Oak Ridge National Laboratory

GRID RESILIENCE LICENSING OPPORTUNITIES

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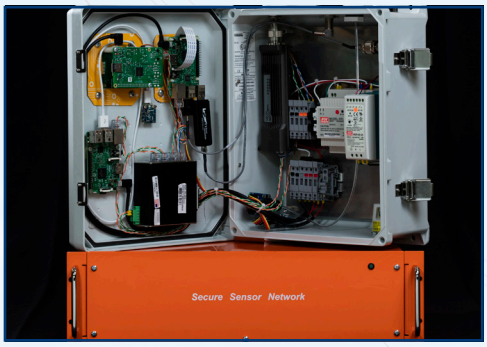
Grid Resilience Licensing Opportunities at ORNL

ORNL researchers are working with the US Department of Energy (DOE), industry, and academia to make the US power grid more modern upon the expertise of ORNL scientists who deliver innovations from concept to implementation through transformational broad-based res being developed for the power grid, transportation, and renewables. ORNL's user facility resources in grid resilience include the Goal Opera and Electric Machinery Research Center and the Distributed Energy Communications and Controls Laboratory. ORNL researchers further pa Center for Ultra-Wide-Area Resilient Electric Energy Transmission Networks. Individuals and organizations can partner with our researchers

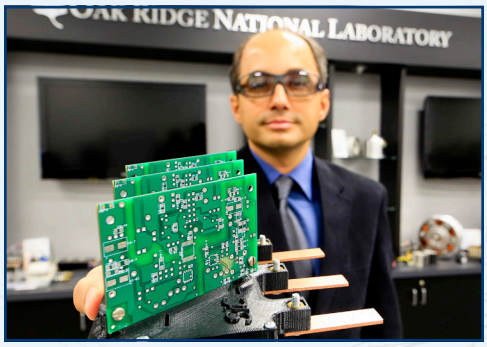
Power Flow Control

ORNL researchers engage in several projects examining novel power flow technologies for transmission and distribution grids. The projects leverage a saturable-core reactor with continuous inductance regulation that avoids disrupting existing power systems and can be applied at all voltage and power levels. ORNL and its partners are working to adapt the Continuously Variable Series Reactor, a low-cost power flow technology, to use in metropolitan areas, where space constraints and the need for sophisticated power flow control are key. ORNL researchers are also developing a tap-less voltage regulating transformer that magnetically regulates voltage, enabling continuous voltage regulation to increase control, durability, and reliability. Their work provides insight into system requirements, proof of principle for new devices, and guidance for continued implementation. The innovations resulting from ORNL involvement in this research area enable operation of power systems that are market friendly, economical, and reliable.



Monitoring

ORNL research in grid monitoring aims to improve grid reliability and resiliency as well as to facilitate ongoing integration of renewable energy sources. End goals in this area include ensuring complete coverage in a locality and continuous real-time grid monitoring that is precise and cost-effective. Leveraging the lab's access to data on our national grid, ORNL researchers have developed methods and systems for monitoring the electric grid and predicting failures and other issues. Power grid data are received from numerous remote power grid sensors and converted into a univariate time sequence, reporting measurements of the same variable over time. Our researchers identify anomaly patterns in the sequence and analyze or simulate data to predict power grid disruption. The patterns are compared with power disruption contingencies to predict present and future power disruption represented by the anomaly pattern.



Inverters and Power Modules

Research at ORNL's Power Electronics and Electric Machinery Research Center facilitates implementation of state-of-the-art transportation-related circuit and motor designs. The center offers broad-based capabilities and an extensive equipment inventory to build, test, characterize, and evaluate power conversion circuit prototypes. ORNL researchers have demonstrated wide-ranging technologies, from gas-cooled traction drive inverters to power modules packaging with double-sided planar interconnections and heat exchangers. Research conducted in this area is cross-disciplinary, leveraging ORNL's world-leading capabilities in high-performance computing and materials characterization to accelerate component design, improve predictions of a devices' field performance, and increase new technologies' lifetime and reliability.

For a list of technologies available for licensing please visit https://gridmodernizationtechnologies.ornl.gov.

and resilient. Developing technologies draw
search. Affordable clean energy solutions are
ations Analytics Laboratory, Power Electronics
artner with the University of Tennessee led
s via CRADA, SPP, or user agreements.

Wireless Charging

ORNL researchers partnering with industry have developed wireless battery recharging technologies for electric vehicles that match the recharging power of, and provide superior efficiencies over, plug-in stations. They have developed an apparatus with point-of-load control for wirelessly charging an electric vehicle battery. The system includes a base unit for generating DC voltage, which is regulated by a power-level controller. One or more point-of-load converters can be connected to the base unit by a conductor, with each converter containing a control signal generator that transmits a signal to the power-level controller. The output power level of the DC voltage provided by the base unit is controlled by the power-level controller such that the power level is enough to power all active load converters when commanded to do so by any of the active controllers, without generating excessive power that may be otherwise wasted. ORNL research in this area provides high grid-to-vehicle efficiency and aims to accelerate the adoption and convenience of electric vehicles.

Licensing Success Story: Brixon, Inc.

"The Internet of Things Multiparameter Sensor Agent Outstation technology provides an extensible infrastructure, capable for deployment to many sensor needs within industrial and electric utility fields," states Dr. Sterling Rooke, Brixon, Inc. founder and co-inventor of the invention. "Brixon, Inc. plans to continue working with ORNL in the future to further adapt, improve, and commercialize this technology."

Baltimore-based Brixon, Inc. has exclusively licensed the Outstation, an integrated platform that unites artificial intelligence and sensor technology to improve the security and reliability of cyber operations and response. The technology leverages a network of connected devices that exchange data to measure temperature, irradiance, chemicals, electric grid elements, and other parameters. New or existing sensors communicate with a main controller, the Outstation, forming a sensor cluster.

The technology is expected to deliver lower cost, better performing, and faster operating sensors than competitors. Outstation's modular design is compatible with conventional commercialized and customized sensors, and the sensors can be mounted or used with unmanned aerial systems for surveillance. Other applications include oil rig inspections, oversight of public water supply safety, and electric utility monitoring.

For more information, contact:

Michael J. Paulus
Director, Technology Transfer Office

Oak Ridge National Laboratory
PO Box 2008, MS 6196
Oak Ridge, TN 37831-6196
paulusmj@ornl.gov

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