Grid modernization to support clean energy	*What are the key grid upgrades or investments needed to enable greater adoption of clean energy by customers and utilities while maintaining affordability for ratepayers and reliability?*

1. Briefly describe the nature of this policy tension/question - What is happening?

Transformation of the electric power system to a system powered by high levels of clean fuels requires integrated planning of technology adoption so as to occur at high speed and in a way that exploits demand flexibility, high potential for energy efficiency, and the low cost of renewables to offset costs of equipment modernization. Whereas supply and load balancing already is executed as a system level function, traditional power system management structures do not provide

- a mechanism for successful management of a rapid and extensive grid technology transformation
- pricing signals that reflect environmental costs
- incentive structures that could drive participants to choose efficient transformational actions

Optimal engagement of renewables and complementary grid and usage technology will require transparency in planning. Likewise, operational effectiveness under conditions of 2-way power-flow will require a significant increase in availability of transmission and distribution data to enable monitoring, control, and system protection.

Challenges for grid modernization include decisions about the scale (utility or smaller scale) of renewable generation most efficiently supported while meeting goals for resilience, and determining who pays and who benefits from necessary investments.

2. To what extent does this policy tension exist in NC + why is it relevant to the state?

The challenges outlined in question 1 are relevant to us. However, relative to states with high levels of consumer level renewables, NC has the capacity to move forward with consumer-level assets but is faced with the challenge in short order of adopting a strategy for successfully exploiting significant availability of large, utility scale solar deployment. This scale of deployment is more readily known and amenable to central management than DERS which in general requires distributed control. However, NC also needs policies that encourage implementation of distributed resource management so that communities in monopoly territory, as well as large corporate campuses, and communities in coops can benefit from stable implementations of smaller scale DER..

3. What policy or regulatory action might be required to address the tradeoffs you see? What entity would need to take the action you've identified?
    - Creation of a working group to evaluate:
        - Feasibility of new incentive structures for suppliers, consumers, and technology providers
        - Framework for transparent analysis and decision making
        - Technical framework for real time asset management and situational awareness
        - Alternate cost recovery and/or incentives for utilities and third parties to invest in grid upgrades and renewable sources

- Interconnection rules to facilitate higher levels of distributed resources

Ultimately the balance between affordability and ensuring grid reliability in the face of increased clean energy adoption will likely come before the North Carolina Utilities Commission (NCUC) as it considers cost recovery for investments made by utilities or requirements for interconnection that involve new grid upgrades or investments needed to manage grid instability. Many states have created incentive structures for utilities or interconnected resources to deliver solutions to the grid instability problems resulting from incompletely managed intermittent generation. hile there are no fully established frameworks for assessing the appropriateness of stability solutions, our utility commission could be charged with requesting proposals for solutions and having them evaluated by independent industry professionals.

4. How are people in other places responding to this tension? What are the most innovative and promising solutions? Do they seem feasible in NC?

According to the NC Clean Energy Technology Center's The 50 States of Grid Modernization: Q1 2019 Quarterly Report: "Over half of U.S. states are currently examining these regulatory frameworks or actively working to deploy advanced grid technologies. This activity is expected to continue, as states and utilities conduct studies, try new approaches, and learn from one another about how best to achieve the many benefits of a more modern grid."

In terms of incentives to encourage clean energy developers to invest in storage or other technologies to address clean energy intermittency, California Rule 21 is the ruling from the CA PUC that covers distributed energy resources interconnection requirements for utilities including technical standards and tariffs. Each of the IOU's in CA have their own tariff to cover the implementation of Rule 21 in their territory. The latest updates have included requiring smart inverters and communication standards to better enable the integration of DER's.

5. Are there ways you think NC should consider responding to this tension? What entity would need to take the action you've identified?

Beyond the policy or regulatory actions mentioned above, NC should be aware of all the technologies available today to ensure grid reliability in the face of increased clean energy adoption. While this is not an exhaustive list, some current technologies include battery storage, electric vehicles, demand response, energy efficiency, smart inverters, and system-wide grid investments. System-wide grid investments were noted in NC DEQ's 2018 *Energy Policy Council Biennial Report* as "distribution automation, which is the addition of smart switches that enable fault location, isolation, and restoration; new distribution monitoring and data gathering systems (e.g., Supervisor Control and Data Acquisition) (SCADA)); and two-way communications to intelligent energy devices (IED) on the distribution grid." The Biennial Report also noted, "Each new system generates orders of magnitudes of new data that can be analyzed and interpreted."

NC also has world-class research institutions, which can be leveraged to push for new technological solutions that are increasingly affordable. Private companies in the Research Triangle Park, Charlotte and elsewhere throughout the state can also be consulted for technical solutions to these challenges.

APPENDIX: References

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