June 8, 2016

Shared Perspectives
of the
North Carolina Electric Utility of the Future Steering Team

Our mission

The North Carolina Electric Utility of the Future mission is to develop a framework for new electric utility and service provider business models to be successful in the environment of a 21st century electric system, including:

- Enabling innovative technologies and business models to serve evolving customer needs
- Identifying the values, costs, constraints, and obligations that a modern electric system must recognize
- Crafting incentives for utilities, consumers, and energy service providers that encourage rational individual choices leading to overall system benefits
- Supporting the economic development of North Carolina and positioning the State as a leader in the energy space

This white paper expresses our shared perspectives on the current and future electrical system and some high-level recommendations on a path forward. Our goal is to provide a framework for State leaders and facilitate a public conversation on the topic of the utility of the future. We urge readers to engage in this discussion with us and to help enact the recommendations below. By acting now, we can position North Carolina as a leader in energy and promote the prosperity of our State and its people.

Our challenge

The drivers of the 20th century grid be reexamined for the 21st century

Over the last century, strong growth in electric consumption and economies of scale necessitated investment in large, central, long-lived generating assets. These delivered electricity, as a commodity, to consumers through a one-way transmission and distribution system. This paradigm defined the business, policy, and regulatory environment for electric utilities, but is challenged today by a combination of technological and behavioral factors.

New technologies change the way the grid operates

Significant improvement in the economics of generating technologies such as solar, microturbines, and fuel cells have made bi-directional power flows a practical reality, potentially creating grid integration challenges for these distributed energy resources. New demand response technologies adopted from other industrial sectors, including energy storage, advanced computing technology, smart appliances, and wireless communications, both enable and require much more decentralized, flexible and sophisticated energy management and dispatching systems.

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Peak demand is growing faster than total energy use

The average annual growth in electricity consumption in the United States has slowed from 9.8% per year in the 1950s to 0.5% per year over the past decade. Contributing factors include slowing population growth, market saturation of major electricity-using appliances, efficiency improvements in appliances, and a shift in the economy toward a larger share of consumption in less energy-intensive industries. The Energy Information Administration forecasts 0.8% annual growth in U.S. electricity consumption through 2040, although some states, such as North Carolina with its growing population and attractiveness for industry, will likely see consumption grow faster. While growth in average electrical energy consumption appears to be tapering, power demand (the peak electrical power needed at a particular point in time) continues to grow, placing more stress on the grid and increasing the need for capital investment or behavioral changes to avoid grid events such as blackouts or brown outs.

The existing electrical system is aging and needs updating

The aging base of existing infrastructure assets that has served us well for decades requires renewal for continued reliability; but the shifts described above, along with consumer desire for a larger variety of electric products and service models, mean it is unclear exactly what kinds of investments should be made, who should make them, and what business models will support them. The answers to these questions are critical for the long-term competitiveness and dynamism of our State economy in the 21st century, just as affordable, reliable electricity was a key driver of our State's growth story in the 20th century.

Shared Perspectives and Recommendations

Consumer options

- Consumers are asking for an increasingly diverse set of electricity-related products and services, requiring changes in the current construct for utilities and regulators.
  - While some consumers emphasize their desire for simplicity, others want a greater degree of choice and control over their electricity service.
  - The economic viability of information technology infrastructure and distributed energy resource (DER) technologies create more options for consumers to exchange information and energy with the electric grid in increasingly sophisticated ways.
  - Electricity service products should be customizable at the consumer level and responsive to changing demands; regulatory processes will need to be updated to support this.
  - Aggregation of consumers into traditional rate classes is inadequate as "similarly situated" customers can exhibit increasingly heterogeneous usage of energy products and services.
  - Utilities will need to accommodate an increasing number of consumers with self-generation, storage, or demand response capability, providing a means for customer-owned resources to be constructive components of the energy system.

  - Likewise, utility customers who elect to own distributed energy resources will need to accept the safety and power quality responsibilities and liabilities that come with the potential benefits of ownership and operation of such resources.
- Utility system planning processes must evolve to incorporate the increasingly diverse characteristics of customer-owned DER.
  - Utility planning must evolve at the pace of the increasing penetration of customer owned resources
  - Short-term (<1 year) forecasting methods must anticipate customer dispatching decisions for energy storage and demand response.
  - Long-term (>1 year) forecasts must anticipate changing customer behavior and investment in new DER systems under various scenarios.
  - Utility planning should accommodate DER systems and create value by optimizing customer and system benefits:
    - Providing increased data for customers, enabling customers who own DER systems to effectively and independently manage those systems, if desired.
    - Increasing capabilities to manage utility-owned DER systems and some customer-owned systems.
- Utility operations must similarly evolve to adapt to customer dispatching behavior and intermittent resources.

Pricing reform

- Electricity pricing structures must change to become more compatible with the ways people will generate and consume electricity in the future and fairly reflect the cost and value of electricity services.
  - The incremental cost of electric service is highly variable depending on the place and time the energy is generated or consumed
  - Likewise, embedded infrastructure costs of electric service are a factor in the overall costs of electric service.
  - Fair pricing must align with proper allocation of these (incremental and embedded) costs, and promote efficient investments, energy production, and consumption.
  - More granular rate structures and personalized programs will allow utilities to address local infrastructure and time-dependent impacts of electricity consumption and DER contributions to the electric system.
  - Consumers should have more product choices available that enable them to customize the type and level of their electrical services.
  - Electric utilities currently bear certain electricity cost risks, while consumers are (directly or indirectly) exposed to others, including fuel commodity costs and weather. Tariffs and other financial vehicles that enable users to customize their risk exposure to electricity costs should be encouraged.
  - New technologies enable individuals and communities to take more active roles in responding to incentives and in deciding how to participate in a grid-connected electrical system.

- The proposed changes involve a significant reimagining of price structures and utility-customer relationships, therefore the process of change should:
  - Engage and educate consumers about the transition, and do so at varying levels of need to satisfy individual energy users.
  - Implement new pricing systems over time and/or in geographic phases to enable learning and course correction in response to unintended consequences.
  - Be designed for inherent adaptability – pricing *systems* should remain stable even though prices themselves, along with technologies, consumer preferences, and grid infrastructure will evolve.
  - Establish "default" options different from the status quo to accelerate transitions.
  - Maintain economic competitiveness for North Carolina as a significant consideration in price reform.
  - Consider protections for financially vulnerable populations, including models to enhance their participation as well as non-rate mechanisms to support a transition.

Electric utility policy and regulatory reform

- The transition to the electric utility system of the future will require new data and communications infrastructure, experimentation, and innovation. Regulators and policy-makers should support prudently-incurred utility investment in these areas.
  - Widespread rollout of advanced metering infrastructure (AMI) is a prerequisite to achieve the system benefits promised by the electric utility of the future, and regulators should strongly consider these benefits when evaluating investment cases for AMI.
  - In addition, technologies for the planning, integration, and management of DER will also be necessary to fully capture the benefits of the utility system of the future.
  - Accelerated obsolescence of the increasingly IT-driven distribution infrastructure suggests shortening the depreciation lives of many existing and new distribution assets.
  - Cost recovery alone is generally an insufficient motivator for undertaking innovation, which typically requires the assumption of risk. Regulators and policy-makers should consider alternate compensation mechanisms to create incentives for innovation that reward customers as well as utilities.
- Customers value (and are willing to pay for) a broad range of energy service attributes, and utilities and regulators should be encouraged to service these customers with novel offerings, tariffs, and financing vehicles in ways that do not promote cost-shifting
- Traditional cost recovery models may become limiting in the transition to the electric utility system of the future, and enhancements and alternatives should be considered. Mechanisms including decoupling, performance-based ratemaking, earnings banding, and the use of multiple forward planning test years are examples of such adaptive recovery models.

Who we are

The North Carolina Electric Utility of the Future (NCEUF) Steering Team was convened two years ago under the joint sponsorship of E4 Carolinas and the Energy Production and Infrastructure Center (EPIC) at UNC Charlotte. Conceived as an interdisciplinary body of experts to deliberate and elucidate these issues, provide guidance to State leaders, and facilitate a public conversation on the topic, the Steering Team includes executives from North Carolina investor-owned and electric cooperative utilities, renewable energy and energy efficiency executives and advocates, former utility regulators and government energy officers, and experts in energy economics, engineering, law, and electrified transport.

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