Statement of Joy Ditto,
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Before the
Senate Committee on Energy and Natural Resources,
Hearing to Examine Blackstart

October 11, 2018

Chairman Murkowski, Ranking Member Cantwell, and Members of the Senate Energy and Natural Resources Committee:

Thank you for the invitation to testify on examining blackstart--the process of returning energy to the power grid after a system-wide blackout. Given the impact Hurricane Florence had along the Southeast and Mid-Atlantic, this is an incredibly timely hearing. I want to take a moment to commend the hard-working men and women of the utility industry who have assisted in the restoration of electricity in the wake of the storm, often in dangerous circumstances. As my testimony will detail, utility workers are among the first on the scenes after a devastating storm, restoring, repairing, and, when necessary, rebuilding utility infrastructure to bring power back on safely. Without our dedicated crews of utility workers, we would be unable to rebuild and return to normalcy. Many workers are still on the job in the aftermath of the storm, and I wish to convey my appreciation for their sacrifice.

My name is Joy Ditto and I am President and CEO of the Utilities Technology Council (UTC). I am honored to appear before you today to discuss the critical issue of returning energy to the power grid after a system-wide blackout. It is my hope that we never have to experience such a scenario, but the industry knows it must be prepared for the worst, whether it be a catastrophic storm, a physical attack, a cyberattack, or a combination of two or three of these threats. As my testimony details, the utility industry is deploying different levels of technology to make their infrastructure stronger, more robust, more resilient, and more responsive to customer demands. Most, if not all, of these enhancements are enabled by the information and communications technology (ICT) networks built, owned, and/or managed by utilities themselves. Utilities deploy their own ICT networks to assist in storm response and recovery, manage the reliability of the Bulk Electric System[1], deploy distributed energy resources, and to enable utilities to recover from so-called catastrophic "Black Sky" events.

The Utilities Technology Council (UTC) sits at the nexus between the energy and telecommunications sectors. Established in 1948, UTC is the Washington-based global association representing electric, gas and water utilities on their needs related to the deployment of reliable and resilient ICT systems. The majority of our core members[2] are electric utilities of all sizes and ownership structures, ranging from large investor-owned utilities that serve millions of customers across multi-state service territories to smaller cooperatively-organized and public power utilities that may serve only a few thousand customers. We also represent some natural gas-only and water utilities. What our members have in common is that they all either own, maintain and/or operate extensive internal communications systems that they use to ensure the safe, reliable and secure delivery of essential electric, gas and water services. Such networks, and the technologies they empower, are critical to ensuring reliable utility service and prompt restoration.

[1] As defined by FERC, the Bulk Electric System refers to all transmission elements operated at 100 kV or higher and Real Power and Reactive Power resources connected at 100 kV or higher. This does not include facilities used in the local distribution of electric energy. https://www.nerc.com/pa/RAPA/BES%20DL/bes_phase2_reference_document_20140325_final_clean.pdf
[2] See addendum

They also enable the higher levels of granularity required to balance the electric grid as distributed energy resources and other cutting-edge technologies sought by customers become more prevalent at both the Bulk Electric System level and the edge-of-the-grid distribution level.

Utility Private ICT Networks

My written testimony this morning is focused on two central elements related to today's hearing: the criticality of utility ICT networks and how these networks support the process of returning power to the grid after a system-wide blackout. First, I will briefly detail how and why utilities build and operate their own communications networks. UTC was founded in 1948 as utilities began expanding their service territories during the post-World War II economic boom. As utility lineworkers put up transmission and distribution towers, they needed telecommunications networks—often wireless, land-mobile radio push-to-talk devices—to communicate with each other. Given the inherent dangers of working with electricity, these networks needed to be as reliable—if not more so—than the electric power systems they were building. Indeed, if a utility worker needs to know whether a power line on the ground is electrified, the only way to find out is by communicating with another worker. If that communication fails, the consequences can be life-threatening.

It is important to explain the term "private network." A utility "private network" means the utility itself owns the network, rather than it being owned by a telecommunications provider. Instead of contracting out with the telecommunications industry, utilities hired their own engineers and technicians to build out their systems themselves. There are situations where utilities do partner with the telecommunications industry for elements of their ICT networks, often by leasing lines. Additionally, most utilities use telecommunications providers for their public-facing "corporate" or "enterprise" IT network needs (websites, telephone services). While these services are important, they are not tied to the reliability of the electric, gas, or water systems. Private networks are used to support utility operational technology (OT) networks and to communicate with personnel in the field.

New Technologies/Utility 2.0

Utilities have operated private networks – including wireless and wireline communications systems – for decades. Initially, these private networks were used for voice communications, but over time, data traffic on the networks increased as utilities implemented Supervisory Control and Data Acquisition (SCADA) systems to remotely monitor and control their infrastructure. In order to support their increasing communications needs, utilities began increasing the capacity of their networks, deploying fiber and microwave radio technologies. Today, utilities use private networks for a variety of applications that help to protect the grid from faults and deliver energy and water services safely and effectively. These applications include:

- Real-time monitoring of medium and high-voltage networks
- Protective relays
- Energy management
- Outage management
- Distribution management
- Smart metering
- Substation automation[3]

Utility ICT networks are characterized by high reliability and low latency to enable utilities to monitor and control operations in real-time. For example, if there is a fault, it can be quickly isolated and power can be rerouted, thereby avoiding widespread and extensive outages and damage. At the same time, utility

[3] UTC Utility Network Baseline Report 2017

networks continue to support voice communications with personnel in the field, facilitating safe, reliable and secure energy and water operations, maintenance and restoration.

Resilience of Utility ICT Networks

Utility crews must remain in constant communication when restoring power, so their ICT networks are built to withstand and quickly respond to the most severe weather and other disasters, even when electricity is out of service across a wide area. In fact, there have been multiple occasions, including Hurricane Katrina in 2005, when commercial telecommunications providers used utility ICT networks to bring their own communications systems back online after a disruptive event.[4] A recent example of the resilience of these networks came this past March, when a powerful storm brought intense and prolonged winds to the Northeast and Mid-Atlantic. Named Winter Storm Riley, the storm left approximately 1.9 million customers without electricity between March 1-3, from Virginia all the way up to New England. The storm generated frequent wind gusts from 70-90 MPH, and the Washington area experienced sustained winds of nearly 50 MPH for nearly 12 hours.[5]

Yet utility ICT networks remained functional throughout the storm, allowing for the prompt restoration of electricity when it was safe to do so. UTC member Rappahannock Electric Cooperative, a cooperative utility serving parts of Northern and Central Virginia, experienced power outages to 71,246 customers. The storm broke 350 of its utility poles and caused $3.65 million in damages. The utility's territory faced wind gusts up to 78 MPH for nearly half a day. However, its ICT networks sustained minimal damage. Its microwave communications system had three dish antennae blown off of their directional path by the wind gusts, but overall service was not impacted.

Four "Buckets" of Utility ICT Networks

There are four main "buckets" or categories of uses for private utility ICT networks. They are: normal, day-to-day "Blue Sky" operations; hazardous weather, "Grey Sky" operations; catastrophic, unanticipated "Black Sky" events; and utility 2.0/edge of the grid, futuristic operations.

Normal, Blue Sky operations refer to the day-to-day reliable operation of a utility's infrastructure. This generally means moderate temperatures resulting in manageable load/demand expectations, with no weather, cyber, or physical incidents or emergencies. On these "normal" days, utilities use their ICT networks for a host of operations as illustrated in the list above. Even when temperatures are moderate and load is easily met, utility ICT networks are essential to the reliable operation of the grid.

These systems are even more critical in "Grey Sky" operations. Grey Sky refers to what we most recently experienced with Hurricane Florence— in which a utility faces severe weather or other incident causing widespread outages. Hurricane Florence, for example, resulted in approximately 1.9 million temporary power disruptions. Utility crews were able to communicate even when the power was out, allowing them to make repairs and restorations as safely as possible. They were able to do this because they invested extensively in back-up power for their communications towers and other communications sites.

A Black Sky event is something else entirely. Black Sky operation refers to catastrophic events compromising electric reliability and the country's collective effort to respond and restore service, possibly resulting in long-term power disruptions. The reason for such an event could be from a devastating natural disaster, cyberattack, physical attack, act of war, or a combination of incidences. The resulting impact could mean a utility is unable to restore service safely for numerous reasons, including the failure of utility ICT networks. Generally speaking, these are events in which there is little to no

[4] https://transition.fcc.gov/pshs/docs/advisory/hkip/presenters060130/p06.pdf

[5] https://weather.com/storms/winter/news/2018-03-01-winter-storm-riley-noreaster-high-winds-coastal-flooding-heavy-snow

warning, meaning government and industry do not have much time to prepare and implement restoration plans in advance.

The fourth bucket of utility ICT network use is the onset of edge-of-the-grid technologies. Distributed energy resources, smart meters, and many Industrial Internet of Things applications cannot function without ICT networks. Battery storage, rooftop and community solar and other distributed energy resources all require utility communications networks. Otherwise utilities would be unable to balance load with the appropriate resources to keep the lights on and maintain the integrity of the grid. Although these initiatives are largely within the jurisdiction of state and local regulatory authorities, they underscore the need for reliable and resilient utility ICT systems.

Blackstart

The subject for today's hearing is the ability of the utility industry to return energy to the grid after a system-wide blackout. For reference, the Federal Energy Regulatory Commission (FERC) and North American Electric Reliability Corporation (NERC) issued a May joint report called "FERC-NERC-Regional Entity Joint Review of Restoration and Recovery Plans." This report focused on "Blackstart Resources Availability (BRAv)." This report the most recent in a series of joint FERC-NERC studies into the restoration and recovery of the Bulk Electric System from a widespread, prolonged outage or blackout.[6]

Blackstart refers to specific generating units that are used to return power after a massive blackout. The May 2018 FERC-NERC study evaluated blackstart resources and planning by nine utilities subject to NERC regulations. The report notes that, while some utilities have seen a fall in the availability of blackstart resources due to retirement of blackstart-capable units over the past decade, they have identified sufficient resources in their system restoration plans, and have developed comprehensive strategies for mitigating against future loss of any additional blackstart resources.[7] In addition, the report found that the utilities have performed expanded testing of their blackstart capabilities and update and modify their system restoration plans over time.[8]

ICT Networks during Blackstart

As we have already discussed, utility private ICT networks are essential to reliable utility operations in all situations, especially during times of system restoration, repair, and recovery, including the coordination of blackstart generation units to bring power back online after massive outages. The FERC-NERC reports indicate that utilities perform regular testing of their communications systems to ensure they can operate whether faced with a powerful hurricane which could take out power for days or a crippling cyberattack. Utility crews must be able to communicate with each other no matter the circumstances to safely return electricity to the grid -- a delicate, multi-step process. If not done safely and carefully, this process could jeopardize the safety of the utility crews in the field and further damage the grid.

For example, in a June 2017 joint FERC-NERC "Report on the FERC-NERC-Regional Entity Joint Review of Restoration and Recovery Plans," the Commission and NERC worked with eight volunteer registered NERC entities to gauge how they could operate in situations where their communications are compromised during a blackout. The report envisioned a scenario of utilities losing the operation of the SCADA systems and whether and how these utilities would be able to restore service in such a state. The report found that all of the participating entities have protocols in place should this kind of event take place.

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[6] https://www.ferc.gov/legal/staff-reports/2018/bsr-report.pdf?csrt=96776892591043735

[7] https://www.ferc.gov/media/news-releases/2018/2018-2/05-02-18.asp#.W5gWE0xFwXK

[8] https://www.ferc.gov/legal/staff-reports/2018/bsr-report.pdf?csrt=96776892591043735, page 2

"Overall, the joint study team found that participants have made significant investments to help ensure their normal means of communications are available during blackout events to support the system restoration process, including taking steps to ensure expedited restoration of vital communications and data transfer systems, e.g., through implementation of Telecommunications Service Priority. However, similar to their approach for the potential loss of SCADA, all participants also prepare for the possibility that their normal means of communications may be partially or totally unavailable at some time during a restoration event through the provision of alternate and backup forms of communication."[9]

This study also found that the volunteer utilities "have multiple forms of interpersonal communications between system operators/control centers" and reliability coordinators, blackstart generators, other generation plants, field personnel, and neighboring system operators.[10]

Moreover, in its May 2018 report, FERC-NERC point to communications as a critical function of restoring service during a prolonged outage. The report again notes that utilities perform rigorous testing to coordinate their communications systems at higher levels and intervals than as required by FERC-approved reliability standards.[11]

> "For instance, prior to performing expanded testing, the transmission operator typically notifies the reliability coordinator about the date and time of the test and seeks approval for the test. In some regions, the reliability coordinator monitors the entire test. If customer outages are necessary for completing the test, the affected customers are notified prior to testing by the testing registered entity. In some regions, registered entities may also have to be mindful of the emissions restrictions imposed on the blackstart unit and, if necessary, may have to secure the appropriate permits from regulators prior to the test. During testing, transmission operators communicate with substation personnel via radios and maintain constant communications with the generator operator at the blackstart generating unit. Field personnel deployed at substations and along transmission lines periodically communicate with each other and with control center operators. One participant who has successfully performed expanded testing requires constant communication between the control center operators and field personnel performing the tests during each stage of the test. For instance, during the energizing of transmission lines, control center dispatchers provide specific instructions to substation field personnel who perform functions such as opening and closing breakers, and report back to the dispatcher.[12]"

In addition, the May 2018 FERC-NERC joint study indicated that utilities rely on SCADA systems and other ICT network tools to monitor and control voltage, current, and frequency during this testing. "Blackstart generator operators monitor voltage at the generating unit, while transmission operators monitor and control voltage at control centers via EMS/SCADA. Some participants also monitor voltage and voltage limit exceedances at substations. One participant dispatches field personnel to substations with recording equipment to monitor voltage and to ensure that voltage limits are not exceeded."[13]

Every element of the processes described above involves utility communications. Because of the critical nature of ICT networks, utilities implement extended back up power for their ICT systems and design their networks to provide diverse routing and redundant communications to ensure reliability. These high

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[9] FERC-NERC Report on the FERC-NERC-Regional Entity Joint Review of Restoration and Recovery Plans
[10] Ibid.
[11] https://www.ferc.gov/legal/staff-reports/2018/bsr-report.pdf?csrt=96776892591043735
[12] Ibid.
[13] Ibid.

standards are necessary to ensure that if utility communications are indeed compromised, they can be restarted quickly. Once operational, utilities can use their networks for the functions to restore service.

Utilities have added numerous advanced capabilities to their networks to assist in the restoration of service during prolonged outages. Although Hurricane Harvey in 2017 did not result in the need for blackstart services, the devastation posed significant other challenges to power restoration. For example, because of the incredible flooding from the storm, CenterPoint Energy used drones to help crews gain better situational awareness of the damage to their infrastructure, helping them prioritize service restoration. CenterPoint Energy used 15 drones in total, which enabled real-time updates and visuals into its service territory in the wake of the storm. Additionally, CenterPoint Energy said its smart-meter program reduced outages overall and made for more efficient recovery.[14]

Policy Implications for ICT Networks

As demonstrated, utility private ICT networks underpin the reliable operation of our nation's Bulk Electric System. Without them, reliability even on Blue Sky days would suffer, as utilities would not have timely, accurate information to balance generation and demand.

Utility communications networks consist of both wireline and wireless technologies. Depending on the size, location, terrain, and geography of a utility's service territory, along with the expense of laying fiber wirelines to these potentially remote locations, many utilities rely on wireless communications for substantial parts of their networks. Like any wireless network, utility ICT systems need radio frequency spectrum to function, and the reliability of the wireless communications can be affected by radio frequency interference. Because electricity is generated and consumed instantaneously, the electricity grid requires a delicate balance between supply and demand. This means that utility ICT networks must transmit data at high speeds to avoid power disruption. Radiofrequency interference to communications can displace and disrupt signals, potentially disabling the ability of a critical wireless transmission to reach its destination. Because of the critical nature of utility services, interference to mission-critical communications within their ICT networks is intolerable. Therefore, access to adequate and interference-free spectrum is required if these networks are to work as intended.

FERC-FCC Meetings

UTC has filed several statements for the record to this committee in various hearings it has held on FERC and related energy issues. In these statements, we have noted that spectrum policy resides at an agency outside of this committee's jurisdiction—the Federal Communications Commission (FCC). We have stated that the policies decided at the FCC directly impact utility operations which are overseen, in part, by FERC and the Department of Energy, over which this Committee does has jurisdiction.

The FCC manages spectrum policy under the Communications Act of 1934[15], which requires the FCC to manage spectrum in the public interest. In the Balanced Budget Act of 1997, Congress authorized the FCC to award spectrum through auction, although it also exempted utilities from competitive bidding of spectrum, given the importance of utility services to the country[16]. Despite this congressional requirement, the FCC has treated utilities the same as any other commercial entity when it comes to spectrum acquisition. As a result, utilities often find themselves unable to compete with other enterprises for interference-free spectrum. Spectrum is one of the key resources to private utility ICT networks, which also means spectrum is essential to the reliability of our nation's Bulk Electric System.

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[14] http://www.ercot.com/content/wcm/key_documents_lists/103998/5.3.2_CenterPoint_Energy_s_Response_to_Hurricane_Harvey_REVISED_10.12.17.pdf

[15] See Communications Act of 1934, as amended, 47 U.S.C. § 151 et seq.

[16] H. Rept. No. 105-217, Section 3002(a), (1997)

Agency Cross-Coordination Needed

FERC's regulations require electric utilities to meet stringent reliability standards in order to provide the highest levels of reliable service as demanded by the government and, more importantly, the industry's customers. Integral to the utility industry's compliance with these regulations is access to interference-free spectrum. Without access to adequate interference-free spectrum, private utility networks will not be as reliable and resilient as they are now. Yet, the FCC has pending proceedings that threaten to compromise the safety, reliability and security of utility networks. One proceeding would expand access to the 6 GHz spectrum band to unlicensed users. Many utilities use the 6 GHz band for mission-critical communications, including day-to-day reliability monitoring and emergency response. Our fear is that letting new commercial users into the band will cause interference to utility mission-critical networks.

Because spectrum policy is managed by the FCC, and because the deployment of ICT networks is interwoven into the deployment of electric service, we believe it is time to hold cross-agency and cross-jurisdictional discussions between the FCC and FERC about the growing interdependencies between the energy and telecommunications industries. Such meetings would build understanding between the two regulatory bodies and the industries they regulate. On behalf of our members, we urge the Senate Energy and Natural Resources Committee to encourage the FCC and FERC to hold regular meetings. We have also made this request to Members of the Senate Committee on Commerce, Science and Transportation, Members of the House Energy and Commerce Committee, and commissioners and staff of both FERC and the FCC.

We are aware and supportive of efforts to convene high-level discussions between the industries through the various Sector Coordinating Councils, such as the Electricity Subsector Coordinating Council and the Communications Sector Coordinating Council. The industries, along with others, are developing a Strategic Infrastructure Coordinating Council (SICC) to identify mutual priorities and develop cross-sector incident response plans.[17] We believe these discussions underscore the need for FERC and the FCC to discuss the growing interdependencies between the energy and telecommunications industries. We also urge the Departments of Energy and Commerce to embrace cross-sector and cross-agency coordination through providing forums for their agencies to interact on these topics and encourage the regulatory agencies to do so.

Conclusion

Our industry's response to Hurricane Florence demonstrates the importance of this hearing. As much as we in the industry hope that we never experience blackstart events, we still must prepare for the worst. In order to do so, many utilities own and operate their own ICT networks to manage day-to-day reliability and emergency response. Utility crews maintain these systems so they can be used even when the electricity is out, as they are essential to the restoration of utility services. These networks and the technologies they enable have benefited the public by reducing outage duration and developing stronger, more resilient and nimble utility systems. Additionally, utility networks are essential for the deployment of distributed energy resources and other edge of the grid applications. The clear and growing interdependencies between the energy and telecommunications industries require more coordination between federal agencies, and we ask this Committee and others to take a leading role to make this happen.

Thank you for this opportunity to testify this morning. I look forward to answering any questions you may have.

[17] http://www.electricitysubsector.org/ESCCInitiatives.pdf?v=1.8

ADDENDUM

UTC Core Utility Membership Snapshot
(as of Oct. 5, 2018)

<u>Investor-Owned Utilities, 57</u>

Alliant Energy	Dubuque	IA
Ameren	St. Louis	MO
American Electric Power Company, Inc.	Gahanna	OH
AVANGRID	New Gloucester	ME
Avista Corp.	Spokane	WA
Black Hills Energy	Pueblo	CO
CenterPoint Energy	Houston	TX
Central Hudson Gas & Electric Corporation	Poughkeepsie	NY
Cleco Corporate Holdings LLC	Bunkie	LA
Consumers Energy	Jackson	MI
Dayton Power & Light Company	Moraine	OH
Dominion Resources, Inc.	Richmond	VA
DTE Energy	Detroit	MI
Duke Energy Corporation	Charlotte	NC
Duquesne Light Company	Pittsburgh	PA
El Paso Electric Company	El Paso	TX
Entergy	New Orleans	LA
Eversource Energy	Berlin	CT
Exelon Corporation	Chicago	IL
Florida Power & Light Company	Miami	FL
Hawaiian Electric Company, Inc.	Honolulu	HI
Idaho Power Company	Boise	ID
ITC Holdings Corp	Novi	MI
Kansas City Power & Light	Kansas City	MO
LG&E and KU Services Company	Louisville	KY
Louisiana Generating LLC	Baton Rouge	LA

Madison Gas & Electric Company	Madison	WI
Minnesota Power	Duluth	MN
Montana-Dakota Utilities Co.	Bismarck	ND
National Grid USA Service Company, Inc.	Syracuse	NY
Northern Indiana Public Service Company	Merrillville	IN
NorthWestern Corporation	Sioux Falls	SD
NV Energy	Las Vegas	NV
NW Natural	Portland	OR
Ohio Valley Electric Corporation	Piketon	OH
Oncor Electric Delivery Company	Dallas	TX
Orange & Rockland Utilities, Inc.	Pearl River	NY
Otter Tail Power Company	Fergus Falls	MN
Pacific Gas & Electric Company	Oakland	CA
PacifiCorp	Portland	OR
Peoples TWP	Butler	PA
Portland General Electric Company	Portland	OR
PPL Corporation	Allentown	PA
Public Service Enterprise Group	Newark	NJ
Puget Sound Energy	Redmond	WA
SCANA Corporation	Cayce	SC
Sempra Energy Utilities	San Diego	CA
Southern California Edison Company	Rosemead	CA
Southern Company	Atlanta	GA
Tampa Electric Company	Tampa	FL
United Illuminating Company	New Haven	CT
Vermont Electric Power Company	Rutland	VT
Washington Gas Light Company	Springfield	VA
WEC Energy Group	Milwaukee	WI
Westar Energy	Topeka	KS
Wolf Creek Nuclear Operating Corporation	Burlington	KS

Xcel Energy Services Inc.	Minneapolis	MN

Public Power, 51

Burbank Water and Power	BURBANK	CA
Central Lincoln People's Utility District	Newport	OR
Central Nebraska Public Power & Irrigation District	Holdrege	NE
Chelan County Public Utility District No. 1	Wenatchee	WA
City of Folsom, Environmental & Water Resources Department	Folsom	CA
City Utilities of Springfield	Springfield	MO
Cleveland Utilities	Cleveland	TN
Columbia Water & Light	Columbia	MO
Conway Corporation	Conway	AR
CPS Energy	San Antonio	TX
Decatur (TX)	Decatur	TX
East Columbia Basin Irrigation District	Othello	WA
El Dorado Irrigation District	Placerville	CA
Energy Northwest	Richland	WA
Eugene Water & Electric Board	Eugene	OR
Gainesville Regional Utilities	Gainesville	FL
Grays Harbor County Public Utility District No. 1	Aberdeen	WA
Harrisonburg Electric Commission	Harrisonburg	VA
Huntsville Utilities	Huntsville	AL
JEA	Jacksonville	FL
KCK Board of Public Utilities	Kansas City	KS
Kitsap County Public Utility District No.1	Poulsbo	WA
Lakeland (FL)	Lakeland	FL
Lincoln Electric System	Lincoln	NE
Los Angeles Department of Water & Power	Los Angeles	CA
Lower Colorado River Authority	Austin	TX
Memphis Light, Gas & Water Division	Memphis	TN
Modesto Irrigation District	Modesto	CA

Nashville Electric Service	Nashville	TN
Navajo Tribal Utility Authority	Fort Defiance	AZ
Nebraska Public Power District	York	NE
New York Power Authority	White Plains	NY
North Attleborough Electric Department	North Attleborough	MA
Omaha Public Power District	Omaha	NE
Orlando Utilities Commission	Orlando	FL
Platte River Power Authority	Fort Collins	CO
PREPA Networks	Guaynabo	PR
Regional Water Authority	New Haven	CT
Sacramento Municipal Utility District	Sacramento	CA
Salt River Project	Tempe	AZ
Santee Cooper	Moncks Corner	SC
Silicon Valley Power	Santa Clara	CA
Snohomish County Public Utility District No. 1	Everett	WA
Soquel Creek Water District	Capitola	CA
South Feather Water & Power	Oroville	CA
South Florida Water Management District	West Palm Beach	FL
Sweetwater Utilities Board	Sweetwater	TN
Tacoma Power - Utility Technology Services	Tacoma	WA
Tripp County Water User District	Winner	SD
Turlock Irrigation District	Turlock	CA

Cooperative Utilities (Distribution)

Access Energy Cooperative	Mt. Pleasant	IA
Allamakee-Clayton Electric Cooperative, Inc.	Postville	IA
Bandera Electric Cooperative, Inc.	Bandera	TX
BARC Electric Cooperative	Millboro	VA
Barry Electric Cooperative	Cassville	MO

Berkeley Electric Cooperative, Inc.	Moncks Corner	SC
Blue Ridge Electric Membership Corporation	Lenoir	NC
Brunswick Electric Membership Corporation	Shallotte	NC
Callaway Electric Cooperative	Fulton	MO
Cass County Electric Cooperative	Fargo	ND
Central Florida Electric Cooperative	Chiefland	FL
Citizens Electric Corporation	Perryville	MO
Clay Electric Cooperative Inc.	Keystone Heights	FL
Colquitt Electric Membership Corporation	Moultrie	GA
CO-MO Electric Cooperative Inc.	Tipton	MO
Consolidated Electric Cooperative, Inc. (OH)	Mount Gilhead	OH
Consumers Power Inc.	Philomath	OR
Delta-Montrose Electric Association	Montrose	CO
Diverse Power Inc.	LaGrange	GA
Dixie Electric Power Association	Laurel	MS
Dixie Power	Beryl	UT
Douglas Electric Cooperative, Inc. (OR)	Roseburg	OR
Duck River Electric Membership Corp.	Shelbyville	TN
Escambia River Electric Cooperative	Jay	FL
Excelsior Electric Membership Corporation	Metter	GA
Flathead Electric Cooperative Inc.	Kalispell	MT
Forked Deer Electric Cooperative	Halls	TN
Gascosage Electric Cooperative	Dixon	MO
Gibson Electric Membership Corporation	Trenton	TN
Habersham EMC	Clarkesville	GA
Holston Electric Cooperative	Rogersville	TN
Idaho County Light & Power Cooperative Association, Inc.	Grangeville	ID
Illinois Rural Electric Cooperative	Winchester	IL
Joe Wheeler Electric Membership Corporation	Trinity	AL

Johnson County Rural Electric Membership Corporation	Franklin	IN
Kenergy Corp.	Owensboro	KY
Lake Region Electric Cooperative, Inc. (OK)	Hulbert	OK
Lyon Rural Electric Cooperative	Rock Rapids	IA
Meriwether Lewis Electric Cooperative	Centerville	TN
Mid-Carolina Electric Cooperative	Lexington	SC
Mid-South Synergy	Navasota	TX
Midwest Energy Cooperative	Cassopolis	MI
Midwest Energy, Inc.	Hays	KS
Northern Electric Cooperative (SD)	Bath	SD
Northern Neck Electric Cooperative	Warsaw	VA
Northern Virginia Electric Cooperative	Manassas	VA
Owen Electric Cooperative Inc.	Owenton	KY
Ozarks Electric Cooperative	Fayetteville	AR
Parke County Rural Electric Membership Corporation	Rockville	IN
Pedernales Electric Cooperative	Johnson City	TX
Pennyrile Rural Electric Cooperative	Hopkinsville	KY
Plumas-Sierra REC	Portola	CA
Ralls County Electric Cooperative	New London	MO
Rappahannock Electric Cooperative	Fredericksburg	VA
Richland Electric Cooperative	Richland Center	WI
Salem Electric	Salem	OR
San Bernard Electric Cooperative	Bellville	TX
San Luis Valley Rural Electric Cooperative	Monte Vista	CO
Sequachee Valley Electric Cooperative	South Pittsburg	TN
South Central Arkansas Electric Cooperative	Arkadelphia	AR
South Central Indiana REMC	Martinsville	IN
South Plains Electric Cooperative	Lubbock	TX
Southern Illinois Power Cooperative	Marion	IL
Talquin Electric Cooperative, Inc.	Quincy	FL

Tri-County Electric Cooperative (OK)	Hooker	OK
United Electric Cooperative (MO)	Savannah	MO
Warren Rural Electric Cooperative Corporation	Bowling Green	KY
West River Electric Association, Inc.	Wall	SD
Woodbury County Rural Electric Cooperative	Moville	IA
Mille Lacs Electric Cooperative	Aitkin	MN

Cooperative Utilities, Generation & Transmission

Arizona Electric Power Cooperative	Benson	AZ
Arkansas Electric Cooperative Corp.	Little Rock	AR
Basin Electric Power Cooperative	Bismarck	ND
Brazos Electric Power Cooperative, Inc.	Waco	TX
Buckeye Power Inc.	Columbus	OH
Central Electric Power Cooperative (MO)	Jefferson City	MO
Central Iowa Power Cooperative	Cedar Rapids	IA
Chugach Electric Association Inc.	Anchorage	AK
Corn Belt Power Cooperative	Humboldt	IA
Dairyland Power Cooperative	LaCrosse	WI
East River Electric Power Cooperative	Madison	SD
Georgia System Operations Corp.	Tucker	GA
Great River Energy	Maple Grove	MN
Hoosier Energy Rural Electric Cooperative	Bloomington	IN
Kamo Power	Vinita	OK
M & A Electric Power Cooperative	Poplar Bluff	MO
Minnkota Power Cooperative, Inc.	Grand Forks	ND
New Horizon Electric Cooperative	Laurens	SC
Northeast Missouri Electric Power Cooperative	Palmyra	MO
Northwest Iowa Power Cooperative	Le Mars	IA
PowerSouth Energy Cooperative	Andalusia	AL

Rushmore Electric Power Cooperative	Rapid City	SD
South Texas Electric Cooperative	Nursery	TX
Sunflower Electric Power Corporation	Garden City	KS
Tri-State Generation and Transmission Association, Inc.	Denver	CO
Wabash Valley Power Association	Indianapolis	IN
Western Farmers Electric Cooperative	Anadarko	OK
Wolverine Power Cooperative, Inc.	Cadillac	MI