

# Smart Grid Labs OVERVIEW



## INTRODUCTION

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SGL provides our clients multi-faceted assessment services for communications, security, standards compliance, technology/vendor maturity, and implementation assistance across many Smart Grid domains. We offer vendors, utilities and regulatory entities a place to evaluate and understand technology readiness for Smart Grid in ongoing and emerging technology efforts.

Our lab is focused on end-to-end application oriented evaluation of distribution volt/var device controllers, DG interface controllers, field area network access points, smart meters, line current sensors, commercial and home gateways, in home DR devices, smart appliances, etc. Basically everything in the smart grid ecosystem from a communications, command and control point of view from the substation to the consumer – a low power device and communications lab.

The facility provides a simple yet effective framework for vendors to evaluate new designs for compliance with key protocol standards, interoperability with other vendors, and appropriateness for specific utility applications prior to finalizing design and certification. It provides a platform for utilities to evaluate vendors and their solutions in neutral territory. We evaluate technology to mitigate business and technology risk in general. For example, we evaluate cyber security risks for specific pieces of equipment utilities have deployed or want to deploy in the field. The lab infrastructure allows multiple vendors to participate in an interoperability work session in neutral territory to iron out integration problems before going to market or deployment.

We staff experts in each of the key Smart Grid technology domains, their device markets, and components offering, ready to bring best practice in design, test and evaluation to bear on a project. SGL has committed to innovation and ongoing investment in its lab infrastructure. EnerNex maintains strategic mutual relationships with other Smart Grid testing facilities, some located at vendor and client sites, across North America, positioning us to deliver solutions to a wide variety of problems.

We provide our clients outstanding, reliable technology services. We design and implement Smart Grid technology evaluation strategies, processes, and develop specific product requirements based on testable fact rather than assumption. We mitigate the risk of immature and non-interoperable technology adoption.

Building on expertise provided by EnerNex's core team, the Smart Grid Labs has selected the elite of scientists, tech-nologists, engineers, and technicians on staff to translate the diverse set of Smart Grid domains into test operations.

Smart Grid Labs personnel participate and have leadership roles in most major Smart Grid related organizations and related standards bodies. These include the working groups and task forces of the UCA International Users Group, IEC TC 57, the IEEE Power and Energy Society, the IETF, and many more. Most SGL staff involved have helped develop or influence core smart grid standards development.

## SERVICES



### communications

- > Evaluations/assessments
- > HAN interoperability testing
- > 61850/DNP testing
- > Wireless and low voltage PLC testing
- > Specialized testing
- > Generalized communication/ interoperability evaluation/testing
- > Testing on all equipment for distribution and mobile workforce issues



### security

- > Audits
- > Penetration testing
- > Vulnerability assessments
- > Security interoperability / LEMNOS
- > Low-level / Hardware security impact assessment



### metering

- > AMI Functional Testing
- > AMI Acceptance Testing
- > AMI Test Practice Design
- > AEIC and C12 Metering Guidance

### pre-conformance / pre-certification evaluation

- > Perform 'pre-conformance' and 'pre-certification' testing/evaluation (including review of firmware/apps) and recommendations for improvements
- > Interoperability testing for vendors and utilities between all products
- > Evaluation services to utilities for RFPs
- > UCAIug testing guidelines

### other laboratory and testing capabilities

- > Develop in-house high-level testing capability
- > Client implementation support
- > Provide education/training to vendors/utilities/regulators
- > Provide 'public service' education/training
- > Perform webinars/training videos of key testing issues/
- > FAQs/reference designs
- > SGL can review actual source code and perform intrusive testing

## INFRASTRUCTURE

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Smart Grid Labs has a core infrastructure that supports end-to-end application testing from distribution feeder equipment to the substation to utility control centers and enterprise systems to field area communication networks to meters and gateways to building automation networks and home area networks to smart devices and appliances.

Specific equipment types include:

- >> Utility pole mounted cap bank and other controllers
- >> Utility pole mounted field device radio endpoints including a complete WiMax base station and end-points licensed for use anywhere in the US
- >> Distribution line emulation for fault current and other line connected sensor evaluation
- >> A complete substation automation rack with multiple vendor relays, PMU's, network switches, routers, substation managers, GPS time clock, PLC's, panel metering, power quality metering, and other equipment.
- >> Utility distribution automation and advanced load control management software workstations
- >> OpenPDC Server - Phasor Data Concentrator
- >> EIOS OpenADR based demand response enterprise server
- >> Utility enterprise systems management applications and associated workstations
- >> Multiple vendor demand response and metering head ends including in lab and hosted (cloud based)
- >> Multiple vendor field area networks including access points, end points, and management software
- >> Multiple vendor residential and commercial smart meters and end-point test applications
- >> Multiple water heater technologies and demand response interface controllers
- >> Smart washer, dryer and refrigerator
- >> Electric vehicle charger
- >> 1 kW PV array with inverters
- >> Home automation controllers from Control4, Universal Devices, Homeseer and Insteon
- >> ZigBee, ZWave, and Insteon based light switches, dimmers, and controllable outlets
- >> Thermostat evaluation platform
- >> Home Wiring Simulator
- >> RF Spectrum Analysis tools and a multitude of cyber security evaluation/hacking tools
- >> Numerous automation tools, scripts, packet sniffers, and other equipment necessary to instrument and automate our evaluation processes

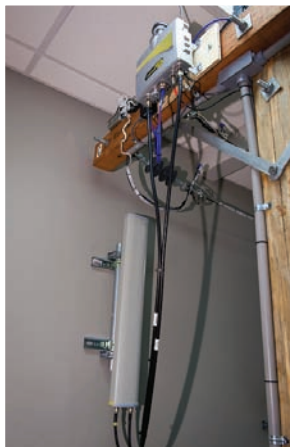
EnerNex Smart Grid Labs has strong relationships with a multitude of technology providers that enable us to negotiate access to additional equipment for end-to-end interoperability testing as needed. Specialty or esoteric equipment needed for specific tasks that is not readily available is leased or borrowed as necessary for any given client engagement.

## INFRASTRUCTURE



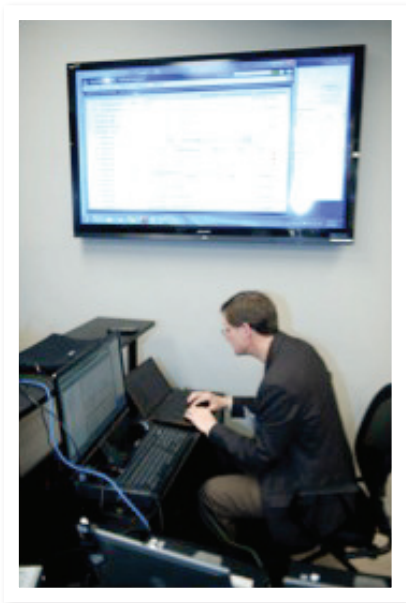
Utility Distribution Feeder, Substation and Control Center Components with Instrumentation

### Residential Consumer Emulation Components

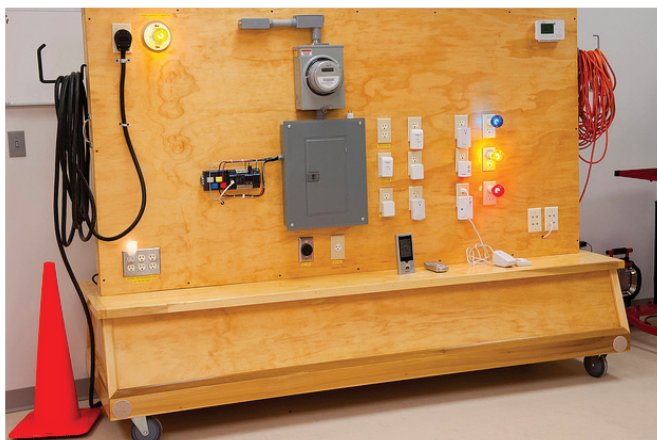


WiMax, 3G Cellular, Trilliant, and Silver Spring WAN and FAN Access Points

## INFRASTRUCTURE



Demand Response Event Dispatch Console  
and In-Home Display / Thermostat Test Platform



Residential Wiring Emulator and Commercial  
Building Automation Switchgear and Networks





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