Texas A&M Engineering Experiment Station
Smart Grid Center

About the TEES Smart Grid Center
The Smart Grid Center is an organizational unit within the Texas A&M Engineering Experiment Station (TEES), formed to expand on the energy-related efforts of TEES in an area of intense national interest in ensuring the reliability, sustainability, and security of the electric power grid.

The Center’s mission is to form a competitive interdisciplinary environment to advance efficient use of electric energy and modernization of the electricity grid. The Center promotes collaboration and creation of multidisciplinary research teams to investigate smart grid problems and deliver more innovative and effective smart grid solutions.

The Center’s vision is a seamless integration of power system infrastructure with the transportation and built environment to create 21st century energy ecosystems capable of solving pressing energy issues while meeting the needs of future generations.

Specific goals are to:
- Assist expanding the government and private sector vision of the smart grid;
- Conduct transformational research to generate new concepts, technologies and integrated systems for the 21st century grid;
- Train engineering students and professionals in electric energy-related concepts and technologies.

Other objectives involve:
- Studying public policy implications;
- Initiating and supporting international collaborative programs;
- Developing partnerships for smart grid research;
- Providing unbiased advice to industry, government and the public related to electric energy production, transport and consumption, and smart grid matters.

Achieving these goals and objectives will position the Texas A&M University System and the State of Texas as global leaders in education, research, and public service in the modernization of the electricity system, leading to job creation and increasing business opportunities for Texas and the nation.

Context
Electric energy is key to every economy and for societal prosperity across the globe. The smart grid effort is aimed at transforming this critical infrastructure into the 21st century using computer-based remote control and automation. The smart grid has been called “electricity with a brain,” the “energy Internet,” and the “Electronet.” Basically, it is about integrating electricity infrastructure and data to produce electricity more efficiently and reliably, as well as cleanly and safely for the environment.

Historically, the electric grid was designed to be passive, causing electric power to flow along the path of least resistance. For decades, utility companies have had to rely on data for the most part collected and monitored by meter readers, repair personnel, and other utility workers. The smart grid modernizes the way electricity is delivered from suppliers to consumers and
describes the next generation of power systems incorporating communications and information technology to generate and deliver electrical energy. In the new context, the electricity grid is viewed as:

- Enabling informed participation by customers
- Accommodating all generation and storage options
- Enabling new products, services, and markets
- Providing the power quality for the range of needs in the 21st century economy
- Optimizing asset utilization and operating efficiently
- Addressing disturbances through automated prevention, containment, and restoration
- Operating resiliently against all hazards.

Capabilities
The TEES Smart Grid Center galvanizes a number of smart grid-related activities that are underway in the A&M System and brings them under a coordinated umbrella to form partnerships essential for smart grid research. These partnerships are funded for a total of more than $10 million over the next five years. The Center aims to expand on its broad range of capabilities and expertise in six key smart grid areas: Electricity Production/Consumption; Clean Energy Enabling Technologies; Transportation System; The Built Environment; Computer Information Services; and Energy-related Markets. They all come together to create an integrated infrastructure able to handle the growing power demands of residential, corporate, and public needs ranging from smart homes and plug-in electric vehicles to distribution intelligence and operation centers.

TEES Smart Grid Center Partners
Robust Adaptive Topology Control (RATC), a $5.5 million project under the U.S. Department of Energy’s ARPA-E (Advanced Research Projects Agency-Energy) GENI (Green Electricity Network Integration) started in 2012 with the duration of 3 years and 4 months. The RATC team develops a new system that allows real-time, automated control over transmission lines to create a more robust and reliable electric grid and reduce the risk of future blackouts. Using topology control as a mechanism to improve system operations and manage disruptions within the electric grid, the RATC system is capable of detecting, classifying, and responding to grid disturbances by reconfiguring the grid to maintain economically efficient operations while guaranteeing reliability. TEES is the lead organization for ARPA-E RATC with partners: Arizona State University, University of California at Berkeley, Grid Protection Alliance, Lawrence Livermore National Laboratory, Applied Communication Sciences, Tennessee Valley Authority, Oak Ridge National Laboratory.

The Electric Vehicle Transportation and Electricity Convergence (EV-TEC) Center, a National Science Foundation Industry/University Cooperative Research Center, $2 million over 5 years
EV-TEC takes a unique systemic approach to the study of a potentially massive adoption of plug-in electric vehicles (PEVs) and other similar technologies. It considers the technical aspects of PEV deployment along with socio-economic, commercial, environmental, regulatory, planning, and industrial factors involved to maximize the opportunity for economic and societal benefit of PEVs. Joint effort by University of Texas (lead), Texas A&M University, and NSF with corporate and governmental agencies including CenterPoint Energy, the Cities of Austin and Houston, Innov8Transport, North Central Texas Council of Governments, National
Renewable Energy Laboratory, Pecan Street Inc., Texas Transportation Institute, and Texas Department of Transportation.

Power Systems Engineering Research Center (PSERC), a National Science Foundation Industry/University Cooperative Research Center, $10 million annually, started in 2010 with the duration of 5 years

Primary research focus areas are power systems, power markets, and transmission and distribution technologies. Led by Arizona State University, PSERC has a total of 13 university partners, including Texas A&M University, and more than 35 industry members. The multidisciplinary expertise of PSERC’s nearly 100 faculty and other researchers includes power systems, applied mathematics, complex systems, computing, control theory, power electronics, operations research, nonlinear systems, economics, industrial organization, and public policy.

Real-Time Distribution Feeder Performance Monitoring, a $4.1 million project funded by the Department of Energy

The project utilizes digital data from sensors and substation Intelligent Electronic Devices to continuously monitor system performance. Using real-time information, utility control center operators will be able to address outages, power quality issues, and other anomalies to reduce the frequency and duration of outages. A demonstration will be conducted on Xcel Energy’s distribution system in Denver, Colorado. ABB U.S. Corporate Research Center (Raleigh, NC) is the project manager, with team members ABB USCRC, ABB Power Products Medium Voltage, Xcel Energy (host utility), and Texas A&M University, that will research, develop, and demonstrate a real-time monitoring, control, and health management system to improve grid reliability and efficiency. Texas A&M also contributes R&D in the areas of system modeling, simulations, integrated power quality analysis, and distribution fault location calculations in the presence of distributed energy resources.

Smart Energy Campus Initiative (SECI) at Texas A&M University

SECI follows general Smart Grid Objectives as defined by the Department of Energy’s National Energy Technology Laboratory, and complements the existing Texas A&M Facilities Office plan for improvement of the campus electricity supply and use. Once fully funded, the SECI will serve as a learning environment for students and faculty in demonstrating sustainable and cost effective generation of electric energy.

Smart Grid Center: Poised for Growth

Electric energy and the electricity grid are – and have been for many years – major research focus areas of TEES. The SGC is both a research and outreach entity that seeks to expand the industrial affiliates program already in place through the resources just described. Having a core group of research leaders as points of contact will simplify the process by which potential partners try to contact researchers and students. The SGC was formed to support these strengths and provide a single organizational structure to bring these researchers together. Further details about SGC may be found at: http://tees.tamu.edu/about/rpc/sgc/.

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