

Grid Solutions

Engineering & Consulting

Your trusted partner to empower and unlock the potential of power systems of tomorrow

Utilities and industries are facing new challenges due to disrupting trends from the traditional power sector. Decarbonization is decreasing short-circuit levels and inertia of the grid, having the need for reevaluation and testing of existing protection schemes, with additional system impact studies required to assure Grid Code compliance and stability. Digitization is increasing the number of interconnected devices and there is a technology gap between traditional system operation and digital substations. Decentralization is adding more complexity to the distribution grids and protection systems and electrification is adding new suppliers to the grid that require flexibility of connection.

Engineering & Consulting Services

As our industry and the power system evolves, Grid Automation Services are designed to support customers through their planning, design, system operations and maintenance transformations.

GE provides a full range of services & support tailored to meet a broad range of power system needs across utility and industrial applications. With deep domain knowledge and industry experts located globally, GE's technical specialists and subject matter experts can help you plan, design, operate, maintain, and modernize your protection, control, monitoring, and automation systems.

Offering innovative and high-quality services that optimize the customer's electrical infrastructure, GE is focused on customer specific outcomes to drive return-on-investment through maximized asset performance and asset life extension.

With a global team that provides regionalized support and services, GE's Grid Automation Services team is the right partner to navigate the challenges of a contemporary electrical system.

Key Benefits

- **Faster, Leaner, more Focused:** In-depth knowledge of relay protection technology as protection relay manufacturers, providing complete scope, from relay/cabinet manufacturing to commissioning services, allow us to be more efficient and assure the selectivity, dependability and reliability of the protection systems that we deliver.
- **Global Reach with Local Presence:** 8 regional delivery hubs in Markham, Sao Paulo, Stafford, Bilbao, Montpellier, Dubai, Pallavaram and Singapore, with more than 200 Technical, Service Application and Field Service Engineers. We have also 4 RTDS labs for Hardware in the loop testing for advanced consulting services.
- **Deep Domain Expertise:** More than 1,000 years of cumulative experience with a dedicated team of electrical systems experts and technicians. We have delivered more than 3 Million Protection & Control Relays and 50,000 Substation Automation Systems worldwide.
- **Best-in-class Post Sales Support:** Utilizing our own technology, services that we provide count with the best-in-class post sales support with more than 50 Technical Support Engineers in 6 regions, which are in closed collaboration with R&D team.



Consulting Services

- Load flow & Power study
- Short circuit study
- Stability Study
- Motor Acceleration & Re-acceleration Study
- Protection Coordination Study
- Arc Flash Study
- Grid Compliance Study
- Grid Integration Study
- Switchgear Sizing
- Power Quality Study
- EMTP Study

RTDS Services

- Hardware in the Loop Testing
- Protection Settings Audit
- Protection Relays Verification
- Playback Testing
- New algorithms validation
- Special Protection Scheme Tests
- Grid Compliance Tests

Engineering Services

- IED Configuration
- IEC 61850 Configuration
- Digital Substation Standardization
- Busbar Engineering Solutions
- Automatic Transfer Schemes
- Relay Performance Analysis
- Test Procedures
- Factory Acceptance Test

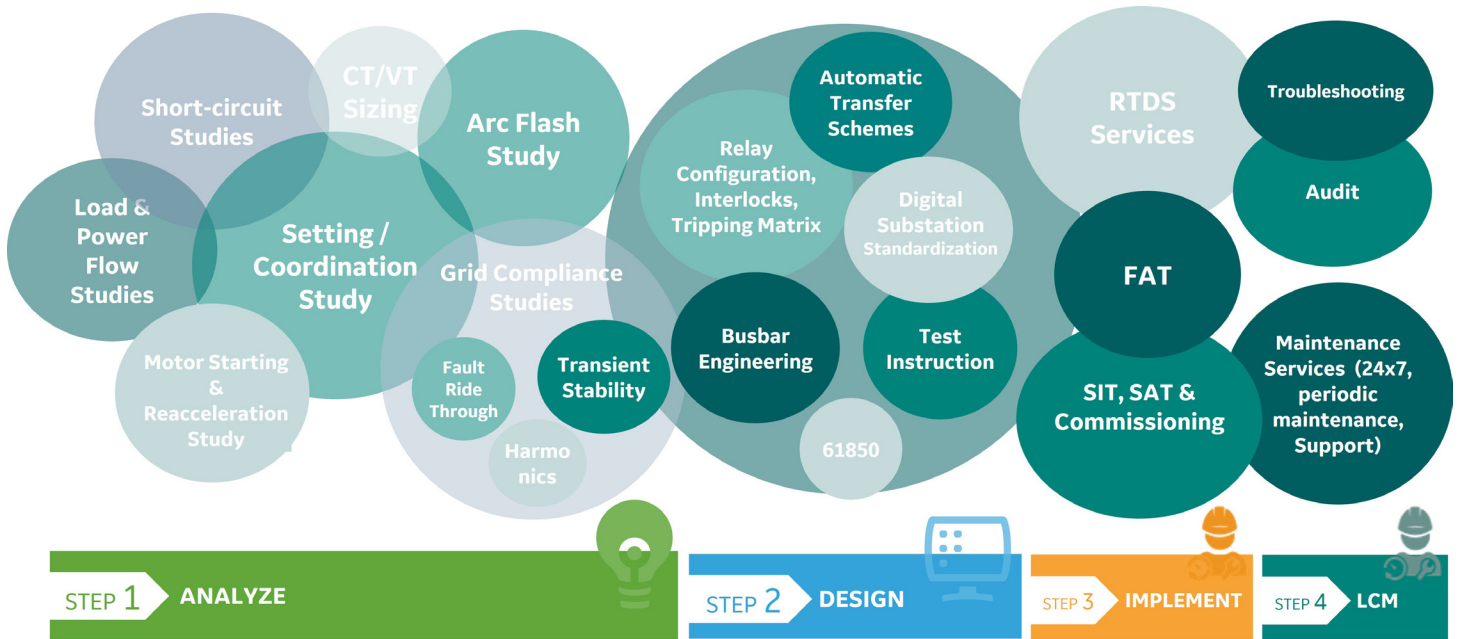
Field Services & Support

- Integration Factory Acceptance Tests
- Site Acceptance Test
- Commissioning Services
- Site Audits and obsolescence study
- Preventive Maintenance Services
- 24/7 Support
- Remote Support

Engineering & Consulting Services Overview

Dedicated to tackling the most pressing challenges in the electric power industry and with passion to focus on providing comprehensive consultancy services and engineering solutions, we are committed to driving the industry forward and ensuring a sustainable energy future.

What sets us apart is our commitment to a complete life cycle approach right from Real Time Simulations, Network Studies, Testing & Commissioning Support. We understand that successful projects require seamless coordination and collaboration across various phases. By offering end-to-end solutions, we eliminate the need for multiple suppliers or consultants, providing our clients with a streamlined and efficient experience. Our team possesses the expertise and experience to navigate the complexities of every project stage, from Engineering Design to Commissioning, ensuring successful outcomes for our clients.



Consulting Services

- Identify Weak points and bottlenecks in the grid to optimize topology and operation through **Load Flow Studies**.
- Ensure sizing of equipment to assess the capability to withstand mechanical & thermal stresses through **Short-circuit studies and CT&VT Suitability studies**.
- Enhanced network reliability through **Protection Coordination study** by ensuring sensitivity, selectivity & stability performed by our team with more than 1000 years of cumulative experience.
- Assess incident energy exposures and determine PPE & safe working distance through **Arc Flash Study**.
- Grid Code Studies** ensure compliance through simulations of Fault Ride Through, Harmonic emissions, and Power Quality, guaranteeing adherence to regulatory requirements.



Engineering Services

- Assure proper logic design and **IED Configuration** based on your specific project needs through our support on complex configurations like **Busbar Engineering** and **Automatic Transfer Schemes**.
- Communication mapping** on 61850 MMS & GOOSE, Modbus, EGD or other protocols for smooth system integration.
- Uploading of configuration files prior to delivery to reduce work at destination through **Configuration Pre-load**.
- Confirm alignment between your project specific requirements and protection system performance with our **Test procedures and Factory Acceptance testing (FAT)**.

Field Services, Commissioning and LCM

- Trust in our team's expertise and guidance to optimize performance, mitigate risks, and achieve successful project outcomes through our valuable **Commissioning Support**.
- Our dedicated team conducts thorough **Site Integration Test (SIT)** and **Site Acceptance Test (SAT)** procedures, delivering a seamless and reliable acceptance process for successful project completion and serves as a final validation step to ensure successful deployment and operation readiness.
- Ask for **lifecycle management services (LCM)**, preventive maintenance and our **24/7 support**.
- Count on us for **site audits** for assessment and scope definition for retrofit or new installations to improve your planning and preparation on system upgrades.



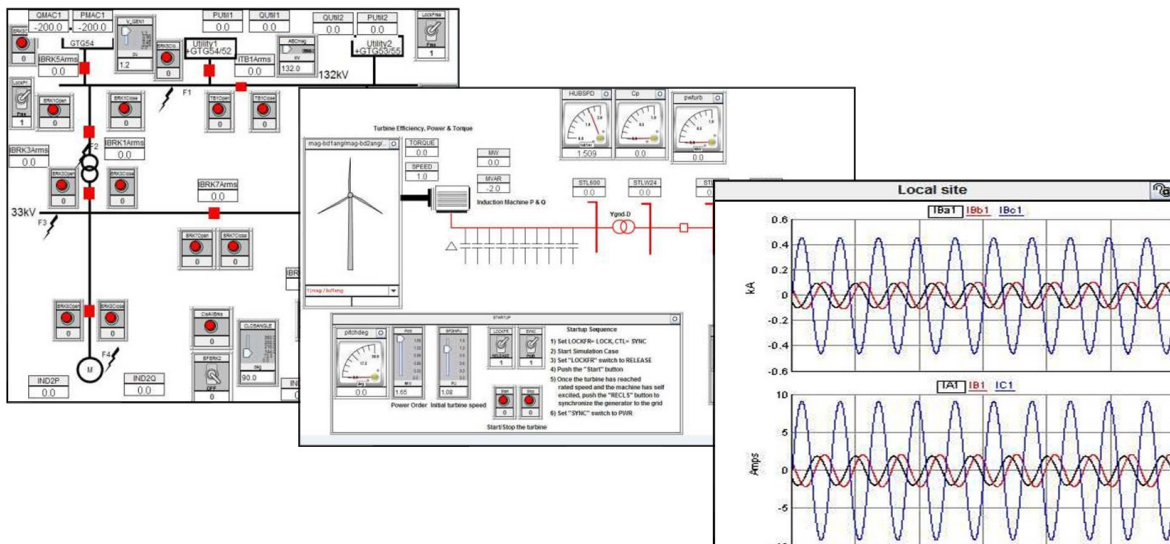
Real Time Digital Simulation Services

Real-Time Digital Simulation (RTDS) has emerged as a crucial technology in the face of the evolving challenges that the electrical grid encounters, such as the integration of Distributed Energy Resources (DERs), Grid Resilience, Smart Grid Technologies and Electric Vehicles (EVs). We support customers with our four dedicated laboratories with Real-Time Digital Simulator (RTDS) to ensure reliable and robust grid operations during and after disruptive events through the following services:

- **Audit of existing protection settings** modelling the electrical power system in scope to have the most realistic transient scenarios and **Verification of new protection relays** like line, busbar and transformer differential elements that can be tested in a **Hardware in the loop (HIL)** environment to assure proper performance and coordination on all type of fault scenarios including evolving and cross country faults. **Playback testing** can also be performed to check settings modification based on historical fault libraries from the customer.
- **Validation of new protection algorithms** that require a fine-tuning based on transient stability studies, like Islanding Detection Protection, High Speed Falling Conductor or High Impedance Protection.
- **Testing of Special Protection Schemes** like Remedial Action Schemes (RAS) or Wide Area Monitoring, Protection and Control (WAMPAC) systems thanks to the capability for multiple injection points and communication protocols simulation with PMU and 61850 data.
- **Grid Compliance Tests** for new power generation assets connected to the grid can be performed through RTDS while Power Plant Controllers and protection elements are tested at the same time in a HIL environment. System Impact and transient studies are performed in real time to analyze the dynamic behavior of the asset to assure Low Voltage Ride Through, Harmonics emission and Power Quality performance.

Key Benefits

- **Hardware in the loop (HIL)** testing in a real time EMTP environment after electrical power modelling provides an efficient way to assure protection system performance under **most realistic conditions**, leading to more efficient and time-saving solutions.
- **Extensive testing scenarios** are run through scripts in automatic mode.
- Interoperability with external systems can be tested due to **PMU and 61850 simulation capabilities**.



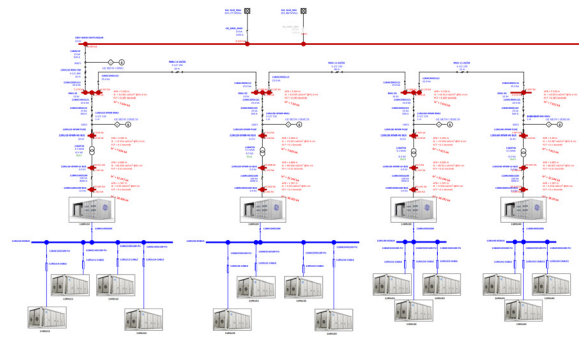
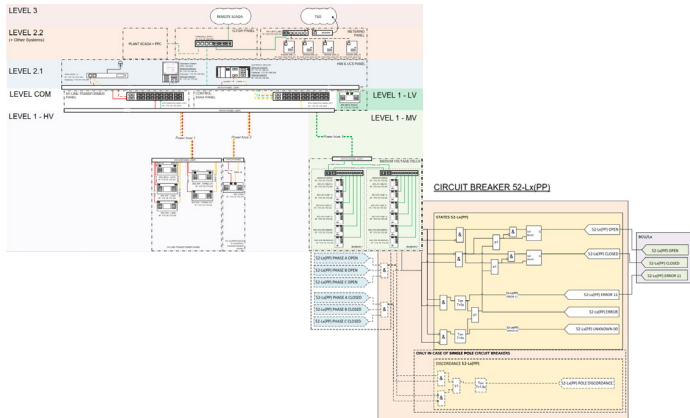
USE CASES

Use Case 1 - Complete turnkey project adding additional services

Challenge: Complexity of protection and control systems through different suppliers creates time and form inefficiencies on execution.

Value Added Proposition: Additional services are added to panel manufacturing as a perfect fit to provide a whole package in a turnkey solution of protection and control to help you plan, design and implement your protection and control system. Power flow, short-circuit study, Protection coordination study, Arc Flash and CT/VT Sizing is included within the scope of work as well as engineering and field services for IED configuration, FAT and SAT.

Benefits: By offering end-to-end solutions, we eliminate the need for multiple suppliers or consultants, providing our clients with a streamlined and efficient experience. Our team possesses the expertise and experience to navigate the complexities of every project stage, from Engineering Design to Commissioning, ensuring successful outcomes for our clients.

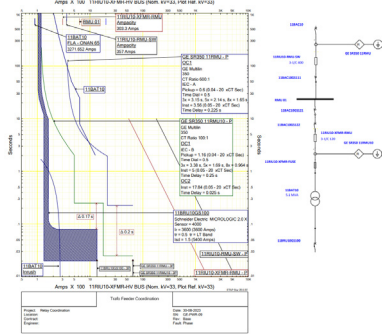


WARNING

**Arc Flash and Shock Hazard Present
Appropriate PPE Required**

Arc Flash Boundary	0.42 m	Level A
Incident Energy in cal/cm ²	1.6	Minimum PPE Requirements:
Working Distance	0.46 m	• Arc-rated long-sleeve shirt and trousers
Shock Hazard Exposure	1500 Vdc	• Arc-rated coveralls and/or arc flash suit
Insulating Gloves Class	0	• Arc-rated face shield
Shock Hazard when covers removed		• Arc-rated hood
Limited Approach Boundary	1.55 m	• Arc-rated hard hat liner
Restricted Approach Boundary	0.42 m	• Safety glasses
		• Ear/eye protection
		• Leather footwear

Equipment ID : PCS01



Use Case 2 – Digital Substation Standardization

Challenge: Assure a new standard for digital substation design. New communications network and architectures on digital substations. Lack of expertise.

Value Added Proposition: Design and implementation of standardized schematics for network architecture and communication signals exchange. .SCD and .CID template files generation.

Benefits: Customer has a standardized solution for his three typical topologies, making them more efficient on digital substation implementation. Closure of technology gap for customer employees.

Use Case 3 - Island Protection Implementation

Challenge: Customer requiring to detect islanding condition and identify events in the grid that could affect the Point of Interconnection (POI).

Value Added Proposition: Determine the parameters and methodology to trigger islanding identification. RTDS tests for validation purposes for loss of generation and loss of load detection through sudden or cascade loss, and trip to island from external grid.

Benefits: Allow plant operation during islanding conditions through balance of load and generation.



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