

iT-1000 Platform

AI-based, electrical energy system edge controller and conditioner
 Best in class, modular, and scalable supervisory control system
 Complementing commercially-available Energy-Management-Systems (EMS)



Modernization of the legacy grid requires shift of the generation landscape from centralized polluting energy resources to Distributed Energy Resources (DERs). DERs consist of intermittent sources of energy generation, e.g., renewables, intermittent energy consumers, e.g., EV-charging stations, and energy storage technologies, e.g., Battery-Energy-Storage-System (BESS), which are the keys to address such intermittencies. Most commercially available management solutions are operating power system based on the underlying assumption that neither configuration of the power system, nor operation modes of the DERs will change. Hence, operation timeframe of such management solutions are in the order of seconds to minutes, referred to as Energy-Management-Solutions (EMS). However, modernized power systems become more and more prone to such changes and the collective operation of BESS along with other types of DERs, considering potential power system re-configurations, result in up to millions of accidental/intentional scenarios which, if not taken care of, can lead to the collapse of the power system.

Our AI-based Power-Management-System (PMS):

Covering up to millions of accidental scenarios:

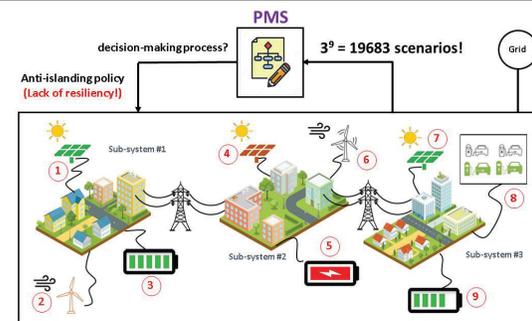
We offer a proprietary hardware-software technology, powered by AI, which enables a high-speed PMS to proactively envision operational solutions for all possible event-driven scenarios that can occur in your modernized electrical energy system, with various types of DERs, and maximize your power system continuity of operation (resiliency).

In-millisecond operation time-frame:

The technology responds to wide range of accidental events in your electrical energy system in a matter of less than one electrical cycle (for a 60-Hz system one electrical cycle is 16.67 ms).

Highly modular, scalable, and future proof:

The proprietary decision-making algorithm we offer can be distributed over multiple hardware-software platforms. The distribution of the algorithm is confirmed to keep the entire decision-making process non-blocking and non-conflicting. Such capability enables us to allocate dedicated management systems in close geographical vicinity to BESS, in order to avoid communication latency negatively impacting imperative operation of the BESS to maintain your power system generation-consumption balanced.



A modernized electrical energy system with high depth-of-penetration of DERs brings about imperative technical challenges in terms of real-time management of the resources. In the decarbonized system, shown above, the collective operation of 9 DERs, with assumption of three possible event-driven scenario for each resource, represent almost 20,000 scenarios that should be managed by the PMS-based supervisory control system!!!!

Maximize Resiliency

We guarantee to offer a management solution that keeps your power system operational subsequent to numerous accidental events that can occur.

Increase Revenue: Each time our technology avoids an outage we save you from exorbitant financial penalties caused by power-outage legislations.

Enable Seamless Islanding and Re-synchronization

Multiple-Microgrid System: A distinct feature of our AI-based algorithm is to utilize BESS in different operation modes (grid forming and grid following) and enable autonomous (off-grid) operation of your electrical energy system. Unlike commercially available microgrid solutions, which only focus on using a single BESS, we are able to utilize multiple BESS for operation of your system as a multi-microgrid system. We ensure to keep BESS units coordinated with each other as well as other DERs, e.g., backup generators, to maximize your electrical energy system operation in islanded mode.

In addition, our iT-1000 platform can enable fast and smooth re-synchronization and re-connection for your previously islanded system back to the utility, as soon as the utility reaches stable operational condition.

Interarea Coordination Between BESS and All other Types of DERs:

Since our PMS-based supervisory control system is BESS-centric, we continuously monitor operation status of the BESS as well as all other DERs in the customer-owned electrical energy system. As soon as the BESS reaches its operational limits, e.g., State-of-Charge (SoC) limits, our AI-based algorithm makes necessary changes in the operation of all other power system generation and load units, to keep the BESS operational as much as possible.

Full-scale Performance Verification of the iT-1000 Platform:

We take pride in our comprehensive Hardware-In-the-Loop (HIL) testing capability. We have an advanced testing center where we have simulated the electrical energy systems of our customers in REAL-TIME. We then have interconnected our computationally-rich simulation platform to our industrial-grade iT-1000 hardware platform to structure a so called HIL platform as shown in the picture below. We have tested performance of our iT-1000 in a comprehensive manner to fully address the requirements set out by our customers, in pre-field-implementation stage.

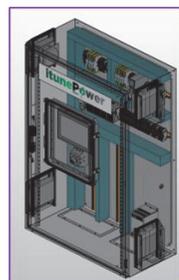
The main value proposition of our HIL testing, is to minimize (i) cost, (ii) time, and (iii) risks associated with the interconnection and operation of our iT-1000 platform during Engineering-Procurement-Commissioning (EPC) as well as troubleshooting processes.

High-speed Power-conditioning Capability

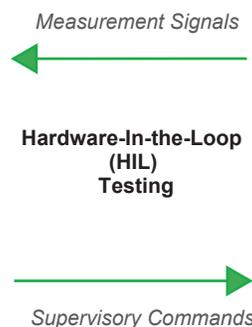
The iT-1000 platform can operate your electrical energy system as a robust Virtual-Power-Plant (VPP). Hence, from the utility point-of-view we operate your assets at:

- safe power-factor level (up to unity),
- safe Total-Harmonic-Distortion (THD) level (close to 1%),
- pre-determined exchange level of real and reactive power (based on market signals or utility demands), from 10 kVA up to 5 MVA, and
- dynamical volt-var support mode, to respond to emergency utility voltage support signals.

The hardware-implemented iT-1000 platform will be comprehensively verified in terms of dynamical performance.



iT-1000 Platform

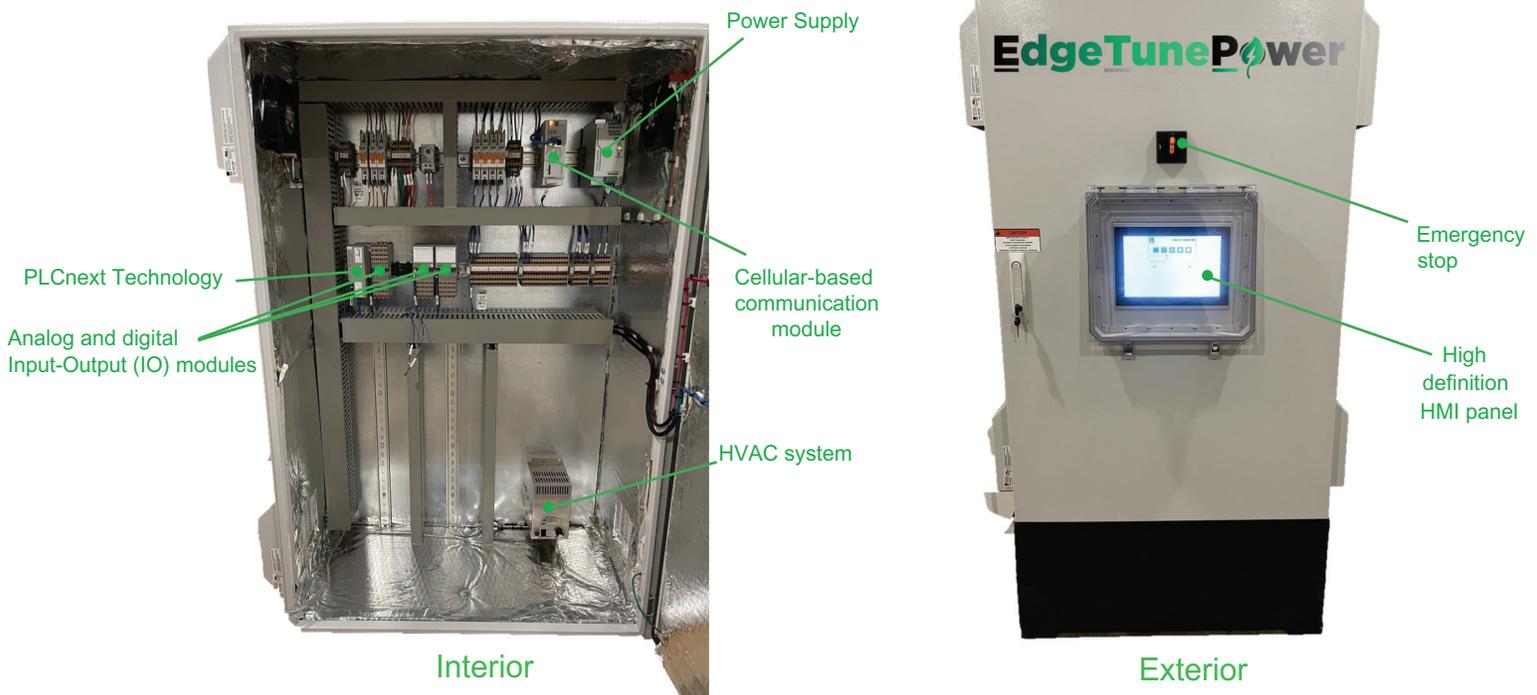


Real-Time-Digital Simulators (RTDS)

A power-distribution system (microgrid) including its power transformers, power lines, and DERs will be simulated in real time.

The EdgeTunePower Grid Edge Solution

EdgeTunePower offers a fully-integrated system including state-of-the-art Programmable-Logic-Controller (PLCnext), provided by our industrial partner, Phoenix Contact Ltd., input-output modules, modules for communication over internal network, cyber-secured cloud mediums, as well as cellular mediums, HVAC system, and high-definition HMI panel.



Modular Design:

iT-1000's modular design helps development of hierarchical, distributed supervisory edge control systems. The PLCnext inside the platform can communicate with same class of the controller commissioned at other physical location of the customer electrical power system.

Distributed Edge Control Availability:

Each iT-1000 platform enables coordinated operation of up to thirty various types of DERs in a geographical proximity of up to ten kMs.

Best-in-class Density:

The platform enables a NEMA system for indoor-outdoor operation with responsive HVAC system.

High Efficiency:

The iT-1000 platform is highly efficient with round trip efficiency exceeding 95%.

Enabling Multi-mode Operation of Diverse DERs:

Capability of switching BESS from grid-following mode (real-reactive power) to grid-forming mode (voltage-frequency), and vice-versa. In addition, managing renewable resources to operate at unity power factor mode or droop-based voltage support mode (reactive power supply). The salient feature of our real-time decision-making algorithm is to enable in-millisecond operation mode change of power system DERs, in order to maximize customers electrical energy system continuity of operation.

Cyber-secured Cloud-based Monitoring and Control:

When combined with Phoenix Contact's **PLCnext Engineering Software™**, our proprietary, AI-based, decision-making algorithm maximizes resiliency of your electrical energy system and enables you to observe the monitoring and control management system over cyber-secured cloud mediums.

"The iT-1000 platform has enabled a fast management system over our 230-kW microgrid system and has complemented our Energy-Management-System"

- Nergica Renewable Energy RD&D

EdgeTunePower's **modular** and **scalable edge controller**, running on iT-1000 platform, is the optimum solution for resilient operation of your power system.

iT-1000 Setup

Component	Specifications
High-definition HMI panel	Web panel with 25.7 cm / 10.1" TFT-display (projective-capacitive (PCAP)), 1280 x 800 pixel(s) (WXGA), 16.7 million colors, Arm® Cortex®-A53, 4x 1.2 GHz, 2x USB host 2.0, 1 x Ethernet (10/100 Mbps), RJ45, Yocto/Linux and user software: Chromium Browser. (bus system: without)
PLCnext Technology	<p>PLCnext Control for the direct control of Axioline F I/Os. With two Ethernet interfaces. Complete with connector and bus base module.</p> <p>Capability of communicating over all IEC-61850-compliance communication mediums, e.g., Modbus-TCP, Goose Messaging, DNP3.</p> <p>Response time of as fast as 500 microseconds.</p>
Input-Output Modules	<p>Axioline F, Analog input module, Analog inputs: 8, Analog outputs: 8, 0 V ... 5 V, -5 V ... 5 V, 0 V ... 10 V, -10 V ... 10 V, 0 mA ... 20 mA, 4 mA ... 20 mA, -20 mA ... 20 mA, connection technology: 2-conductor, transmission speed in the local bus: 100 Mbps, degree of protection: IP20, including bus base module and Axioline F connectors</p> <p>Axioline F, Digital output module, Digital outputs: 64, Digital inputs: 64, 24 V DC, connection technology: 1-conductor, transmission speed in the local bus: 100 Mbps, degree of protection: IP20, including bus base module and Axioline F connectors</p>
Cellular-based Module	Industrial LTE 4G router, European version, fallback to 3G UMTS/HSPA and 2G GPRS/EDGE, 2 Ethernet interfaces, firewall, NAT, 2x SMA-F antenna socket, SMS and e-mail transmission
HVAC System	Designed to prevent condensation and maintain minimum temperature in the enclosure, Built in Thermostat. (-18 C to +38 C) (0 F to +100 F) Fan Auto/On switch with pilot light for Heat On indication High temperature safety protection Aluminum alloy outer casing
Power-supply System	Primary-switched power supply unit, QUINT POWER, Screw connection, DIN rail mounting, SFB Technology (Selective Fuse Breaking), input: 1-phase, output: 24 V DC / 10 A
Warranty	<p>Standard: 3 years</p> <p>Extended Warranty: 4 to 10 years (available)</p>
Cabinet Rating	NEMA 3R / IP44
Single Cabinet Dimensions (W x H x D)	<p>800 mm (W) x 1200 mm (H) x 400 mm (D)</p> <p>31.5" (W) x 3.98" (H) x 2.67" (D)</p>

Learn more at

<https://www.edgetunepower.com/products>

Push the Limits Further

EdgeTunePower

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