report you are reading was created under the National Council on Electricity Policy & Energy Assurance program, a project of the National Association of Regulatory Utility Commissioners (NARUC) Grants & Research Department. This material is based upon work supported by the U.S. Department of Energy under Award Number DE-OE0000578.

This report was authored by the Grants and Research Department. Throughout the preparation process, the members of NARUC provided the authors with editorial comments and suggestions. However, the views and opinions expressed herein are strictly those of the author(s) and may not necessarily agree with positions of NARUC, its members, or those of the U.S. Department of Energy.

Special thanks to:

Jorge Camacho, *District of Columbia Public Service Commission*
Larry Duran, *State of Colorado Public Utilities Commission*
Edison Electric Institute
Reed McKee and Curtis Pohl, *NorthWestern Energy*
Rick Moses, *Florida Public Service Commission*
Jeffrey Pillon, *National Association of State Energy Officials*
Iliana Rentz, *Florida Power and Light*
Philip Riley, *Public Service Commission of South Carolina*
Daniel Searfoorce, *Pennsylvania Public Utility Commission*
Maria Solis, *California Public Utilities Commission*
Aaron Strickland, *Georgia Power/Southern Company*
Christopher Villarreal, *Minnesota Public Utilities Commission*
Commissioner Nick Wagner and Parveen Baig, *Iowa Utilities Board*

Please direct questions regarding this report to Miles Keogh, NARUC's Director of Grants & Research, mkeogh@naruc.org; (202) 898-2200 and Sharon Thomas, Senior Program Officer, Grants & Research, sthomas@naruc.org; (202) 384-1572.

Executive Summary

Electric utilities across the country have been providing mutual aid to each other during emergencies for years. One strategy for communicating and coordinating information as well as tangible resources needed on a wider scale is to use regional mutual assistance groups (RMAGs). This paper explains what an RMAG is, identifies some of the reasons why they are a central mechanism for assuring electric grid reliability and resilience of the power system, and offers suggestions for how we can take a great idea and make it even stronger and better.

For regulators who haven't had very much experience with mutual assistance, this paper may help explain why it's an important grid reliability tool; for those who have extensive exposure to RMAGs, this might help catalyze discussion on ways to address larger-scale emergencies, how to coordinate better across jurisdictions, and how mutual assistance may be used to address less-understood threats like cyberattacks or large-scale acts of terrorism.

The paper begins by defining mutual assistance, explaining how mutual assistance works, and why it is needed. Next, the steps in the order of restoration are explained. This is followed by examples of mutual assistance when severe events occur. Thereafter, the process for how requests for assistance are initiated and carried out is covered. Then, an explanation is provided for RMAGs including how it works on a regional basis in various parts of the U.S. for both investor owned utilities and public power utilities, and commonly shared resources. Next, NARUC workshops on mutual assistance that explored how we value mutual assistance as a part of a portfolio of resilience, reliability, and infrastructure protection investments, is discussed. Scenarios in these workshops highlight the strengths and weaknesses of the policies that underlie and promote mutual assistance. Conclusions that came out of these workshops reflect the questions and concerns facing regulators with regard to mutual assistance. The benefits and obstacles to mutual assistance, which draw from the workshops as well as conversations with utility companies and state PUCs, are then explained. Lastly, various strategies and programs that have worked well in mutual aid agreements between utilities are covered. These programs can enhance resilience of the electric power system and can be utilized to request equipment and labor for events including but not limited to cyber attacks, physical attacks, electromagnetic pulse events, and severe weather events.

One area that has become clear is that the range of risks is far too broad for case-by-case preparation to prevent every possible eventuality. Commissions and companies must manage a broad range of risks to prioritize high impact events that have the worst combination of vulnerability, likelihood, threats, and consequence. A primary tool that helps implement corrective measures to almost any kind of hazard is mutual assistance. There may be areas – such as cybersecurity – where shared preparedness and response may be underexplored. This paper explores ways that State Commissions can take this cornerstone of grid resilience and continue to nourish and improve it.

Introduction

The power sector in the United States is subjected to the recurring threat of hurricanes, superstorms, wildfires, winter weather, accidents, attacks, earthquakes and the occasional disgruntled pickup truck owner. From 2008 to 2012, weather-related power outages cost the economy as much as $200 billion.[1] Yet the restoration efforts in the United States are the envy of the world after power is disrupted. This is accomplished through the principle of "strength in numbers".

In the worst and most widespread outages, one company may not have the skilled people, trucks, equipment, experts, and data to get lights back on all by itself. The power system is an interconnected network and restoring service to the grid goes faster when utilities can share resources to make the necessary repairs and replace specialized electrical equipment among other things. Utilities address these resource constraints by using "mutual aid" or "mutual assistance" programs that allow companies to pool resources to meet their shared needs during emergency events.

Mutual assistance refers to voluntary partnerships among utilities in the same region, where utilities can get help from other utilities in the same mutual assistance network. Utilities may also belong to two or more regional networks. Partnerships such as these save utilities from having to keep large numbers of emergency crews on staff all the time. Generally, the items that are shared include utility employees and contractors, specialized equipment, supplies, and information.[2]

Utility restoration workers are often from neighboring or nearby utilities, but as the power system becomes more interconnected and there are a bigger set of response events, a wider net is cast when utilities activate these mutual assistance networks. Today, restoration crews often travel long distances - sometimes hundreds of miles like in the cases of Hurricanes Katrina and Sandy - to help the requesting utility rebuild power lines, repair or replace other damaged infrastructure, and to provide logistical support to the restoration workers. Mutual assistance partnerships streamline the process for utilities to use to request support from other utilities near and far, which they have agreements with.

If you have ever personally experienced a broad-area outage, you may have seen utility lineworker crews and bucket trucks from companies other than your home utility working on restoration, or lined up in convoys on the highway travelling to help their neighbors. It's not just crews however – some of the other commonly shared items[3] are distribution and transmission equipment including transformers and substations, specialized workers (tree trimming crews, damage assessors, logistics managers), and other experts such as engineering supervisors and hydraulic technicians. Additional items include shelter, food, poles, mobile transformers and generators, communications gear, and other support infrastructure. Utilities also engage in sharing outage and restoration information during emergencies.

---

[1] Ernest Moniz "Energy Infrastructure Needs Our Attention." Houston Chronicle, April 2015, http://www.pressreader.com/usa/houston-chronicle/20150506/282553016801822/TextView.

[2] Edison Electric Institute, "Understanding the Electric Power Industry's Response and Restoration process." May 2014, pg. 2, http://www.eei.org/issuesandpolicy/electricreliability/mutualassistance/Documents/MA_101FINAL.pdf.

[3] Aaron Strickland, Georgia Power/Southern Company, Personal Interview, July 2015; Curtis Pohl, Northwestern Energy, Personal Interview, August 2015.

Public Utility Commissioners are not emergency managers. Nevertheless, the State Commission role in cost recovery and prudency reviews of restoration costs are a central element – without PUC approval, mutual assistance (or its alternatives) cannot be enacted. Reliable service is at the heart of a Commission's oversight role, and mutual assistance is an indispensable tool for assuring that. Many PUCs conduct after action reviews to identify problems and help improve utility response after a major event. Finally, PUCs can also play a vitally important proactive role in motivating and nurturing mutual aid by asking the utilities questions about their practices, and by supporting their efforts with political stakeholders.

NARUC's staff used several sources in writing this paper. In addition to internet sources, NARUC staff spoke with a number of experts at the utilities and at the utility commissions (acknowledged in our acknowledgements section). In 2014-2015, NARUC also ran a series of six workshops geared at determining what issues exist that create potential policy obstacles and opportunities for improving mutual assistance. These workshops took place in multiple regions and reached a number of partners. The workshops used a highly interactive format that engaged teams of regulators, utility officials, emergency managers, and others in problem-solving scenarios that explored how we value mutual assistance as a part of a portfolio of resilience, reliability, and infrastructure protection investments. The scenarios were designed to highlight strengths and weaknesses of the policies that underpin and support mutual assistance and generally focused on a combination of weather events and man-made hazards. Using the feedback from participants in these workshops, NARUC extrapolated a number of conclusions that reflect the questions and concerns facing regulators in the arena of mutual assistance. We used the experience of running these workshops extensively in understanding the regulatory interface with mutual assistance: what works, what doesn't, and what regulators can do about it.

How We Restore Power After A Disruptive Event

Before discussing how working together affects power restoration, it's worth taking a quick look at the order of restoration. As with all stories, this one has a beginning, middle, and end.

Pre-Event: Before the event, companies are gathering information about system operating conditions and sharing it. Some events aren't predictable. Earthquakes, physical and cyberattacks, accidents, and other human-influenced events give little warning. Other disasters give some lead-time. Hurricanes, wildfires, storms and floods are often discretely predictable with some lead-time, and in a broader way occur with a statistical regularity that supports planning for them. Agencies like the National Weather Service, the US Forest Service, the US Army Corps of Engineers, US Department of Homeland Security, Federal Bureau of Investigation, and the US Department of Energy can play a supportive role in communicating impending threats, and associations like the Edison Electric Institute (EEI), American Public Power Association (APPA), and NARUC can help disseminate that information.

Communication and coordination between utilities and state or local emergency operations centers is necessary for determining restoration priorities.[4] This effort should start by identifying those with key communications and IT components that are critical to the continuation of essential services in an emergency. Emergency managers also specify any procedures to be followed in the hours preceding a storm to protect records. They develop a team that will take action during and following an emergency. (This task must clearly define employee roles and responsibilities and establish a chain of command for operational functions and maintenance of communications infrastructure and IT services.) They develop employee contact lists that include office telephone numbers, work cell phone and other contact numbers, and office email addresses.[5] Examples of preparatory measures taken before an emergency include pre-staging of equipment and personnel, locating places for them to sleep, stocking food and water, making plans to save lives and to help response and rescue operations, and determining how to assure medical care, public safety, and other services.

During the event: While an event is occurring, power companies are managing a long task list of assessing, identifying, prioritizing, and repairing systems from those that enable the most customers to receive restored power to those that serve the fewest (although exceptions are made to prioritize key systems like hospitals, public safety, national security, and other critical social functions). Responding to an event requires help from specialized workers with training. Using mutual assistance means utilities can count on adequately trained crews of high competence. Restoration work is not only difficult but also complicated. It requires utility equipment knowledge as well as the knowledge to assess outages, prioritize them, and manage the logistics of restoration. This is a big job. A great deal of information sharing is required that is only possible through mutual assistance. Crews must also be supported during the event. They need food, water, shelter, medical care, and other essentials.

After the event: Mutual assistance is voluntary and sometimes crews come from areas that are also affected, or when a new event appears (like a second hurricane) that may mean they need to return quickly to deal with that next incident. In some circumstances, quick response may mean a quick exit.

Recovery involves decisions and actions such as restoring interrupted utility and other essential services, as well as reestablishing transportation routes,[6] and permanently repairing and rebuilding infrastructure.[7] Additional measures include evaluation of the incident to identify lessons learned, post incident reporting, and development of initiatives to mitigate the effects of future incidents.[8]

The recovery process requires balancing the more immediate need to return the community to normalcy with the longer-term goal of reducing future vulnerability. Because the recovery function has

[4] Connecticut State Government's General Assembly, "An Act Enhancing Emergency Preparedness and Response." March 2012, https://www.cga.ct.gov/2012/ba/2012SB-00023-R000401-BA.htm.

[5] Federal Communication Commission's Public Safety and Homeland Security Bureau, "Emergency Planning: First Responders, Preparation, Communications and Continuity of Operations." 2015, https://transition.fcc.gov/pshs/emergency-information/guidelines/first-responders.html.

[6] Malcolm E. Baird. The Recovery Phase of Emergency Management. January 2010. Vanderbilt Center for Transportation Research (VECTOR), pg. 7.

[7] Baird, pg. 2.

[8] FEMA, FEMA Strategic Plan; Fiscal Years 2008-2013. 2008, pg. 52.

such long-lasting effects at usually high costs, the participants in the process are numerous. They include all levels of government, the business community, political leadership, community activists, and individuals. Each of these groups plays a role in determining how the recovery will progress.[9]

After the event, crews need to get home; this can involve a number of transportation and permitting headaches. In some cases where aircraft or other equipment from the federal government were used, it also requires new ways of coordinating across jurisdictions and new relationships that extend beyond the scope of the Regional Mutual Assistance Group (RMAG) agreement. Thankfully, there are groups working on initiatives to relieve some of the logistical and permitting issues.[10] In addition, accounts must be settled and lessons learned must be internalized and acted on to be even better prepared for the next event.

What Are Some Examples of Mutual Assistance?

Mutual assistance has proven itself repeatedly in the worst storm-driven disruptions of the last decade. Some of the most notable examples follow.

Superstorm Sandy in October 2012: Approximately 8.5 million[11] customers lost power across 24 states in the Northeast, Mid-Atlantic, and parts of the Midwest. Tens of thousands of restoration workers—representing 80 utilities from almost every state and Canada – were involved in the response and recovery efforts.

June 2012 derecho: A sudden and widespread storm with peak wind gusts ranging from 80-100 miles per hour caused more than four million customers across Ohio and the Mid-Atlantic to lose power. Utilities responded with a workforce of about 30,000, including local utility workers and crews from as far away as Canada, Texas, and Wyoming.

Hurricane Irene, August 2011: Hurricane Irene made landfall on the East Coast, leaving approximately 5.9 million[12] customers without power. Nearly 50,000 electric utility restoration workers from regions as distant as the West Coast and Canada assisted with the restoration efforts in 14 states and the District of Columbia.

Hurricane Katrina, August 2005: When this hurricane hit the Gulf of Mexico, it damaged almost an entire 400-mile section of coastline from southeast Texas to central Louisiana. More than 46,000 electric utility restoration workers and contractors from around the country travelled to the Gulf Coast to help the local electric utilities with restoration. It was followed by a second hurricane – Rita - less than a month later, creating widespread destruction and millions of outages in Texas.

---

[9] Baird, pg. 2.

[10] Multi-State Fleet Response Working Group 2015, http://www.fleetresponse.org/home/.

[11] U.S. Department of Energy Office of Electricity Delivery and Energy Reliability, 'Hurricane Sandy Situation Report #20.' November 7, 2012, http://www.oe.netl.doe.gov/docs/2012_SitRep20_Sandy_11072012_1000AM.pdf

[12] U.S. Department of Energy Office of Electricity Delivery and Energy Reliability, 'Hurricane Irene Situation Report #5.' August 28, 2011, http://www.oe.netl.doe.gov/docs/2011_SitRep5.pdf

How Mutual Assistance Requests Are Initiated and Carried Out

Companies maintain a skilled workforce sufficient to provide for maintenance, operations, and system management as well as to meet most of the restoration needs they face, such as relatively-commonplace storms, downed trees, and accidents. Most of the time, when a power utility is faced with a service outage, it draws from its own resources to restore service. If more help is required, the affected utility may draw from approved contractors that supply line workers and trucks as well as other skilled workers (electricians, substation techs, etc.). If the utility still needs more assistance, it may initiate a request for further assistance through the RMAG it belongs to and will notify its RMAG of what resources are needed. The RMAG then sends out an email to initiate a conference call with the other utility members. Once the member utilities are on the call, the event is summarized and the needs are communicated. Each member utility identifies the resources they have available to provide and how long it will take them to get to the affected area. Lastly, helping utilities travel to the affected area and resources are deployed. When a utility receives mutual assistance crews and other equipment, the utility receiving the assistance is responsible for them financially, covering the costs for the crews and dealing with liability and other related expenses. However, responding utilities are expected to handle the logistics of their travel to the requesting utility.

However, the terms of this sharing are not simply ad-hoc. Agreements are put into place well before-hand, defining the roles to be played (and money to be paid) by utilities engaged in mutual assistance. These agreements for mutual aid can differ in content and format – sometimes they are contracts and other times they are memorandums of understanding (MOU) between utilities.[13] These contracts and agreements vary slightly from state to state.

If utilities are aware of an oncoming event such as with Hurricane Sandy, a few days before landfall individual utilities begin planning and evaluating their resource needs. Utilities try to meet the needs of the affected areas with their own resources, and contact RMAGs for additional resources.[14]

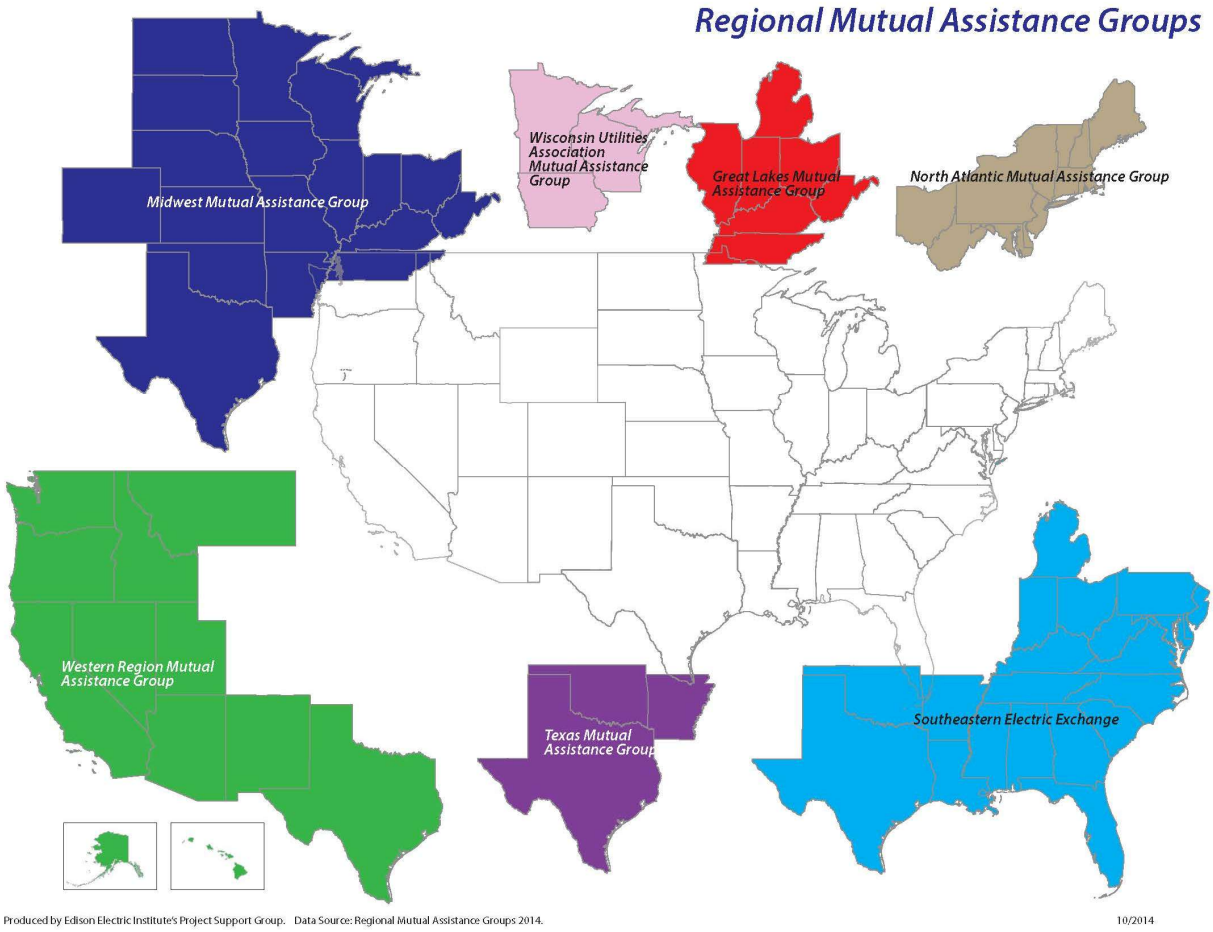
Mutual Assistance on a Regional Level

Many mutual aid agreements among investor owned utilities (IOUs) are managed by seven RMAGs across the country. Figure 1 below illustrates RMAGs for IOUs.

[13] Jorge Camacho, District of Columbia Public Service Commission, Personal interview, August 2015.

[14] Edison Electric Institute, "Understanding the Electric Power Industry's Response and Restoration process." May 2014, pg. 2, http://www.eei.org/issuesandpolicy/electricreliability/mutualassistance/Documents/MA_101FINAL.pdf.

Figure 1: RMAG Map for IOUs[15]



These RMAGs are groups of utilities in a state, region, or across the country that have agreements to offer mutual aid assistance when a request is made. RMAGs facilitate the process of identifying available restoration workers and help utilities coordinate the logistics and people to help with restoration efforts when the affected area is regional in scope.[16] Investor-owned utilities (IOUs) that are in RMAGs follow guidelines established by the EEI, and also establish additional guidelines that aid in the communication process and rapid mobilization and response efforts. If needed, utilities in one RMAG will assist those in another region.[17]

[15] Produced by Edison Electric Institute's Project Support Group. Data Source: Regional Mutual Assistance Groups 2014.

[16] Edison Electric Institute, "Understanding the Electric Power Industry's Response and Restoration process." May 2014, pg. 2, http://www.eei.org/issuesandpolicy/electricreliability/mutualassistance/Documents/MA_101FINAL.pdf.

[17] Iliana Rentz, Florida Power and Light, Personal Interview, August 2015.

Mutual aid also varies by region. The Eastern Interconnection utilities contend with weather-driven widespread outages and tend to enact mutual assistance more regularly, and as such tend to use RMAGs more often. Utilities in the western states generally coordinate responses directly with each other, rather than through an RMAG.[18] In Colorado, for instance, regional mutual assistance is coordinated by the state's Division of Homeland Security and Emergency Management organization using the Emergency Management Assistance Compact (EMAC).[19] EMAC was established in 1996 and is a national disaster-relief compact that facilitates the sharing of resources, personnel, and equipment across state lines. Fifty states, the District of Columbia, Guam, Puerto Rico, and the U.S. Virgin Islands are members. EMAC offers assistance during governor-declared states of emergency through a system that allows states to send resources to help disaster relief efforts in other states.[20] To help organize EMAC responses in Colorado, the Colorado Department of Public Safety, Division of Fire Safety, maintains a database of local resources for mutual assistance. The Division of Emergency Management provides an EMAC coordinator to facilitate EMAC resource requests and deployment.[21] Information on how mutual aid works in California can be found in paragraph two of the section titled 'Things that have been working well' on pg. 15 of this report.

The most commonly shared items according to NorthWestern Energy and Southern Company are distribution and transmission equipment including transformer and substations, specialized workers (line crews, tree trimming crews, damage assessors, logistics managers), and other experts such as engineering supervisors and hydraulic technicians.[22] Additional items include shelter, food, poles, and information sharing.

Public power utilities are involved with APPA's mutual aid program. These utilities have local, state, and regional contracts and agreements for mutual aid, and there is also a national mutual aid agreement with over 2,000 public power and rural electric cooperatives, that connects utilities so they are able to help one another when needed. Figure 2 below illustrates the mutual assistance regions for public power utilities.

[18] Edison Electric Institute, "Understanding the Electric Power Industry's Response and Restoration process." May 2014, pg. 2, http://www.eei.org/issuesandpolicy/electricreliability/mutualassistance/Documents/MA_101FINAL.pdf.

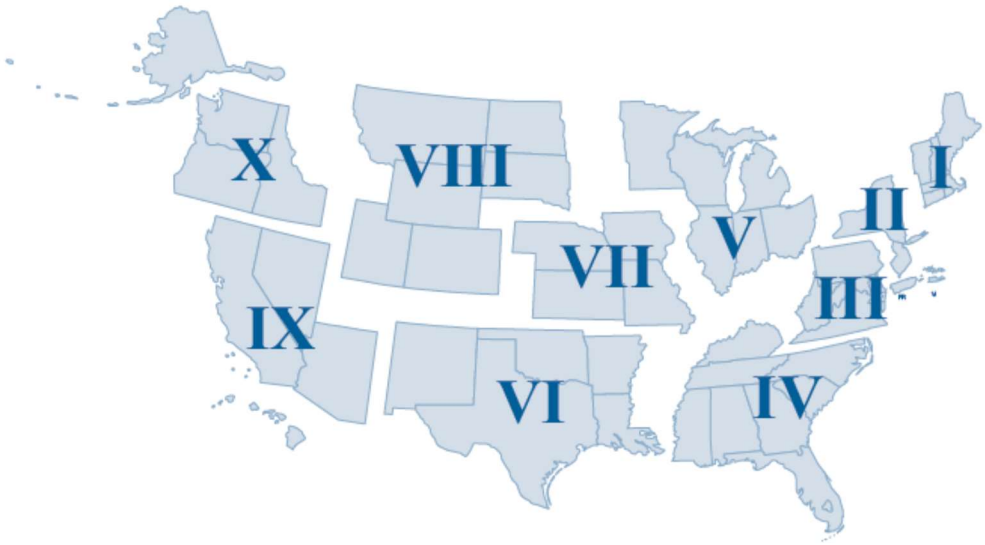
[19] Larry Duran, State of Colorado Public Utilities Commission, Personal interview, July 2015.

[20] Emergency Management Assistance Compact, "What is EMAC?," August 2015 (date retrieved), http://www.emacweb.org/index.php/learnaboutemac/what-is-emac.

[21] Colorado Division of Homeland Security and Emergency Management, "Colorado Procedures for Emergency Management Assistance Compact Requests." August 2015 (date retrieved), www.coemergency.com/2010/05/colorado-procedures-for-emergency.html.

[22] Strickland; Reed McKee, NorthWestern Energy, Personal interview, August 2015.

Figure 2: Public Power Utilities Mutual Aid Regions[23]



The mutual aid roles and responsibilities for public power utilities are defined at the local/state, regional, and national levels. Level 2 and 3 events, which are at the local/state or regional levels, involve utility and network coordinators. A level 4 event, which is on a national level, involves the utility coordinator, network coordinator, and APPA serving as national coordinator. For a national level event, APPA works with network coordinators from the following affected industry associations: EEI, the National Rural Electric Cooperative Association, the trade association for the cooperative electric utilities, and other organizations such as the National Emergency Management Association.[24]

National Response Events

Given the increasing severity of storms in the United States, such as Superstorm Sandy in 2012, the electric power industry recognized the value of enhancing the mutual assistance process to scale it to a national level. The EEI, through the efforts of a project team, developed the National Response Event process[25]. An industry-wide National Response Event (NRE) is a natural or man-made event that is forecasted to cause or that causes widespread power outages impacting a significant population or several regions across the U.S. and requires resources from multiple RMAGs.

A requesting utility's CEO (or a designated officer) from an EEI member utility may initiate the NRE process if or when multiple RMAGs cannot adequately support the resource requirements. When an

[23] American Public Power Association, "Public Power's Mutual Aid Network." September 2015 (date retrieved), pg. 2, http://appanet.files.cms-plus.com/PDFs/Mutual%20Aid%20Playbook%20Executive%20Summary.pdf.
[24] American Public Power Association, "Public Power's Mutual Aid Network." September 2015 (date retrieved), pg. 3, http://appanet.files.cms-plus.com/PDFs/Mutual%20Aid%20Playbook%20Executive%20Summary.pdf.
[25] See here for more information on the NRE Process: http://www.eei.org/meetings/meeting_documents/deric.pdf.

NRE is declared, all available emergency restoration resources (including contractors) will be pooled and allocated to participating utilities in a safe, efficient, transparent, and equitable manner without regard to RMAG affiliation. Each utility will designate a "Home" RMAG for NRE events at the operating utility level. Resource allocation in regional events will continue to be managed through the existing RMAG processes. This process works to ensure that resources are equitable distributed for a large-scale, multi-regional event.[26]

Benefits of Mutual Assistance

The advantages to being part of a mutual assistance program are numerous. Outlined below are some of the key benefits that were identified through the workshops, as well as conversations with utility companies and directly with state utility commission staff:

(a) Resource Sharing**:** Mutual assistance provides a way for utilities affected by natural or man-made hazards, to request and receive emergency assistance in the form of personnel, equipment, materials, and other specialized resources and associated services.[27] (Non-tangible services commonly offered range from training and guidance, to reviewing utilities' mutual aid plans and offering recommendations.[28])

(b) Cost Effectiveness: Mutual aid allows for a more efficient allocation of resources by eliminating the need for utilities to keep additional full-time staff on-hand for emergency only situations; this also saves utilities money by not having to keep additional labor on staff for these situations.

(c) Information Sharing: RMAGs can also provide a forum for discussing industry related topics, forming supportive relationships, sharing best practices, minimizing individual company risks and labor costs, setting safety expectations, and coordinating regional restoration.[29]

(d) Emergency Preparedness: These partnerships are helping to improve emergency preparedness by facilitating more collaboration as well as streamlining coordinated processes between state and local governments and the electric power industry, which can help ensure that we are even more prepared for the next major outage.[30]

---

[26] Thomas Kirkpatrick, AEP and Miki Deric, Davies Consulting, LLC, "Overview of the Electric Power Industry's Mutual Assistance Process During a National Response Event (NRE)." Slide 5, Presentation at Edison Electric Institute's Executive Storm Response Symposium, May 2014, http://www.eei.org/meetings/meeting_documents/deric.pdf.

[27] FEMA, "Glossary and Acronyms." September 2015 (date retrieved), pg. 12, http://www.fema.gov/pdf/emergency/nrf/nrf-glossary.pdf.

[28] Duran, *supra*.

[29] Pat Conti, "2011 Summer Reliability Meeting Mid Atlantic Mutual Assistance Group (MAMA)." Duquesne Light Company, 2011, Slides 9 and 10, https://www.puc.state.pa.us/electric/pdf/Reliability/Summer_Reliability_2011-DQE.pdf.

[30] Edison Electric Institute, "Mutual Assistance Enhancements." October 2013, pg. 4, http://www.eei.org/issuesandpolicy/RES/TAB%205.pdf.

(e) Rapid Response: Mutual aid networks provide rapid, short-term dispatch of emergency services by responding utilities to restore operations of the utility experiencing an interruption or outage. Mutual aid partnerships can speed up recovery when replacement equipment is needed, for example.[31]

Elements of Mutual Aid That Have Been Working Well

The underlying principle of mutual aid is "strength in numbers, and generally this has proven a reliable proposition. A number of practices have emerged that underpin this success. One practice that Southern Company and other utilities have been using is called Area Supervision, which has operational, efficiency, and safety aspects. Under this arrangement, restoration crews have defined electrical boundaries by feeder, substation, etc., that they have full control over in a given area. Other features include: (a) you can only work within your assigned area, so you can better ensure the safety of your team; (b) outside entities cannot perform work in this area without permission from the Area Supervisor; (c) all work must be completed within this boundary before moving to the next area; (d) switching the power back on after the work is complete, is turned over from the Distribution Operations center to the Area Supervisor overseeing the area under restoration, and thereafter control is returned back to the Distribution Operations Center (others cannot perform any switching that could jeopardize your area or safety); and (e) areas are both geographically and electrically assigned so that areas do not overlap and create safety issues. This strategy has been shown to reduce restoration times when used by utilities. Utilities have found it more efficient for a crew to finish work in one section and make one call at the end to the designated area of control to confirm that each circuit's power has been restored, rather than running multiple workgroups into and out of the same area and having the crews make multiple calls throughout the restoration process to the designated area of control.[32]

Another example of what works well can be seen in California. When there is a governor-declared state of emergency, the State of California utilizes the Standardized Emergency Management System (SEMS) and coordinates directly with the California Utilities Emergency Association (CUEA).[33] CUEA is part of the Incident Command System (ICS)[34] at the Office of Emergency Services (OES) and operates within the

[31] FEMA, "Glossary and Acronyms." September 2015 (date retrieved), pg. 12, http://www.fema.gov/pdf/emergency/nrf/nrf-glossary.pdf.

[32] Strickland, *supra.*

[33] CUEA is a private company in the governor's office, which serves as a point of contact for critical infrastructure utilities before, during and after an event to facilitate communications and cooperation between member utilities and public agencies, and with non-member utilities when possible; provides emergency response support wherever practical for electric, petroleum pipeline, telecommunications, gas, water and wastewater utilities; and supports utility emergency planning, mitigation, training, exercises and education. Members take part in both statewide and interstate mutual assistance agreements with Washington, Oregon, Nevada, and other border states. The CUEA is unique to California and has been functioning very effectively in disaster recovery events. http://www.cueainc.com/about/.

[34] The ICS is a standardized management tool for addressing emergency or nonemergency situations on any scale including for planned events, natural disaster, and terrorist acts. It represents "best practices" and is a key feature of the National Incident Management System (NIMS). The ICS is designed to enable effective and

State Operations Center (SOC) during a catastrophic event.[35] ICS was developed after a number of disastrous fires in urban areas of California in the 1970s, which caused millions of dollars in damages to property as well as injuries and deaths. Response problems with these events were not largely attributable to a lack of resources or failure of tactics, but rather, response problems were far more likely a result of inadequate management than from any other single reason.[36] Local mutual assistance is coordinated at a local or state level through the SEMS structure within California that incorporates the ICS structure.[37]

The level of involvement by state utility commissions with mutual aid varies from state to state. Mutual aid has been working very effectively in the state of Florida. The Florida Public Service Commission (FPSC) only gets involved to a limited extent, however, because the utilities have been handling mutual aid very well on their own. The nature of aid from the FPSC to utilities in need of mutual aid has been logistical (coordinating air lifts, etc.) and in the form of helping crews obtain access to affected areas. Since Florida frequently experiences hurricanes, much of the usual mutual aid problems encountered in other states have been worked out in Florida over the years. A key element that has helped Florida address the problem of utilities and other companies experiencing delays at toll booths and weigh stations when crossing state lines, is that Florida developed standard language in the Governor's executive order that gives the authority to grant waivers and permits to the extent the waivers and permits are needed. This then gives authority to the Department of Transportation during an emergency event, to waive tolls as well as some size and weight restrictions on vehicles transporting emergency equipment.[38]

Other things that help facilitate effective mutual assistance include: having clearly written contracts or MOUs in place well in advance to help avoid delays;[39] having government employees at all levels as well as utilities and others involved with mutual aid efforts participate in emergency exercises;[40] and a strong willingness by all members to participate since high participation is crucial for programs to succeed.[41]

---

efficient domestic incident management by integrating a combination of facilities, equipment, personnel, procedures, and communications operating within a common organizational structure. A basic premise of ICS is that it is widely applicable. ICS is used by all levels of government—Federal, State, local, and tribal—as well as by many private-sector and nongovernmental organizations and is also applicable across disciplines. It is normally structured to facilitate activities in five major functional areas: command, operations, planning, logistics, and finance and administration. http://training.fema.gov/emiweb/is/icsresource/assets/reviewmaterials.pdf.

[35] Maria Solis, California Public Utilities Commission, Personal Interview, August 2015.

[36] FEMA, "Incident Command System." May 2008, pg. 1, http://training.fema.gov/emiweb/is/icsresource/assets/reviewmaterials.pdf.

[37] Solis, *supra*.

[38] Rick Moses, Florida Public Service Commission, Personal interview, August 2015.

[39] Camacho, *supra*; Solis, *supra*.

[40] Solis, *supra*.

[41] Camacho, *supra*.

Obstacles to Mutual Assistance

Although mutual assistance is a potent tool in our resilience toolbox, it is not without challenges. These include:

(1) Logistical coordination is highly complex: Once crews arrive at the site where help is needed, they must be provided for (i.e., food, beds, bathrooms, etc.). Arranging for these items to be readily available and dispatched on time can be challenging, especially if access to an area is limited due to roads being blocked, for example, by trees or downed power lines. Additionally, hotels can sometimes be filled to capacity with local residents displaced from their residences, requiring mobile housing, restrooms, etc. to be brought in.[42]

(2) Political pressures can sometimes be strong**:** Local pressure to keep utilities from deploying help to other areas can be strong. The view that "our crews will stay in our state until all our customers are back online" may reduce the ability to handle a multistate outage with the greatest efficiency. Additionally, when mutual assistance crews are deployed there can be pressure for them to return home as quickly as possible, and depending on the job they are facing, they may need more time. Some state commissions find it beneficial to educate their elected officials and emergency management partners about the RMAG process and how beneficial it can be to restoration. For example, letting stakeholders know that if utility crews are kept within the state and not allowed to assist others, it may affect the offers to assist that state in the future.

(3) There can sometimes be varying degrees of red tape: For example, permitting when crews are responding across state lines has been a challenge. Often when electric utilities that are part of a mutual aid network are called upon for help, they experience delays – sometimes as long as 12 hours at toll collection areas and or weigh stations – as they try to move resources across state lines due to these utility crews not having the necessary licenses to travel through non-affected states. As a result, there are delays encountered in obtaining the appropriate authority to pass through these states, thereby delaying power restoration to communities experiencing outages and delivery of food and water supplies.[43]

(4) Mutual assistance is expensive, but it's worthwhile. The state receiving help must reimburse the helping state utility crew for their time, lodging and meals. However, this is much more cost effective than utilities keeping additional emergency crews and/or contractors on staff around the clock for high impact, low frequency events[44].

(5) Funding Constraints: At smaller utilities, resources are more limited and there can be a lack of oversight for tracking, monitoring, and mitigating risks to infrastructure. As a result, someone in IT, for

[42] William Atkinson. "Mutual Aid Comes of Age." April 2012, American Public Power Association, http://www.publicpower.org/Media/magazine/ArticleDetail.cfm?ItemNumber=34001.
[43] EEI / NAFA Fleet Management Association Workshop. Washington, D.C., May 18, 2015.
[44] EEI / NAFA Fleet Management Association Workshop. Washington, D.C., May 18, 2015.

example, may end up wearing multiple hats for areas where they do not possess high expertise, due to these budget constraints[45].

(6) Cybersecurity risks to critical infrastructure**:** There is great deal of information about cybersecurity threats on various fronts, regulations, and best practices. The high volume of activity and information can sometimes be overwhelming to keep up with and monitor at the county, city, state, and federal levels[46].

(8) Local crews are familiar with local systems: Political and logistical pressures may not be the only restraints on relying on crews shared by other utilities. There may be resistance to this for reasons as simple as efficiency brought about by familiarity with the system, procedures and practices, that would lead to a decision to use crews close to home.

(7) Travel distance**:** Often times, utility restoration crews must travel long distances to reach the areas affected by utility service disruptions or outages. Florida, for example, has a long peninsula that takes a long time for helping utilities to traverse, so utilities that need help request it as early as possible[47].

(8) Response time: Restoring utility services to communities in a timely manner can be challenging due to the aforementioned permitting issues, difficulty accessing areas with outages when there are downed power lines, trees, etc. that need to be cleared.

(9) Safety rules and terminology: It is sometimes the case that the same terms can mean different things to different utilities, which can be a challenge to overcome.[48]

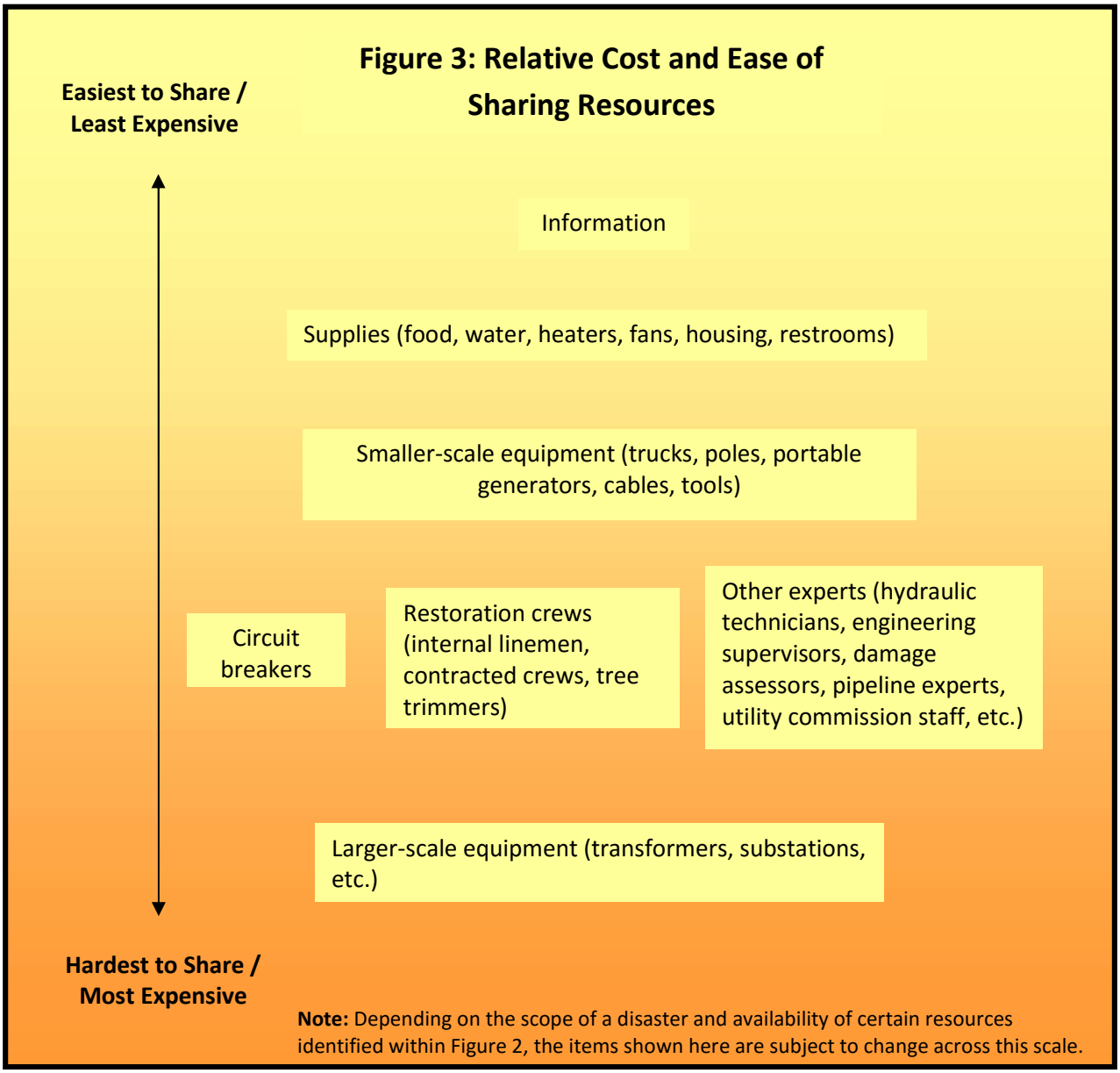
(10) Utility System Design: Individual utilities apply different criteria to design and install their equipment. It is crucial that workers are knowledgeable in system design applications and equipment deployment.

Additional Resources That Can Improve Mutual Assistance

Sharing of linemen, equipment, and supplies are the most common resources shared among utilities in a mutual assistance programs.

Figure 2 below illustrates examples of resources that can be shared on scale indicating the ease of sharing them and their costs relative to each other.

[45] Duran, *supra*.
[46] Duran, *supra*.
[47] Rentz, *supra*.
[48] McKee, *supra*.



Other resources areas being discussed by industry that could contribute to mutual aid are programs focusing on resilience mutual aid and cybersecurity mutual aid.[49] It could be worth exploring if there are possibilities of including contractual provisions for these or other institutional devices that are multi-utility or multi-state. One program for cybersecurity is called InfraGard, which is a partnership between the Federal Bureau of Investigation and the private sector. It is an association comprised of

[49] Rentz, *supra*.

representatives from businesses, academia, state and local law enforcement agencies, and others to share information and intelligence to prevent hostile attacks against the U.S. InfraGard provides a mechanism for the public and private sectors to exchange information pertaining to cyber intrusion matters, computer network vulnerabilities and physical threats on infrastructures.[50]

The following programs are available that make sharing resources other than crews, much easier. The following programs would address mutual aid from a resilience standpoint and can be utilized to request equipment when events such as cyber attacks, physical attacks, electromagnetic pulses resulting from solar storms (coronal mass ejections) or man-made explosions (high altitude nuclear explosions), and severe weather events occur:

The Spare Transformer Equipment Program (STEP) is an electric industry program that aids with quicker restoration of the transmission system as a result of terrorist attacks. Any electric utility – regardless of ownership structure – in the U.S. or Canada, can be part of this program. STEP currently has fifty-four utility members and helps to increase the inventory of spare transformers and streamline the process of transferring them to affected utilities when there are transmission outages due to terrorist attacks. Participating electric utilities must maintain a specific number of transformers. The program requires each participating utility to sell its spare transformers to any participating utility that suffers from an act of terrorism that destroys or disables one or more substations, and results in a state of emergency declaration by the U.S. President.[51]

SpareConnect is a program for utility asset owners and operators, which allows them to network with other SpareConnect members to share transmission and generation step-up (GSU) transformers and related equipment, including bushings, fans, and auxiliary components.[52] SpareConnect establishes a formal program which already exists on an informal basis, to communicate equipment needs in the event of emergency or other non-routine failures, and to connect interested utilities more effectively and efficiently.[53]

Emerging energy assurance programs: there is a dynamic and growing range of additional private sector responses that address these types of resilience approaches. For example, a product in the market that started up in June 2015 is Grid Assurance LLC, which is a collaborative effort by utilities to cost-

[50] Ronald L. Dick, "Testimony Before the Senate Committee on Governmental Affairs "Federal Bureau of Investigation." May 2002, https://www.fbi.gov/news/testimony/critical-infrastructure-information-sharing.

[51] Edison Electric Institute, "Spare Transformers." July 2014 (date retrieved), http://www.eei.org/issuesandpolicy/transmission/Pages/sparetransformers.aspx#sthash.iPgrVBEk.dpuf.

[52] SpareConnect does not create or manage a central database of spare equipment, but rather, provides decentralized access to points of contact at power companies so that in an emergency, members can connect quickly with one another in affected voltage classes. SpareConnect does not obligate participants to provide any information or to make any particular piece of equipment available. Once connected, participants who are interested may provide additional information or share equipment directly and privately with each other on the specific terms and conditions of any potential equipment sale or other transaction. http://www.eei.org/issuesandpolicy/transmission/Pages/sparetransformers.aspx#sthash.iPgrVBEk.dpuf

[53] Spare Connect, "About." August 2015 (date retrieved), https://spareconnect.com/about/.

effectively improve the resiliency of their transmission and bulk electric systems. This program will provide utility and transmission-owning subscribers with timely access to emergency spare transmission equipment, which typically take long periods of time to acquire. The equipment is stored in secure warehouses and readily deployable after a major system failure.

Grid Assurance plans to own and maintain equipment at secure, strategically located warehouses to facilitate the equipment being placed in service faster than traditionally possible. It expects to offer additional logistics support to expedite transportation of equipment to impacted sites. Grid Assurance can complement existing programs in the industry such as STEP and SpareConnect.[54] Grid Assurance filed a petition with the Federal Energy Regulatory Commission (FERC) in late June 2015 seeking confirmation that this service can be part of a transmission-owning entity's strategy to effectively address grid resiliency mandates. Grid Assurance will not be FERC regulated, but plans to charge cost-based subscription fees, similar to FERC-regulated transmission formula rates. Cost-based subscription fees are expected to facilitate subscribers' ability to recover expenses. Moving forward the power sector is likely to see other adaptive offerings to help bolster response and resilience.

Cybersecurity and Shared Network Defense

A great deal of attention has been paid in this paper to response to physical events that disrupt the power system, but an area of growing risk awareness and preparedness relates to cybersecurity. There is extensive literature that explores the vulnerabilities of the power grid to potential cyberattacks, and the increased use of intelligent systems in this sector creates additional cyber vulnerability to manage even as it helps manage outage impacts and improve system visualization.

Can mutual assistance help here as well? Conceptually, shared network defense against cyberattacks and system restoration appears to make sense. In the information gathering and threat assessment areas, a great deal of collaboration is already the norm for the power sector, with institutions like the Electricity Information Sharing and Analysis Center (E-ISAC) convening dialogue among power companies. It is worth noting that robust debate still exists about whether information sharing efforts are adequate and what can be done to improve them, ranging from a push to increase the number of asset owners and operators with clearances, to broader declassification of threat information.[55]
It is possible that market barriers and other forces impede or disincentivize the idea of mutual assistance and shared defense in the cyber arena. The power sector does have some advantages, though: concerns about sharing commercially sensitive information between companies are generally less in this sector than in others where monopoly service providers are less prominent, and competitive pressures are different between companies.

[54]Grid Assurance, "A new, cost effective solution to electric grid restoration." August 2015, http://gridassurance.com/.

[55] Two excellent information assessment nad sharing tools available from the Federal Government are the Cybersecurity Risk Information Sharing Program (CRISP, a broad federal-private sector partnership that provides information analysis and sharing) and the Electric Sector Cybersecurity Capability Maturity Model (ES-C2M2, online at http://energy.gov/oe/services/cybersecurity/cybersecurity-capability-maturity-model-c2m2-program).

Yet, cyber mutual assistance remains essentially unexplored. No determined, highly effective and damaging cyberattack has ever been successful against an electric utility. A serious attack on the scale of the Shamoon attacks[56] in the Middle East may require the repair of tens of thousands of systems, massive data quarantine procedures, and large reinstallation operations – maybe even hardware replacements at a larger scale than anything experienced to date. In the event of such an attack, it may be worth considering whether individual companies, acting independently, have the number of skilled personnel and expertise needed to repel and recover from the most serious attacks. In short, the utility industry may not have explored this kind of arrangement because it has never needed to.

Some of the experts we talked to in the States felt that the issues involved with a cyberattack were not comparable to those from a natural disaster, and that most times cyber-oriented disruptions would require different responses by people with a different set of skills. This question may be worth further exploration to see whether the same benefits apply when translated from preparedness for a physical hazard to preparedness for a cyber hazard. Utility commissioners may wish to explore this topic with companies and by asking questions catalyze conversations among owners and operators about how they can explore the possibilities and potentially create agreements, drills, training, communications networks, institutions and other instruments that enable shared cybersecurity expertise, restoration capabilities, and network defense in the power sector.

Conclusion

Mutual assistance is an indispensable tool in our electric power system's resilience. Although it poses profound benefits and is often one of the most cost-effective tools for response, it faces numerous challenges**.** The greatest challenges come with the larger scale emergencies, and when these occur on a national scale, that makes resources even more scarce and complicated to share. However, clear and regular communication, strong partnerships, and shared practices are what make RMAGs strong and effective.

Mutual assistance has proven that we are stronger together, and mutual assistance must resist political pressures that trend policymakers towards insularity. It is important for regulators to consider and help motivate not only the sharing of lineworker crews, but be open minded about shared equipment, hardware, and expertise. As the power system becomes more inextricably linked to intelligence, the growth of cyber vulnerabilities must also be managed. As much as they play an important role in overcoming the barriers to traditional mutual assistance, State regulators may play a tremendously influential role in supporting and engaging shared strength in non-traditional areas like shared stocks of equipment and spares, the sharing of information, and the defense and restoration of cyber assets.

[56] The Shamoon virus overwrote the boot sector of tens of thousands of oil company workstations in the Persian Gulf in the summer of 2012. A vernacular summary is online at https://en.wikipedia.org/wiki/Shamoon