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QEd – Quantum Edge Device

Technological proposition for smart grid projects

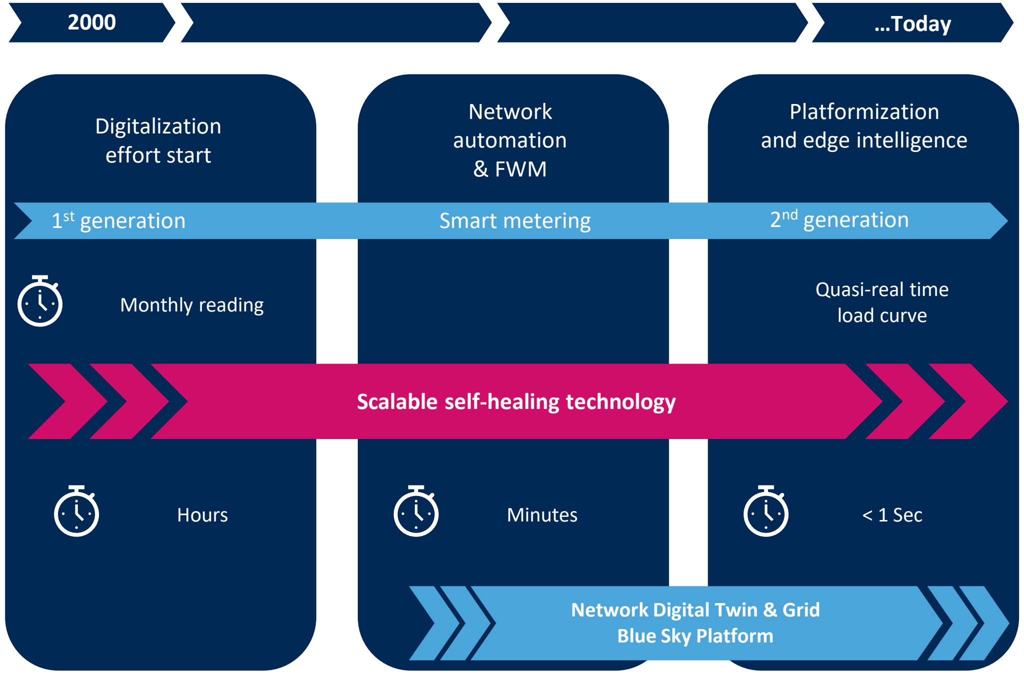
August 2025

Gridspertise

Who we are

Our Story

Set up in **2021 as a carve out of Enel's** experience in developing and scaling up digital technologies to transform distribution networks into smart grids, Gridspertise consolidates **20+ years of Enel know-how in smart grids** in an independent company, jointly controlled by Enel Group and CVC Capital Partners since Dec '22. In Nov '23 Gridspertise acquired Aidon, a **smart metering leader in the Nordics,** and founded with Cuculus the JV neugemacht for German market**.**



Our Mission

Deliver a new era of sustainable and reliable smart grids

Our Vision

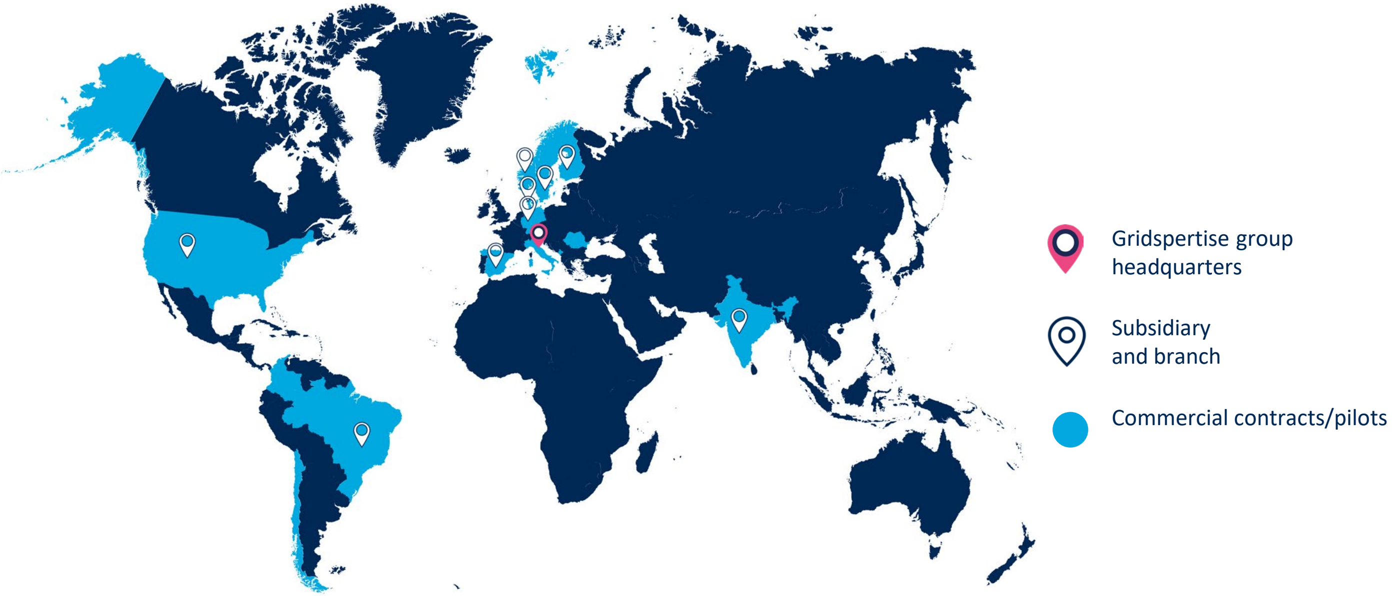
Upgrade grid users' experience through cutting edge sustainable solutions for the digitalization of energy transition actors

Our Ambition

Impact change in the broader industry and society to accelerate the transition to a sustainable energy future

Our Global Presence

gridspertise accelerating your electric future | Aidon a gridspertise company | neugemacht



500 employees | **110M smart meters** | **200+ clients** worldwide

5 trends reshaping Grid Operations requiring advanced digitalization

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Trends	Description	Implications
Distributed Resources and Reverse Flow	**50%+** of RES distributed by 2030	Need to upgrade the grids to **sustain distributed generation paradigm** (e.g. control / monitoring of distributed flexible resources; transformer rating adjustment)
Climate Resilience	**75x** increase in extreme weather events (ex., SAIDI, SAIFI)	Improved observability **of network assets** (e.g., IoT to monitor weather conditions across grid; status of substations/feeders
Tech and Non-Tech Losses	**Energy lost** through grid inefficiencies and external factors like theft or inaccurate metering	Requires better monitoring, smart metering, and data-driven loss reduction strategies.
Grid stability & reliability	**Higher value of loss** load due to increasing electrification (ex., EV charging and Large Consumers)	**Update grid management** systems (e.g. **advanced fault location, preventive maintenance)**
Cybersecurity Raising relevance with network digitalization	More frequent and sophisticated Cyberattacks - **250k** people in Kyiv without power for cyberattack	**Higher cybersecurity level required** especially in communications **between central operations** and **peripheral nodes**

Digitalization and edge computing will be key enablers for future-proof grids

Quantum Edge Device (QEd)

QEd - Quantum Edge® platform

Unlocking new potential for grid operations

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Meter data concentrator

LV Grid Monitoring

Remote Control and Automation

DERS observability and Control

The Smart Substation Platform for virtualization and edge processing

Edge Intelligence

Distributed computational capabilities enable to extend the typical centralized systems functions to **run operations closer to the sources of data in near real time**.

This is key to manage **grid observability** and **DER integration**.

Virtualization

Virtualization technology enables increasing functionalities without adding new devices.

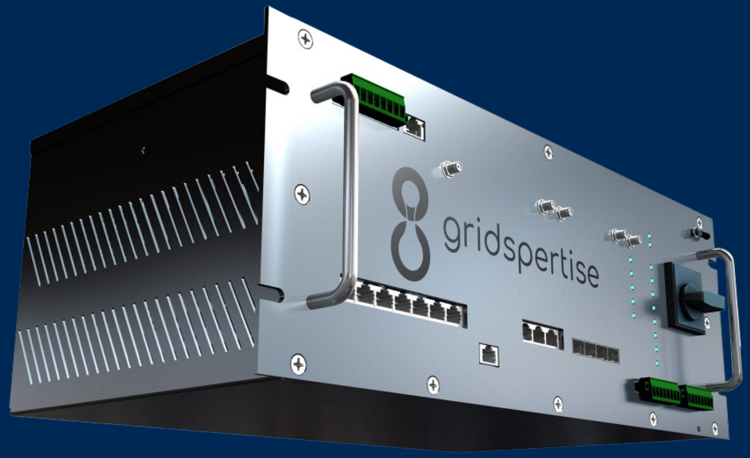
Substation traditional equipment can be digitalized into an edge platform through virtual apps, cutting down installation costs and optimizing maintenance, logistics and safety.

Open approach

QEd **open platform** allows the DSO to adopt the apps included from the first installation, to purchase new ones over time, as well as develop **customized apps** based on current and future needs.

The **Co-Creation program** goes in that direction.

The Quantum Edge Device



Purpose-built for the distribution grid, combining advanced protection capabilities with a software platform that enables diverse edge applications on a single device.

Advanced Edge Computing

- High efficiency Qualcomm System on Chip design
- ARM Octa-core 64-bit processor @ 3GHz
- 8 GB of embedded RAM
- 3x Digital Signal Processors
- **Artificial Intelligence Engine**

Robust I/O Interfaces

- 6 smart terminations for MV feeders
- 1 smart termination for busbar voltage reference
- 4 digital inputs, 5 digital outputs
- 3 ethernet/fiber connections to remote I/O via IEC61850

Multi-Channel Communications

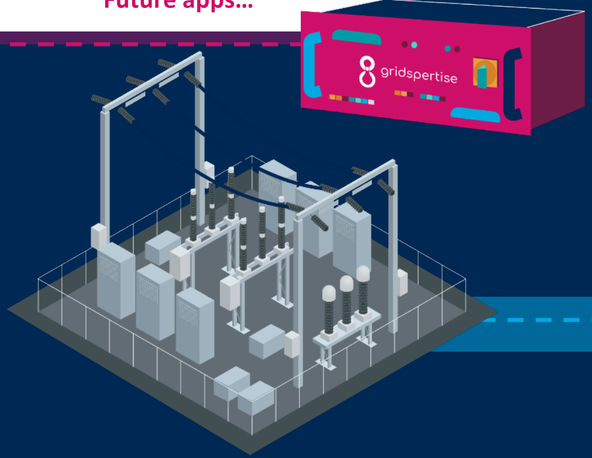
- LTE/5G + WiFi + BLE
- Radio Frequency (169MHz)
- RF SRD (868 – 920 MHz)
- Ethernet Switch Copper/Fiber
- IEC 61850 (MMS, GOOSE, SV), IEC 60870-104, DNP3, Modbus, MQTT

Built-in Electrical Protections

- Current protections (ANSI 50/51-50/51N-67-67N-46BC)
- Voltage protections (27-59-59N-59V2)
- Frequency protections (81L,81H, ROCOF), Syncro-check (25)
- Max Active Power (32P)
- Programmable Autorecloser (79)
- Intermittent arc detection
- Over-current setting for worker safety

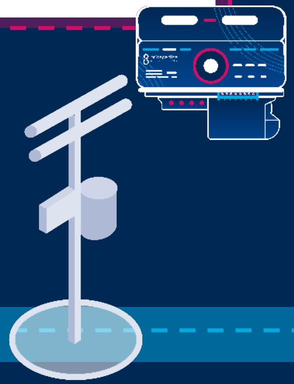
Advanced monitoring and control across the distribution grid

- Virtual protection automation and control
- Transformer monitoring
- Feeder monitoring
- Environmental monitoring
- Hosting capacity
- MV backup protection
- PMU fault location
- **Future apps…**

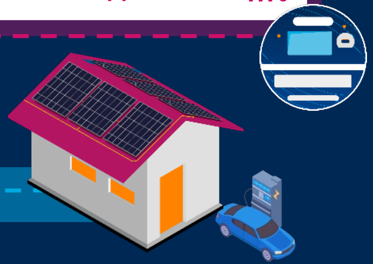


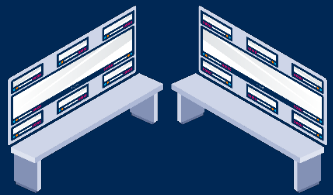
- Virtual protection automation and control
- Recloser controller
- FLISR / Self-healing
- Transformer/feeder monitor
- PMU fault location
- Microgrid control
- Flexible load orchestration
- **Future apps…**

- Transformer monitoring
- Feeder monitoring
- Environmental/tilt monitor
- Smart meter gateway
- **Future apps…**



- Head-End System
- Meter Data Management
- Customer Portal
- Meter Analytics
- Flexible load orchestration
- **Future apps…**





Utility Integrations

- SCADA
- DERMS
- ADMS
- HES/MDM

QEd co-creation program

DSO
DSO to identify strategical use-cases and share technical specifications for IED virtualization/app in QED platform

App Developers
Deployment and integration of QED App including whole-life-cycle maintenance and bug-fixing

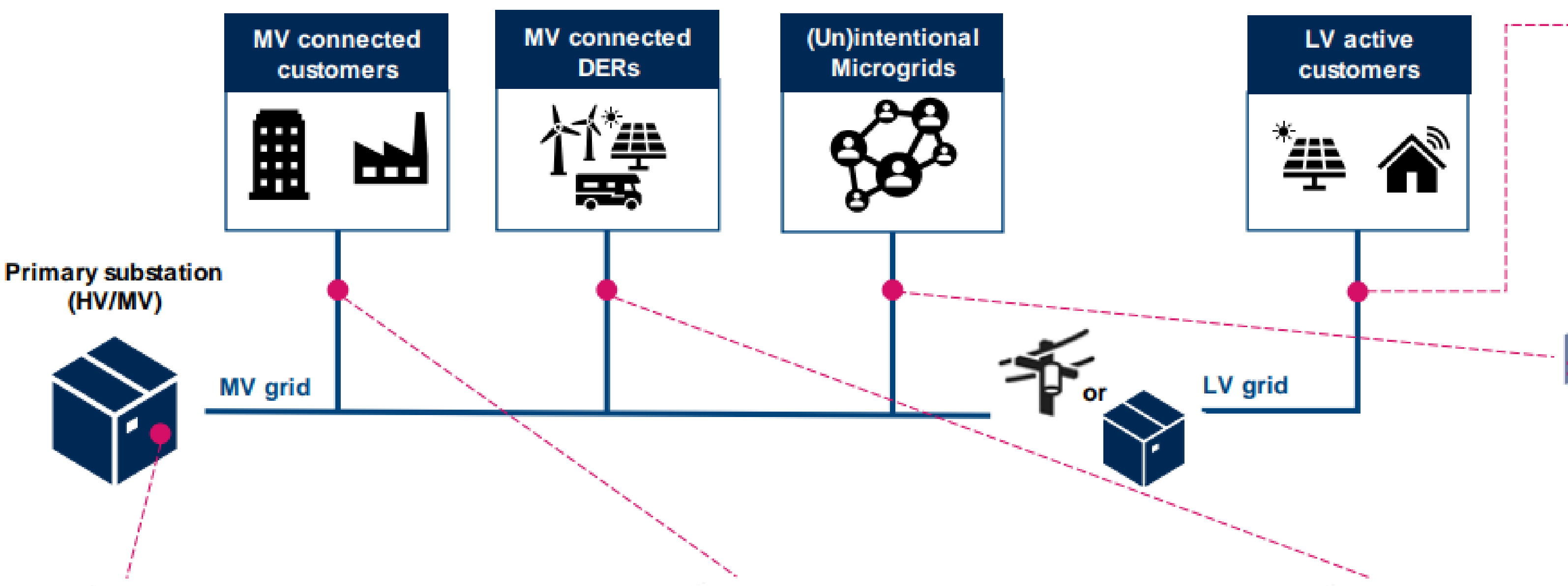
Gridspertise
Orchestrating the partnership, deploying industrialization, explore new business for the App

Co-Creation Program for New Edge Applications

- Collaborate with Gridspertise to identify high-value uses cases and define technical specifications for new edge applications
- App developed by Gridspertise, utility or third-parties using Gridspertise SDK
- Establish lab and field test methodology, criteria and KPIs
- Complete testing in Gridspertise or utility lab environment followed by field validation in utility grid
- Publish app on Gridspertise App Store, implement across utility
- Revenue sharing opportunity selling app to other global utilities

Use Cases

QEd Ecosystem | Use cases overview



QED for MV/LV Substation or Pole mounted

- Virtual PAC
- Smart meter management (M&M/G3H/ Prime)
- Recloser Controller
- Pole stability monitoring
- LV Digital Twin

QED for Microgrids

- Virtual PMU (M-type)
- Virtual PAC
- Microgrid Controller (DER balancing)
- Substation Automation (virtual PLC)

QED for Primary Substation

- MV back up Protection relay
- DERs Gateway / RTU
- Substation Environment monitoring
- Virtual M-type PMU
- Fault location estimation
- Smart OLTC management
- Substation Automation (virtual PLC)
- Partial Discharge monitoring

QED for MV Delivery Points

- MV multifeeder Protection relay
- DERs Harmonized Interface [1]
- DERs real time management (w/ DERMS)
- Substation Environment monitoring
- Substation Automation (virtual PLC)
- Partial Discharge monitoring

QED for MV DERs

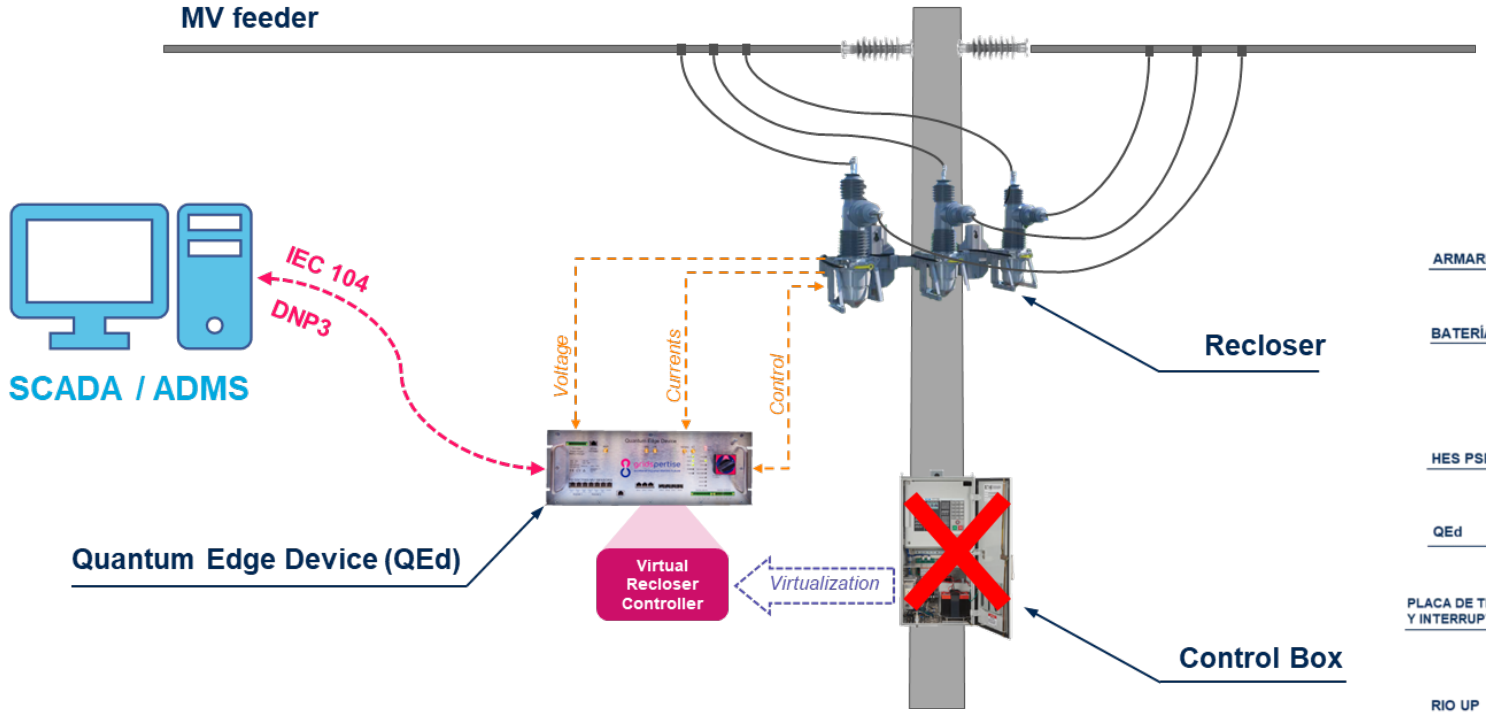
- MV multifeeder Protection relay
- DERs Harmonized Interface [1]
- DERs real time management (w/ DERMS)
- Substation Environment monitoring
- Virtual M-type PMU
- Partial Discharge monitoring

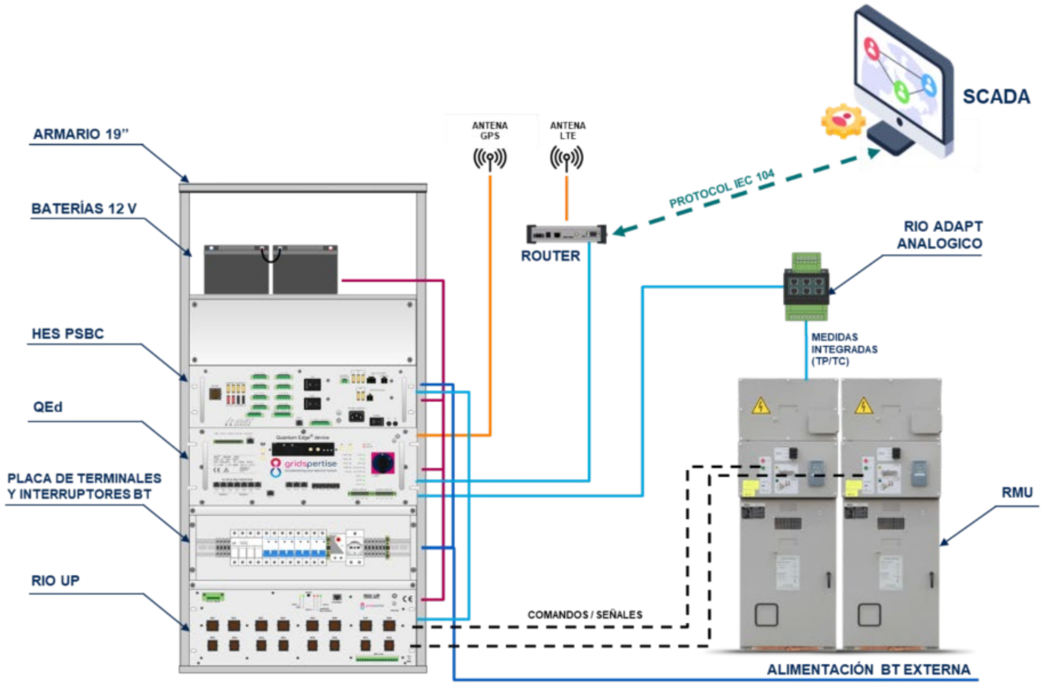
1 Based on Italian CCI functionalities described in CEI 0-16 standard

Recloser controller virtualization

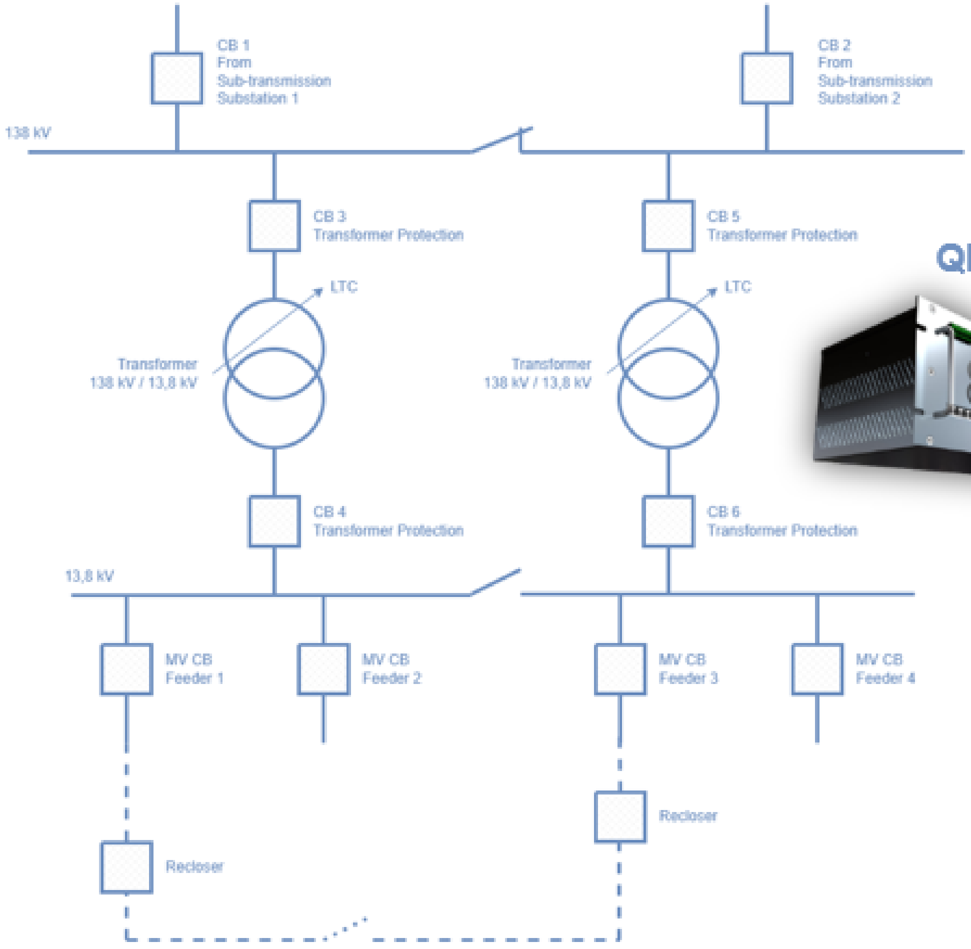
Assumption: The customer needs to install a circuit breaker (CB) and use it like a recloser.

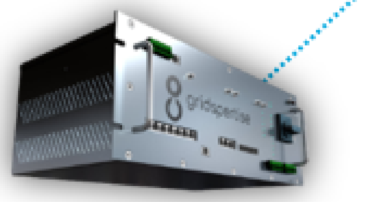
Solution: The QEd allows to use the CB as a recloser, performing all the functionalities of a recloser controller. Furthermore, it guarantee the comunication with SCADA/ADMS via IEC 104 or DNP3.

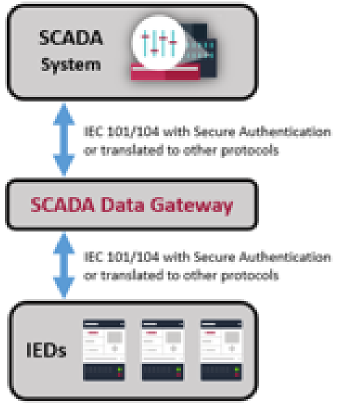




QEd for Primary Substations







Virtualization Enabling of HV/MV Architecture

Device Virtualization Layer

- MV backup Protection Relay
- vRTU
- Mini SCADA or Second Level or Substation SCADA
- DERs Control and Gateway between edge devices and central systems (ADMS, SCADA, DERMS)
- Substation Environment Monitoring
- Smart OLTC Management
- Partial Discharge Monitoring

Gridspertise Apps + 3rd Party Apps

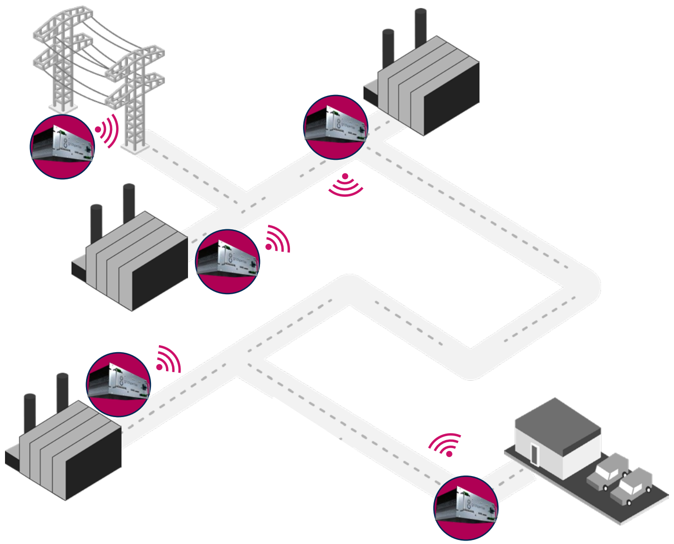
- Virtual M-type PMU
- Fault Location Estimation
- Substation Automation (Virtual PLC)
- Logic Selectivity and Self-Healing Strategies

Benefits

- Quick responses under adverse weather conditions
- Enhances the resilience of distribution grids
- Reduces the number of affected customers
- Improves grid performance indicators

Self-Healing + Demand Response

Commercial & Industrial Customers



Software Integrations

Remote Device Manager

Remote monitoring and control of devices

Grid Automation

FLISR software compatible with any SCADA and GIS

Existing Utility Systems

QEd integrates external SCADA/ADMS/DERMS

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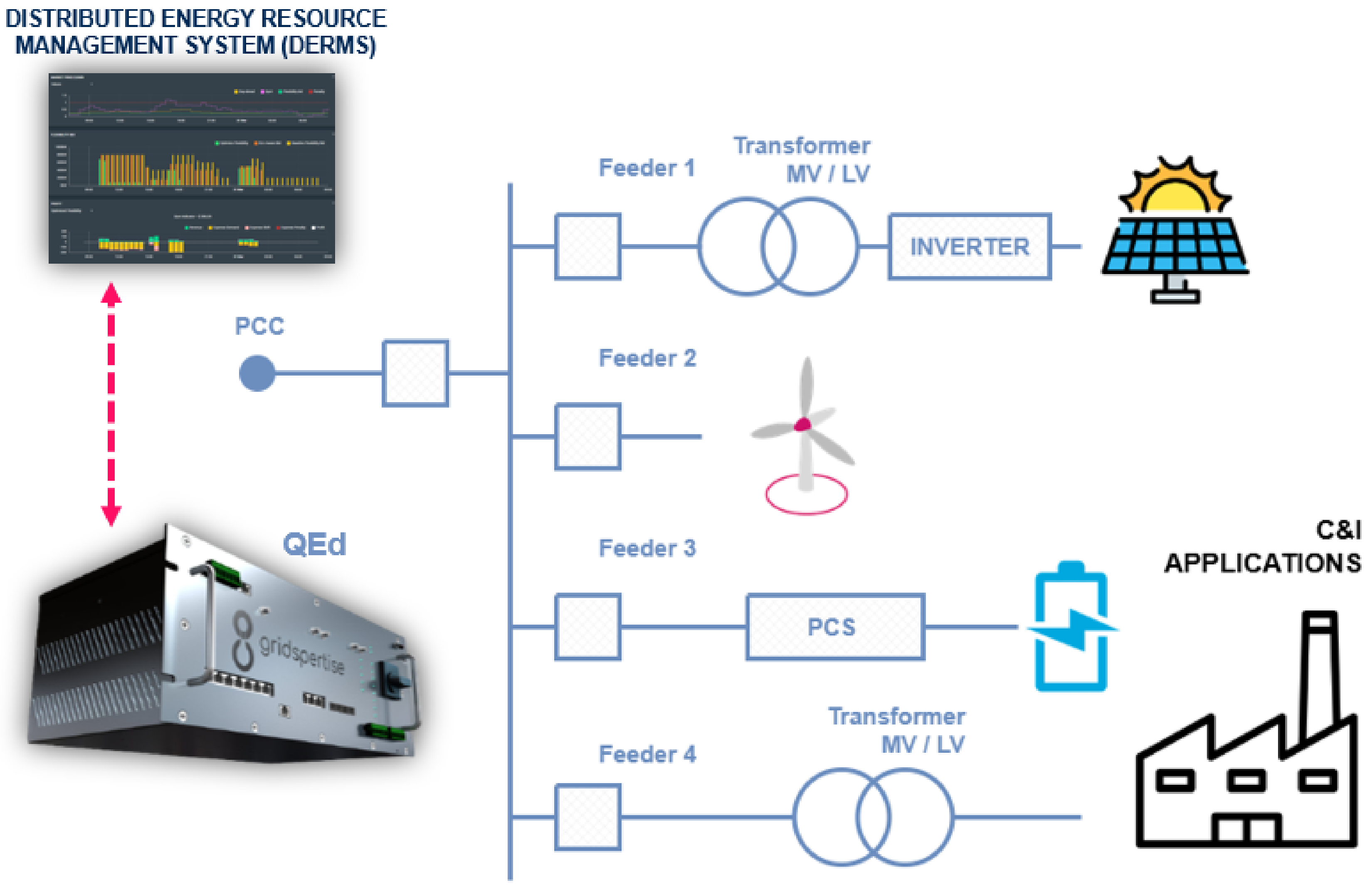
Features

- Following a grid fault, automatically facilitate load transfer and demand response to manage load
- Algorithm determines the optimal load reduction from each customer
- Ensure that voluntary or contractual load reduction is not exceeded through duration of grid fault

Process

1. QEd detects fault condition and manages load switching at substation
2. QEd determines optimal load reduction from each customer in demand response program
3. Telegram messages sent to customers requesting optimal load reduction
4. Customers have 20 minutes to reduce loads
5. QEd at customer sites ensure that load reduction is not exceeded until fault is cleared

MV Connected Customers



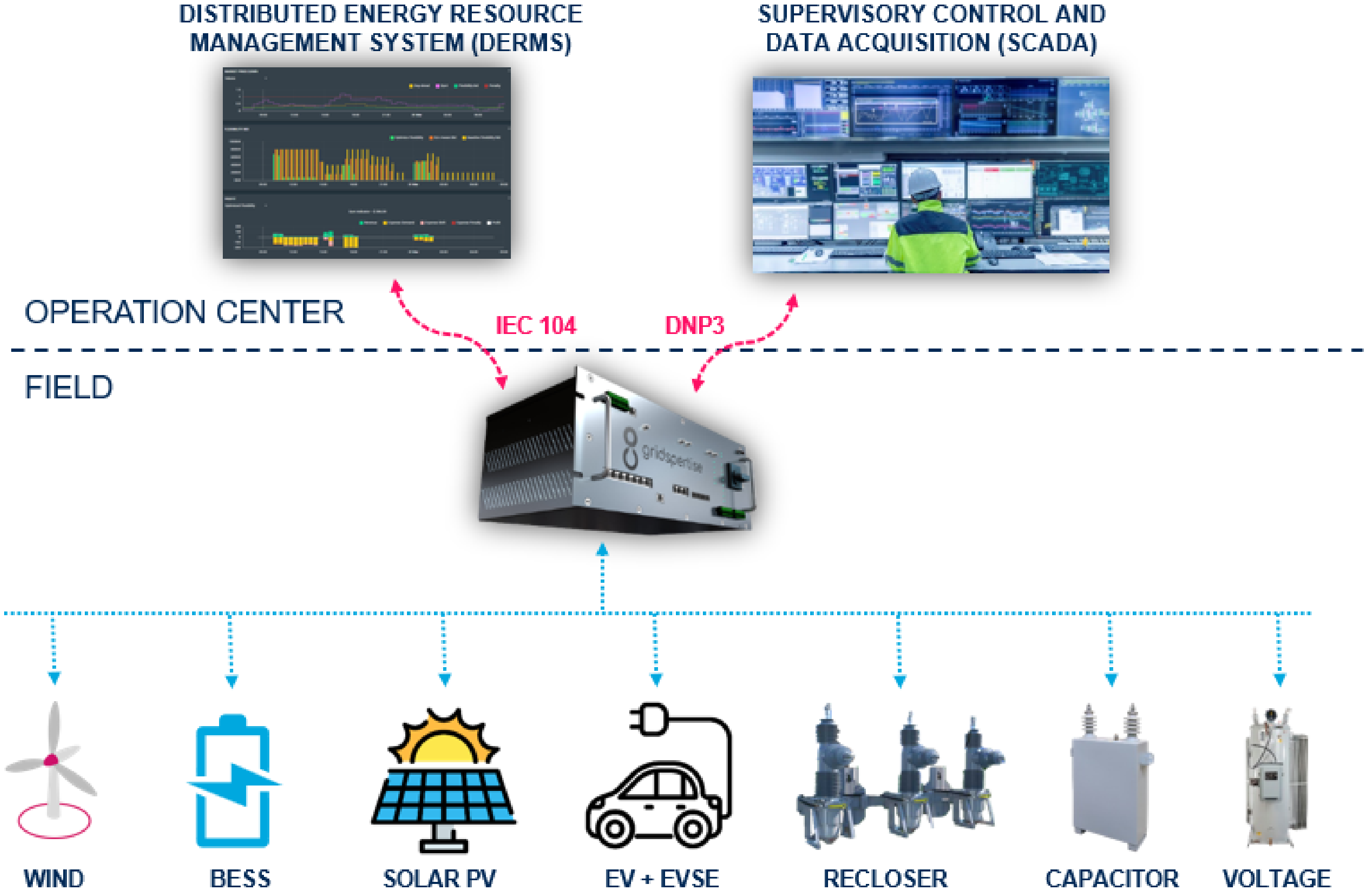
Enabling an Ecosystem of Software Applications

Gridspertise Apps + 3rd Party Apps

QEd for MV Delivery Points

- vProtection Relay for MV Multifeeder
- vRTU
- Real Time Management: Consumption and DERs (w/ DERMS)
- DERs Control & Harmonized Interface
- Voltage and Frequency Monitoring
- Flexibility Enable
- Smart OLTC Management
- Substation Environment Monitoring
- Substation Automation (vPLC)
- Partial Discharge Monitoring

MV Connected DER



Enabling an Ecosystem of Software Applications

Gridspertise Apps + 3rd Party Apps

QEd for DER

- DER real time management: QEd instantaneous decision in field
- Integrated with DERMS
- Flow reverse control
- Adaptative Protection – New set of parameters for relays in field
- Virtual M-Type PMU
- Partial discharge monitoring
- BESS activation capacity for charging and discharging
- Price signals based on surplus or shortage energy from DER to EVSE

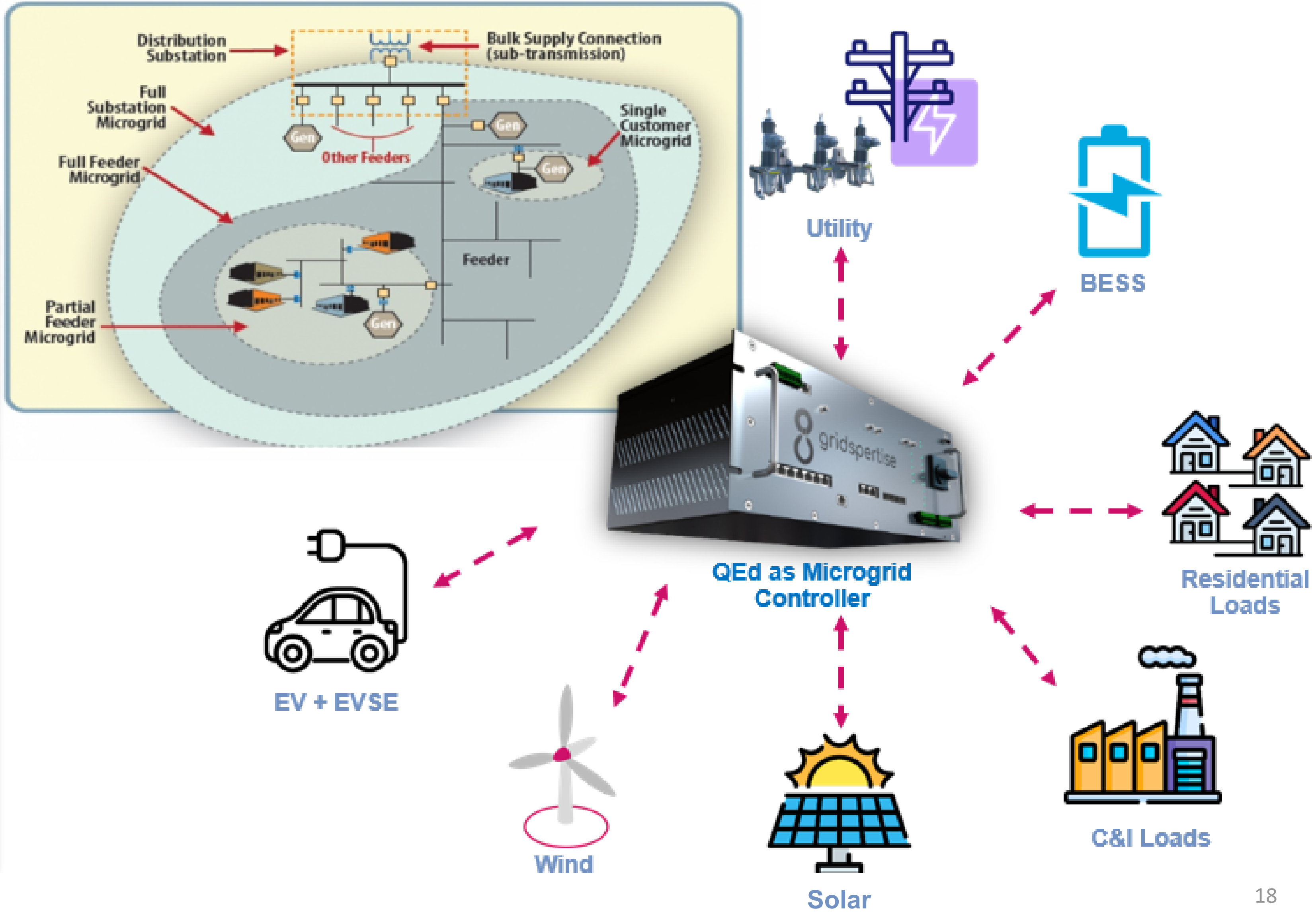
(Un)intentional Microgrids Applications

Enabling an Ecosystem of Software Applications

Gridspertise Apps + 3rd Party Apps

QEd for Microgrids

- Microgrid Controller (DER Balancing)
- Substation Automation (vPLC)
- Virtual PAC
- Virtual PMU
- Integrated with DERMS
- Distributed Generation coordination
- BESS integration with advanced functionalities
- Smart Street Lighting integration
- Smart Meters coordination
- EVSE + EV availability
- VPP enabler



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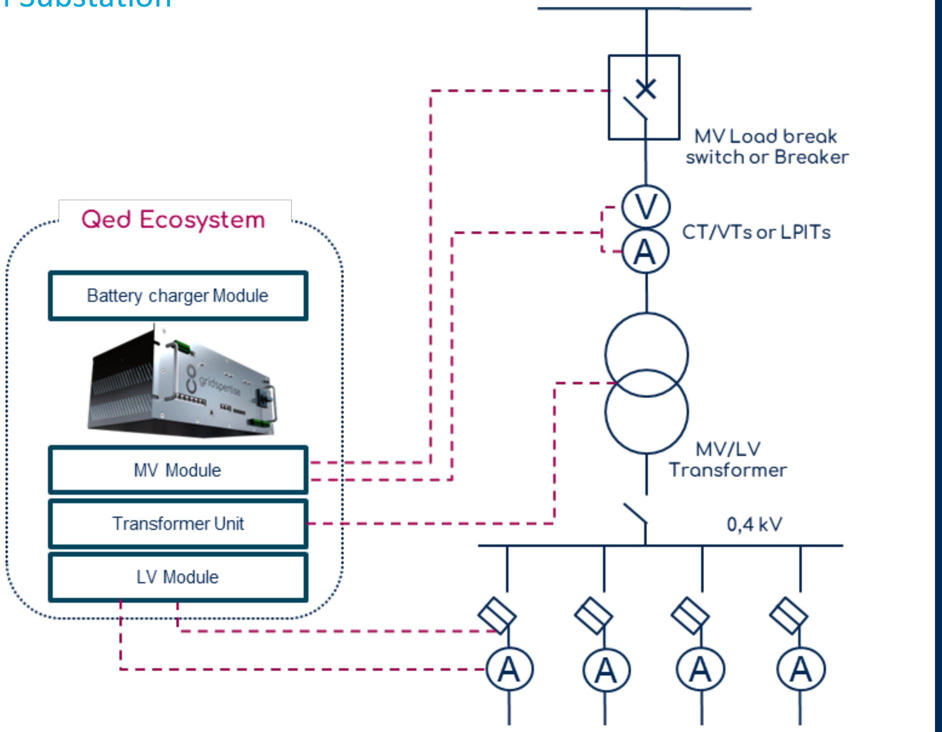
Substation Automation

Distribution Substation



Software Integrations

Remote Device Manager

Remote monitoring and control of devices

MV/LV SCADA

GIS Integrated MV/LV SCADA

Grid Automation

FLISR software compatible with any SCADA and GIS

Existing Utility Systems

QEd
SCAD

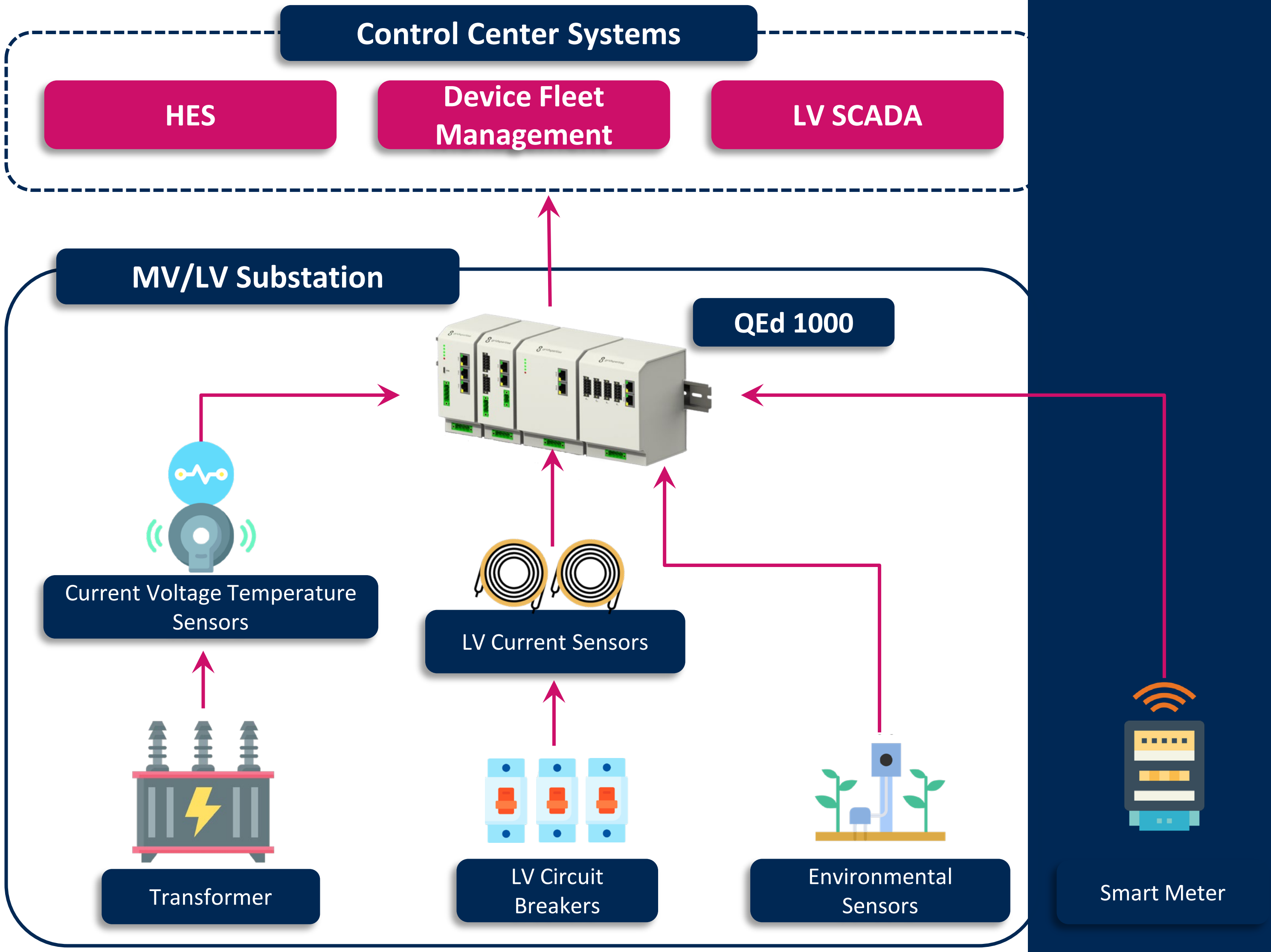
Use-cases

- Virtual protection automation and control with self-healing
- Transformer monitoring
- OLTC smart management
- MV feeders monitoring & control

Unique Benefits

- Decentralized self-healing ensure availability during loss of communication and reduced latency
- Dynamic management of OLTC integrating Smart Meter data to increase hosting capacity
- Device Manager Platform ensure minor maintenance-related OPEX

LV Monitoring and Control



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Highlights

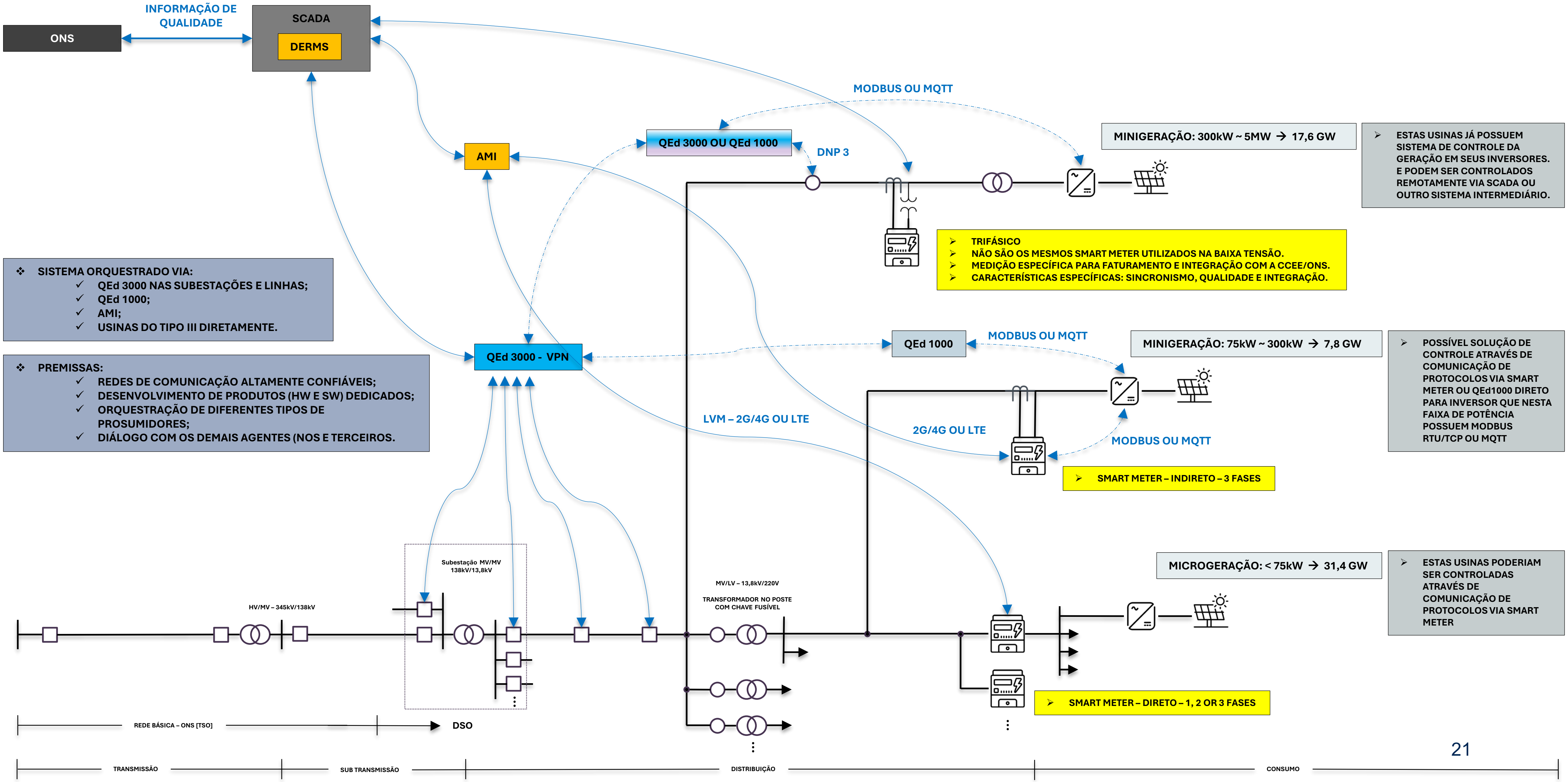
QEd 1000: a decentralized distribution network management structure for acquiring data and measurements on the edge. Use cases enabled:

- Feeder Monitoring
- Transformer Monitoring
- Data Concentrator

LV SCADA: a centralized Low Voltage Supervisory Control and Data Acquisition platform for real time monitoring

Device MGMT and IoT Paltform: a central SW solution for managing intelligent electronic devices, reducing field inspections and operational costs

Reverse Flow



Field performances

Gridspertise QEd Flagship Projects

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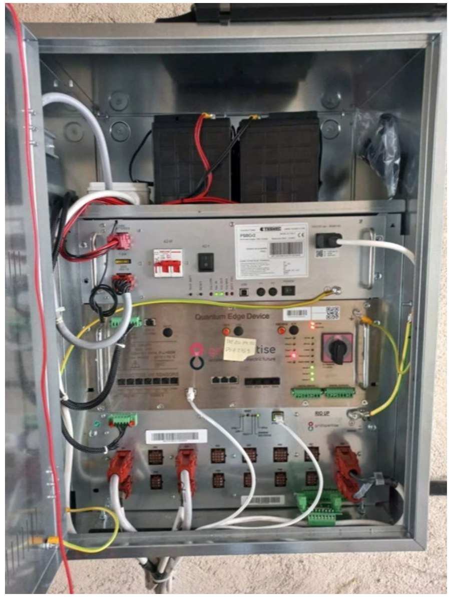
Our Innovative Solution

Quantum Edge Device is an advance Virtualization Platform with Edge Computing capabilities

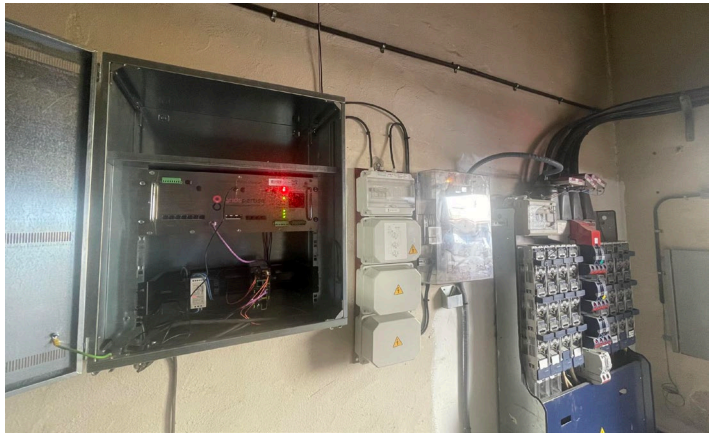
QEd – DSOs ongoing projects

Italy

Romania



Spain



United States

Colombia

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Maurício
Andrés
Paez Prieto

Alexandre
Cunha
Echebarrena

Marcos Aurelio
Izumida Martins

Customer
Success LATAM
Sanderson
Dos Santos

Customer Operations
Bruno Martins de Biaz

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Ready for a new era of smart grids?

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