1. How can redundancy in grid transmission lead to grid resilience? What is Congress's role in improving or increasing transmission? Please provide insight on both regional transmission and interregional transmission.

Transmission facility redundancy (redundancy), in most cases, provides increased grid resiliency because it allows flexibility in system restoration during system events which can include weather and equipment failures. In addition, redundancy allows the grid operator the ability to reconfigure transmission power flows during maintenance of existing transmission assets or commissioning of new transmission assets. Redundancy also increases the nation's physical and possibly cyber security postures for the grid by enhancing its robustness to withstand such attacks while continuing to supply power. Finally, redundancy (a) enables the proper functioning of power markets and (b) could decrease the likelihood of large spikes in wholesale power prices due to the unavailability of sufficient transmission capacity.

With respect to Congress's role in improving or increasing transmission, Congress should avoid expanding FERC jurisdiction over rural electric co-ops; socializing the costs of building transmission facilities; and establishing a minimum interregional transfer capability. Congress could consider directing DOE to assign additional weight to the project if it were included in a regional transmission plan for purposes of regional transmission cost allocation under the regional transmission planning and cost allocation process required by FERC Order No. 1000.

2. Congressional mandates on physical security measures aren't a cost-effective or permanent solution. What physical security measures have been successful in the past? What is currently recommended for substations now?

Protecting America's electric grid from cyber and physical threats is a top priority for the nation's 900 electric cooperatives and their communities. Rural electric cooperatives are member-owned, not-for-profit, and formed to provide safe and reliable electric service to their member-consumers at the lowest reasonable cost. They are committed to securing the delivery of electricity to homes and businesses across the country.

The electric sector is currently subject to a mature and evolving security regiment for cyber and physical incidents crafted through a deliberate, industry-driven process that is vital to enhancing the security posture of the electric grid. These standards, known as The North American Electric Reliability Corporation (NERC) Critical Infrastructure Protection (CIP) standards, establish requirements for the identification and protection of critical assets, detection and response to security incidents, personnel and training, and physical security measures.

The electric sector employs risk-based, layered defense strategies to implement these standards and protect critical assets which include power plants, transmission infrastructure, and substations and distribution lines. Electric cooperatives conduct a comprehensive security risk assessment to understand their risks and vulnerabilities and identify tailored security measures to address the specific identified risks. Security solutions can vary across an electric cooperatives system and the most effective protective measures take into account each asset's unique risk profile, surrounding geography, location, or system criticality. Some successful measures may include fencing, access controls, lighting, barriers, and hardened critical equipment.

Additionally, information sharing, and public-private partnerships play a vital role in deterring and preventing attacks on the electric grid. Sharing insights about emerging threats, vulnerabilities, and attack patterns enables a collective, proactive response. It allows utilities to stay ahead of potential threats, fortify their defenses, and respond effectively in the event of an attack. By fostering a culture of information sharing, electric cooperatives safeguard the reliability of the electric grid, ensuring the uninterrupted delivery of power to our communities.

Securing the electric grid against physical and cyber threats is paramount to our nation's security and economic well-being. Electric cooperatives' strategies for ensuring the reliability and security of the electric system are continuously evolving with the threat landscape. We cannot stop a storm or predict every possible disruption but by working together we do everything in our power to keep the lights on and our members protected.

3. One issue revealed following the Moore County attack was the length of time it takes to get parts necessary to repair a station. [A)] How do we mitigate supply chain challenges that may keep communities in the dark after grid failures? [B)] What happens if the parts you need to replace critical energy transmission infrastructure are not available?

A) Although the attack in Moore County was directed at a Duke Energy substation, rural electric cooperatives in the area were also affected, including over 2,700 Randolph Electric Membership members who lost power. The Asheboro-based co-op immediately responded by dispatching crews to assess the damage and craft a plan to restore service to members as quickly as possible. The damaged transmission equipment fed into Randolph's Eastwood substation and Seven Lakes substation. Co-op crews, aided by mutual aid personnel and contractors from the surrounding areas, responded immediately and began building more than two miles of new lines to connect the co-op's de-energized lines to available power supplied from other locations. The timeline enabled the co-op to restore service to members on a rolling basis due to power constraints at the time. Thankfully, Randolph had sufficient equipment in reserve to quickly rebuild the electric infrastructure necessary. But a more widespread and coordinated attack could have overwhelmed reserves of transformers, poles, conductor and other equipment, causing the power outages to extend far longer.

   Lawmakers can assist utilities and rural electric cooperatives mitigate supply chain challenges affecting critical grid infrastructure in a number of ways. First, electric cooperatives would encourage Congress to enact targeted workforce funding for grid infrastructure manufacturing that will help ensure a readily available supply of components needed to keep the lights on in America's rural communities. The U.S. Senate Appropriations Committee has passed $1.2 billion dollars in repurposed supplemental funding in response to requests made by the electric sector and others to assist with this workforce assistance, and we encourage this funding to be enacted without delay. Congress is also providing critically important oversight over rules and regulations proposed by the Department of Energy that may diminish the availability of critical grid components, such as distribution transformers.

B) Electric cooperatives operate under a set of principles that emphasize cooperation among cooperatives and concern for the community. These underlying principles guide the actions cooperatives take before and during an emergency event or outage.

When critical electrical components are not available during an outage, electric cooperatives must take action to address the situation and restore power as quickly and safely as possible. The exact course of action will depend on the nature and scale of the outage, the availability of resources, and the policies and procedures of the individual electric cooperative.

Before an event, cooperatives strive to maintain a well-organized, redundant inventory of spare parts and critical components ahead of outages to ensure quick restoration of power. If the critical components are not available in their own inventory, cooperatives will explore alternative sources for the required components. This may involve working with other cooperatives or utilities in the area, manufacturers, or suppliers to acquire the necessary components. In some cases, electric cooperatives may need to engage in emergency procurement to quickly acquire the needed components. This could involve fast-tracking orders, working with suppliers to expedite deliveries, or making use of existing emergency procurement contracts.

During a prolonged event, cooperatives may implement temporary fixes or workarounds to restore power until the required components become available. If the event is severe enough to warrant a federal disaster declaration, the Electric Cooperative Mutual Assistance may be activated to aid, prioritize restoration activities, and coordinate and dispatch crews, equipment, and materials.

4. How do you think North Carolina can better leverage innovative energy technology, like microgrids, in the face of grid failures? Could this improve the time it takes to get a substation back online?

North Carolina's rural electric cooperatives have long been leaders in the development of microgrids to help provide greater resiliency and keep electricity affordable and reliable. A microgrid can improve system reliability by generating their own power to avoid prolonged and rotating blackouts during and after storm events. In addition, microgrids connect to the main grid to supplement and diversify power resources and serve as a resource that can be called on during times of peak demand. They also help reduce power supply costs by providing an alternative source of power generation and storage.

North Carolina's electric cooperatives have four active microgrids, with one more in development. These microgrids provide a learning opportunity that will help discover future uses for microgrids and their components – including improving the time it takes to get a substation back online.

Ocracoke Island: The Ocracoke Island microgrid, located on North Carolina's Outer Banks, began operation in February 2017. North Carolina's Electric Cooperatives developed and installed the microgrid in partnership with local cooperative Tideland EMC. Ocracoke Island's remote location leaves it vulnerable during weather events and isolated from central power generation sources. The microgrid will support better power reliability for the island, serve as a resource that can be called on during times of peak demand and allow for the testing of system components to discover future uses. The microgrid components include a controller, solar panels, battery storage, internet-connected smart thermostats, water heater controls and a diesel generator.

Butler Farms Microgrid: The Butler Farms microgrid, located in Lillington, NC, is a microgrid project that integrates components owned by North Carolina's Electric Cooperatives with resources owned by the farm and seeks to incorporate alternative energy sources, including biogas, solar and battery storage. The farm has existing generation used to support its power needs during times when service has been interrupted, and it also sells power produced from renewable sources, including swine waste and solar, to its electric cooperative, South River EMC. The microgrid became operational in February 2018. The goal of this project is to learn more about how a microgrid located on a member's property can be incorporated into the electric cooperatives' distribution system, and it also serves as a case study for the ways agribusiness and utilities can work together to develop solutions that are mutually beneficial and support both industries, as well as quality of life in North Carolina's communities.

Components of this microgrid include the controller, solar panels, a Samsung battery, biogas generation and a diesel generator. The microgrid is also being used as an educational resource for local students and teachers.

Heron's Nest: Located in the eastern North Carolina community of Shallotte and developed in partnership with developer The Adams Group and local electric cooperative Brunswick Electric, Heron's Nest is the state's first residential microgrid. Once fully operational, the site's 30-plus homes will be equipped with solar panels, demand response water heaters, demand response ecobee programmable thermostats and an option for electric vehicle charging. Energy efficient and sustainable features are incorporated throughout building materials. A portion of the neighborhood is dedicated to a larger community solar array with battery storage.

The community is made up of interconnected loads and resources connected to the main electric grid. On a typical day, residents will obtain power from the main grid, supplemented by power from their solar panels and the community solar array. However, should the connection to the main grid become unavailable — after a storm, for example–the residents will benefit from continued solar power as well as the battery backup system. In addition, the demand response thermostats and water heaters can be controlled by the local electric cooperative to make more power available to the system during that time, as well as during periods of high demand.

Eagle Chase: Eagle Chase is another residential microgrid being developed by North Carolina's Electric Cooperatives in Youngsville, NC in partnership with builder Winslow Homes and local electric cooperative Wake Electric, with the goal of providing enhanced electric service reliability and resiliency, as well as reducing peak electricity costs. The microgrid will be able to support the neighborhood for up to 36 hours during outages and will also remain connected to the main grid during normal operations to provide power diversity and increased reliability. The Eagle Chase microgrid will include a single 300-kilowatt propane powered electric generator and a 1 megawatt-hour/500 kW Tesla PowerPack battery system. North Carolina's Electric Cooperatives will own the battery and the microgrid controller that brings the various components together. The microgrid will also integrate smart water heater controls for each home that will help reduce peak demand for power. Wake Electric is offering a rebate for the installation of electric water heaters in each house, and the garage of each home will also be pre-wired for electric vehicle charging.

Rose Acre Farms: North Carolina's Electric Cooperatives are partnering with Hyde County egg producer Rose Acre Farms and its local electric cooperative, Tideland EMC, to develop an agricultural microgrid that will deliver a variety of benefits to the farm and surrounding community, including enhanced environmental sustainability and power grid resiliency. The project will integrate solar energy and battery storage and other components owned by North Carolina's Electric Cooperatives with resources owned by the farm to create a microgrid that is capable of generating its own electricity during times of power loss. It will also be connected to the main grid to help improve reliability and resiliency.

The first phase of the project will include the installation of a 2 MW solar array, and a 2 MW battery energy storage system, which allows energy generated by the panels to be stored and dispatched when needed. The solar production is expected to offset about a third of the energy consumed by the farm. The second phase of the project will add a microgrid controller that manages existing emergency backup diesel generators and all the other components to evolve the project into a full microgrid.