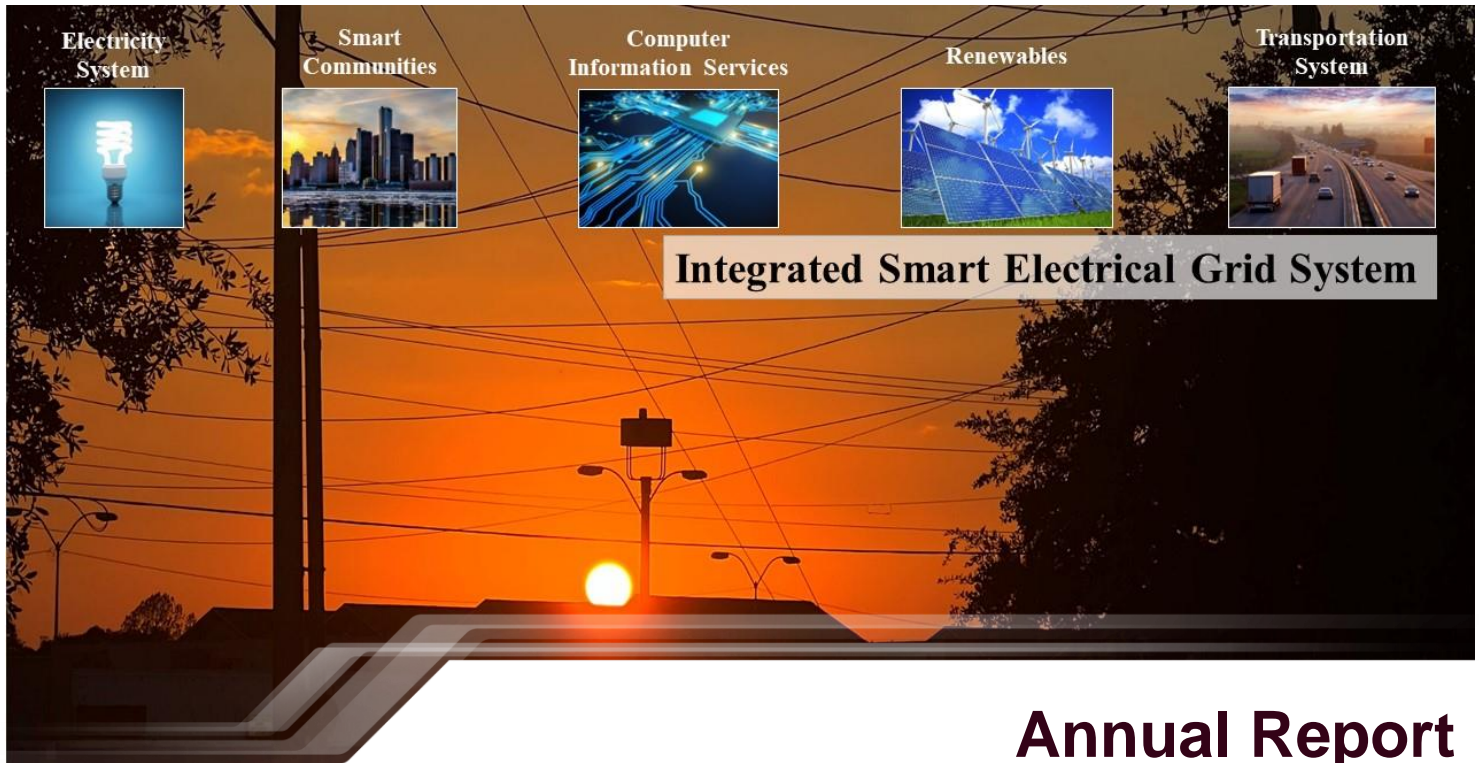




SMART GRID CENTER

TEXAS A&M ENGINEERING EXPERIMENT STATION



Annual Report

September 2022 - August 2023

The main goals of the TEES Smart Grid Center (SGC) continued to be: 1) Developing strategic large-scale research projects; 2) Pursuing research projects funded by SGC partially based on its membership with companies; 3) Hosting SGC webinars and a short course; and 4) Co-hosting a Research Day.

Membership of Smart Grid Center

The following companies were currently SGC members:

- CenterPoint Energy, Full Member
- Dell Technologies, Inc., Full Member
- ERCOT, Full Member
- Lower Colorado River Authority (LCRA), Associate Member.

Research Projects Funded by the Center

- “Predictive Outage and Asset Management Decision-making Tool Assisting Distribution Operators”, PI: M. Kezunovic (ECE TAMU) started in 2019;

- “Application of Texas A&M Electric Grid Control Center Testbed”, PI: T. Overbye, Co-PIs: K. Davis and A. Birchfield (ECE TAMU) started in 2019;
- “Common Operating Picture”, PI: K. Davis, Co-PI: T. Overbye (ECE TAMU) started in 2022;
- “Data Science and AI Applications in Power Systems”, PI: L. Xie, Co-PI: A Birchfield (ECE TAMU), 2022-2023;
- “Distributed Generation and Its Impact on Market and Protection”, PI: L. Xie, Co-PIs: D. Kalathil, M. Begovic (ECE TAMU) completed in 2022.

Strategic Project Focus Areas

Cyber-physical security with emphasis on interactions between different critical infrastructures; Future wholesale ancillary service products and retail market participation strategies; Synthetic grids; Microgrids; Testbeds; Impact of geomagnetic disturbances on power grid;



Smart Grids Control Room Lab is located at the Center for Infrastructure (CIR) building at the RELIS campus of Texas A&M University System.

Big data including weather impact analyses integrated into GIS framework; Synchrophasors and synchronized sampling technology for transmission & distribution applications; Flexible loads including on-site energy storage and distributed generation at different scales; Renewable forecasting with focus on solar and wind generation; Data science and AI applications in power systems.

Smart Grid Center founded in August 2012

GRID INTERACTIONS RESEARCH FACILITY (GIRF)

New facility devoted to modernization of the grid-edge and electrification of transportation mobility

New Large Research Projects

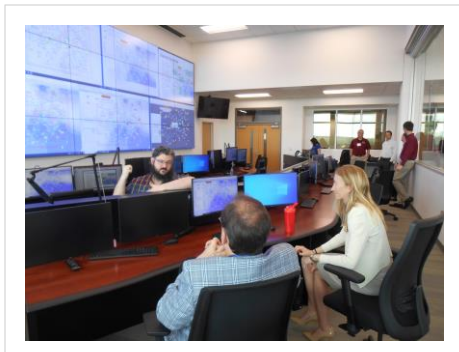
“SCORE – Physics-Aware and AI-Enabled Cyber-Physical Intrusion Response for the Power Grid”, PI: K. Davis (ECE, TAMU), Co-PIs: A. Goulart (ET&ID, TAMU), S. Zonouz (GaTech), R. Bobba (OSU), S. Mohan (GWU), Partners: Network Perception, PSC Consulting, EPE, DOE award \$2.7M including cost share, 3 years, started in Oct. 2022.

“Advanced Learning for Energy Risk Tracking (ALERT)”. PI: M. Kezunovic (ECE, TAMU), Co-PIs: Z. Obradovic (Temple Univ.) A. Brown (ECON TAMU), P. Pavlou (Bauer Univ.), R. Enriquez (UTSA), Partner: CPS Energy, NSF award, \$1,498,793, 4 years, started in Sept. 2022.

Advisory Board Meetings

The SGC Leadership Team gave presentation on research advancement, recently submitted research proposals, events.

- The 21st Board meeting was hosted by CenterPoint Energy in Houston, TX, on Oct. 3, 2021.
- The 22nd AB meeting with demonstration in the Control Room Lab was held at the Center for Infrastructure Renewal on the RELLIS campus in Bryan, TX, on Apr. 10, 2023.



New SGC Research Facility

Grid Interactions Research Facility (GIRF) was introduced at the 22nd Board meeting. It is funded by a Governor’s University Research Initiative (GURI) grant received by T. Overbye and devoted to modernization of the grid-edge and electrification of transportation mobility. More is posted at <https://ctr.c.tti.tamu.edu/facilities/girf/>.

Video Short Course

The short course “Data Science and Machine Learning for Modern Power Systems” course was self-paced; Course Director: L. Xie (ECE TAMU). The number of attendees were 36 in this time frame.

Symposium and Workshops

- The Resilient Electric Grid Consortium of North America Symposium (RECONS) was held with 101 attendees at Center for Infrastructure Renewal on November 17, 2022. The event was free for employees of SGC member companies.



- Sustainable Transportation Electrification for an Equitable and Resilient Society (STEERS) Workshop was chaired by T. Overbye (ECE TAMU) and held at Center for Infrastructure Renewal on Sept. 16, 2022. The event was attended by 31 participants.



- Workshop on Steering Cities and Regions Towards Resilience was jointly organized by the Linder Institute for Urban Research and our Center. It was chaired by L. Duenas-Osorio, (Civil & Env. Eng., Rice Univ.) and was held at Rice University on Dec. 15, 2022.
- NSF Workshop on Carbon-Neutral Electricity and Mobility. Chair: L. Xie (ECE TAMU) held at Texas A&M Hotel & Conference Center on Apr. 24-25, 2023

Energy and Power Research Day

To showcase research projects and to facilitate discussions with industry, these events are co-sponsored by the Center and the Energy and Power Group (EPG ECE). On Apr. 28, 2023, 94 participants attended this at Center for Infrastructure Renewal.

Webinars

- “Modeling and Analysis of Interdependent Electric Power Grid and Natural Gas Network” talk presented by A. Birchfield (ECE TAMU) and attended by 296 people on Sep.21, 2022.
- “Opportunities for Deep Learning-based Detection of Stelth Attacks in Power Systems” talk presented by K. Davis (ECE TAMU) and attended by 99 people on Dec. 21, 2022.
- “Do North American Electric Grids Have Distinct Inter-Area Electro-Mechanical Modes?” talk presented by T. Overbye (ECE TAMU) and attended by 395 people on Jun. 6, 2023.

Exhibition at Texas Science and Engineering Fair

An exhibition booth featured hands-on activities of energy and power simulations at the “Night at the Zach” event at Texas A&M on March 24, 2023.

Publications

- Research results were published in 25 peer-reviewed papers, 1 book, and 23 conference publications by SGC faculty collaborators.
- SGC-Qatar faculty, staff, and students published (as first authors) 17 peer reviewed papers, and 10 conference publications.

Selected publications can be downloaded from the Center’s websites.

SGC Websites

- Expertise of collaborating faculty members, news on relevant activities, selected publications, and more can be viewed at <http://smartgridcenter.tamu.edu>.
- For the SGC-Q, news and information on people, projects and publications are posted at <http://www.sgc-q.com>.

Future Plans

- Recruiting new companies to become SGC Members and retaining the membership of current SGC companies.
- Maintaining the representation of SGC member companies on Advisory Board.
- Developing large, multi-disciplinary research proposals involving member companies to attract federally sponsored funding.
- Extending current testbeds for research, education, and industry training.
- Organizing a Research Day, workshops, short courses, and webinars.