Georgia Tech | Energy Policy and Innovation Center

Distinctive Characteristics and Strategies for a Energy Partnership to focus on the Southeast Region

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This overview underscores distinctive regional characteristics that form the bases and potential focus areas of an interdisciplinary energy center focused on Southeast Regional issues. The purpose of this list is not to highlight all energy technologies of relevance to the Southeast, or even all important energy technologies, but rather to highlight energy areas that are simultaneously relevant to the region and nationally distinctive. Such a center would support other public-private objectives toward accelerating the deployment of clean energy regionally, nationally and internationally.

- **Energy Sources, Generation and Carbon Intensity in the Southeast:** The electricity matrix in the southeastern U.S. is diverse, flexible, and increasingly low carbon. A significant regional differentiator is the presence of large, vertically integrated regulated utilities, with increasing consolidation in the electricity and natural gas markets. These utilities have strong histories of partnership with research institutions, such as universities, national labs, and EPRI. Distinct characteristics and recent trends include the following:
    - **Nuclear Power**: Nuclear accounts for approximately 25% of the region's electricity compared to 20% nationally. Nuclear power plants in GA and SC are slated to come online by 2020 and represent the first new nuclear power plants to be permitted since 1979. The region is also leading advanced nuclear reactor technology development, as well as the Consortia for Advanced Simulation of Light Water Reactors (CASL). The Institute of Nuclear Power Operations (INPO) is similarly headquartered in Atlanta, GA.
    - **Natural Gas**: Natural Gas derived electricity accounts for 30% of the region's power, and since 2010 has grown at 27%, *double the national rate*. In fact, 28% of all US natural-gas derived electricity was generated in just seven southeastern states (AL,FL,GA,MS,NC,SC,TN). Major gas turbine R&D and manufacturing activities are present in the region, as also described in Sec. 2.
    - **Photovoltaics (PV)**: With a rich resource base of solar energy, the share of electricity from PV in the Southeast grew at a rate in excess of 1100% between 2010 and 2014, as a result of both distributed and utility scale projects. Further, critical implementation tools have been pioneered in the region, including grid integration of renewables **and** comprehensive techno-economic analyses of renewable resource additions. Moreover, Suniva Corp. based in Norcross, GA, is the largest US-borne manufacturer of photovoltaics.
    - **Carbon Capture and Sequestration (CCS)**: The Southeast has taken an active role in RD&D initiatives related to CCS. The Southeast is home to the National Carbon Capture Center, major national demonstration plants capable of carbon capture from both gasification and pulverized coal (Kemper IGCC and Barry plants respectively), and a host of utility and university-led carbon capture research and demonstration efforts, including one DOE EFRC.
    - **Biofuels/Bioenergy**: The region boasts abundant biomass resources (woody feedstocks and agricultural residue), and is active in bioeconomy/bioproducts initiatives. It is home to substantial R&D in advanced biofuels via thermochemical & biochemical pathways. Bioenergy accounts for up to 3.3% of the region's electricity, compared to 1.6% nationally.

- **Electric Grid and Energy Utilization:** The Southeast is actively modernizing its grid and is pioneering novel load reduction initiatives involving time-of-use pricing and direct load control. Given its

climate and geographic location, the Southeast has also been successful at implementing nationally directed efficiency initiatives involving weatherization, smart meters, energy star and LEED building programs. Significant differentiating attributes include the following:

- **Energy Intensive Industry and Manufacturing**: The Southeast has dominated the "reshoring" trend for manufacturing, particularly with regard to energy (e.g., GE, Siemens), aerospace (Boeing, Airbus), and automotive sectors (e.g., Toyota, Mercedes, BMW, Honda, Hyundai). For example, GE, Siemens, MHI, and Alstom have invested roughly $1B in the region in major advanced R&D and manufacturing facilities for advanced gas turbines. Similarly, the region is home to the largest concentration of pulp and paper in the country, as well as significant manufacturing leadership in the textile, carpet and chemical industries. Companies headquartered in the Southeast are proactively collaborating from a host of sectors including home improvement, financial services, and transportation.
- **Grid Modernization and Energy Storage**: Consistent with national efforts, the Southeast is home to several critical grid modernization projects and major testing facilities/consortia (e.g., National Electric Energy Testing, Research, and Applications Center, or the Duke Energy eGrid facility). Engaging the major utilities in the region, including Southern Company, Duke Energy, and TVA, Grid modernization projects include transactive load control strategies for distribution and buildings, distributed PV Impacts, and predictive analytics for systems risks.

- **Nationally Leading Cross-cutting themes:** The Southeast has differentiating capabilities in several crosscutting areas that should be leveraged:
  - **Research Development and Deployment (RD&D)** of key technologies. The region is home to two national labs, several major research universities, and a major office of the Electric Power Research Institute (EPRI). A number of nationally leading DOE hubs, DOE EFRC's and NSF ERC's in energy-critical areas are centered in the region.
  - **Industrial Big Data and Analytics.** The Southeast has probably the largest global concentration of corporate facilities that are aggregating, analyzing, and remotely monitoring/controlling major energy infrastructure. For example, GE's Georgia-based facility performs real time monitoring and analysis of over 750 power plants globally, over 330 GW of capacity. Similarly, NextEra Energy, one of the country's largest operator of wind turbines (110 wind farms with 12 GW of capacity), remotely monitors and manages health and performance of this fleet from its Florida facility. Siemens Energy, Mitsubishi Heavy Industries, EPRI, and several other Utilities (e.g., Southern Company, Duke Energy,) have similar fleet analytics facilities located in Florida, Alabama, and N. Carolina. Finally, the NSF Southeast Big Data Hub has a distinct "spoke" that focuses on industrial infrastructure, such as the electric grid and power plants.

- **Significant Additional Regional Opportunities.** A number of significant demonstration and deployment opportunities exist in which national objectives can be deepened and accelerated via southeastern regional efforts. These areas include:
  - **Large Scale and distributed Energy Storage**
  - **National gas based distribution generation, including fuel cells**
  - **Low speed wind development**
  - **High voltage DC power development**
  - **Microgrids**
  - **Community Solar**