



Smart Grid Interface Module SGIM

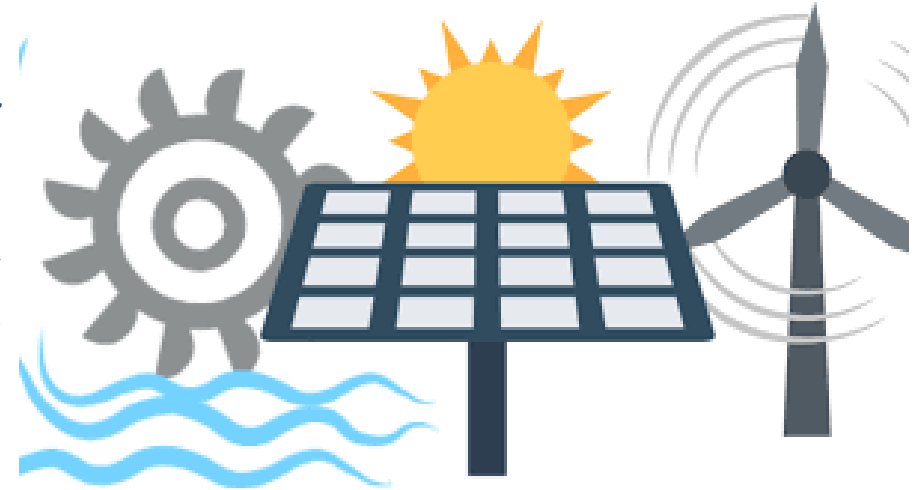
Challenges of the Energy Mix Transition

■ Targets

- Major increase of renewable energy share of gross electricity consumption by 2030
- Switching off conventional (thermal) power plants and (in some countries) nuclear power plants
- Reduction of greenhouse gas emissions and primary energy consumption (oil, coal, gas, etc.) by 50%

■ Challenges

- Load fluctuations within the electric transmission and distribution network due to volatility of renewable energy generation (meteorology = wind + sun)
- Increase of peak current demand due to changeover of inner city and passenger transportation to e-mobility



Background

Last Mile Transparency

- First step: More knowledge
 - Measurement in local distribution substations and cable distribution cabinets
 - Voltages, currents, power and energy
 - Power quality
 - Communication and central aggregation of measuring data
- Second step: Do the right thing
 - Bottleneck management within the electrical distribution network
 - Definition of redispatch actions
 - Demand-drive network planning and expansion



Distribution Substation Monitoring ↔ Smart Metering

■ Simply Thought

- Use of smart metering data for network/load monitoring
- Load switching through smart meter communication and smart meter circuit breakers

Grid Operation

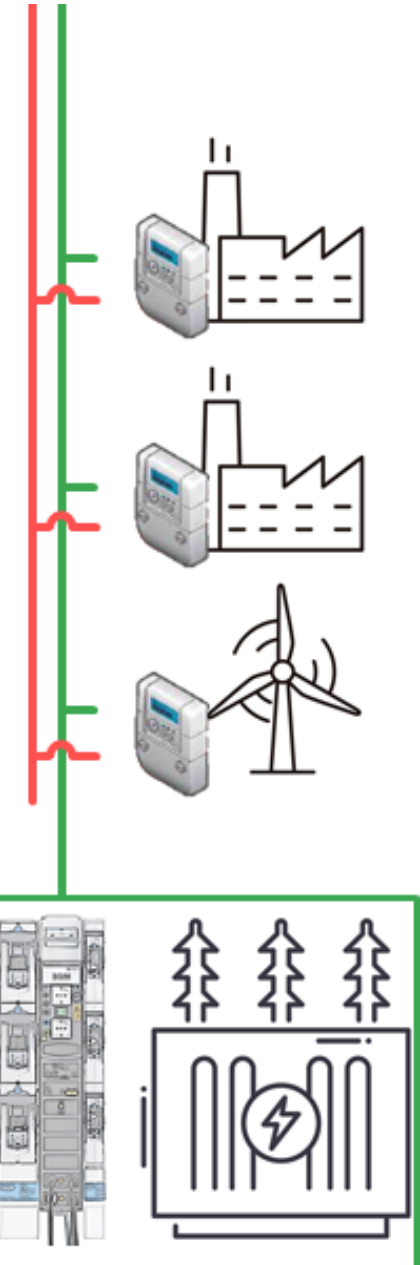
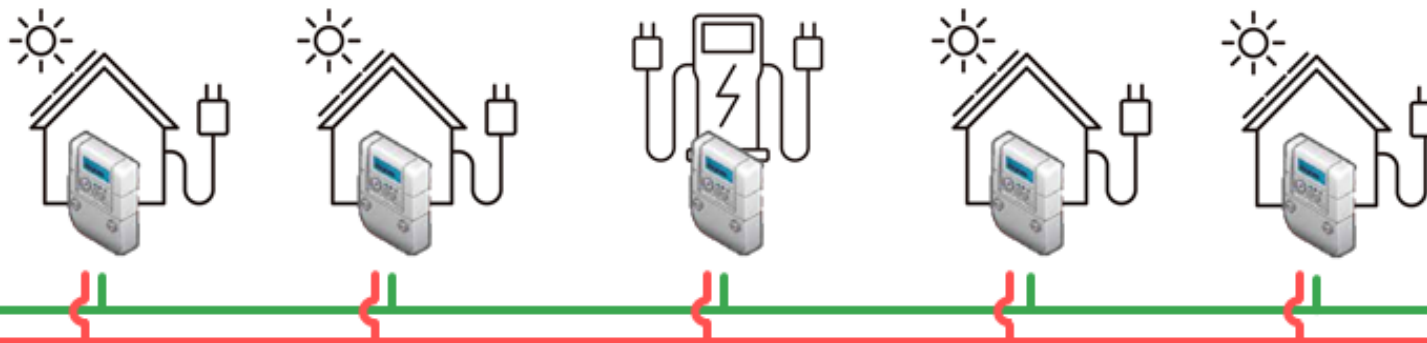


■ Made Difficult

- Metering Services $\neq$ Grid Operation (e.g. missing data connection)
- Time-criticality of measurements for grid operation



Metering Services



■ Company Profile / History

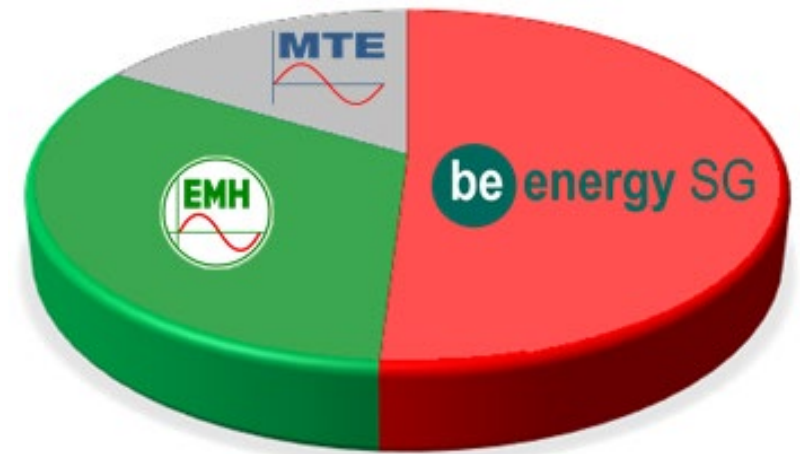
2018: Management Buy-Out from **BECK** (industrial/SCADA communication expert of electric power systems)

2019: SGIM (Smart Grid Interface Module) and SGIM Light market introduction

- 5 employees
- Turnover (2020): approx. 1 Mio. €

■ Investment of MTE Meter Test Equipment AG / EMH Energie-Messtechnik GmbH

- Jan. 2021: Investment of 49%
- Taking over sales/marketing in Germany/Europe
- Cooperation with MTE's broad sales network
- Joint development of SGIM power quality module based on MTE's measurement technology
- Synergies with HYDROCAL monitoring products



Smart Grid Interface Module

Idea

- Network Stability in the Future Smart Grid
 - Volatile (renewable) energy generation
 - Peak consumptions for charging of electrical vehicles due to e-mobility increase
 - ⇒ Transparency of energy flows
 - ⇒ Network planning and expansion (if necessary)
- Modularity
 - Easy and cost-effective installation of measuring technology at critical sites of the electricity distribution network
 - Installation on 185mm busbar system without power interruption
 - Measurement of up to 10 secondary circuits by flexible current transformers or integrated CTs of NH strip-type fuse-switch disconnectors acc. EN IEC 61439/60947
 - Communication via SCADA protocol EN IEC 60870-5-104 or EN IEC 61850



■ Smart Grid Interface Module

Construction Setup



■ Installation Platform

- Installation on 185mm busbar system without power interruption
- Width 100mm (NH strip-type fuse-switch disconnectors size 1-3 acc. EN IEC 61439/60947)
- Preparation for later installation of measurement technology at critical sites of the distribution network

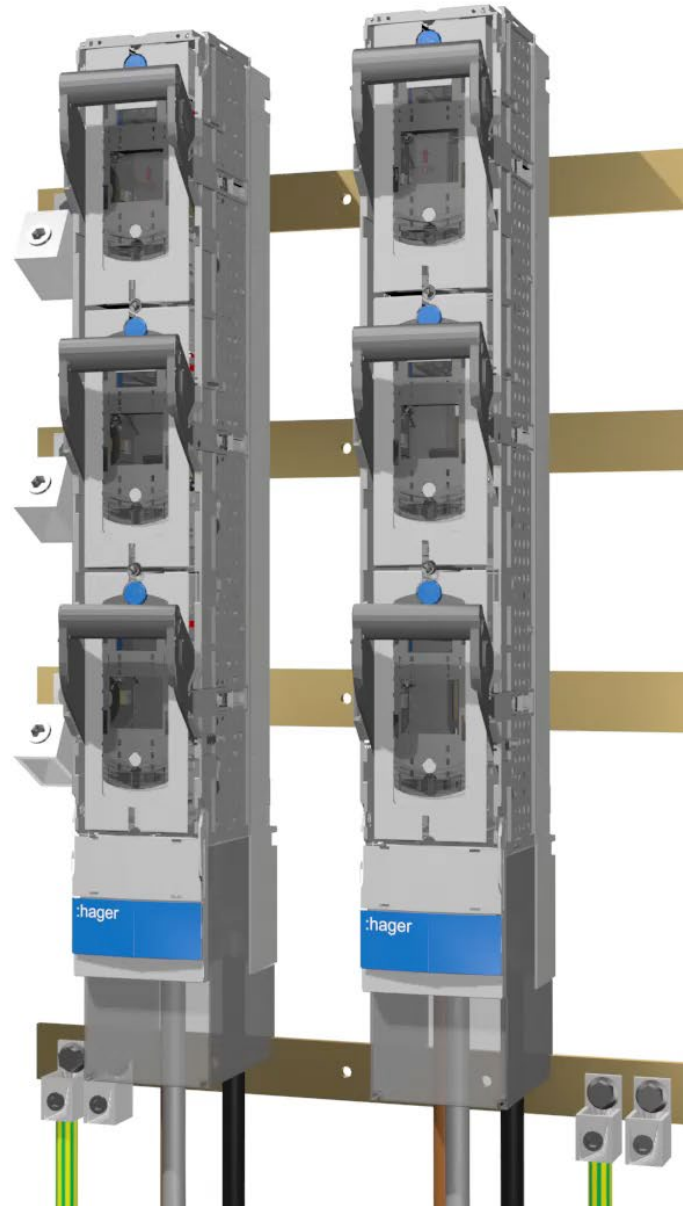
■ Smart Grid Interface Module (SGIM)

- Measurement of voltage and frequency
- Modular expansion for the current, power and energy measurement of up to 14 secondary circuits
- Modular expansion for condition assessment and load switching
- Communication via Ethernet (RJ45/fibre-optical), MODBUS, LoRaWAN and LTE
- Integrated cabinet temperature/humidity measurement



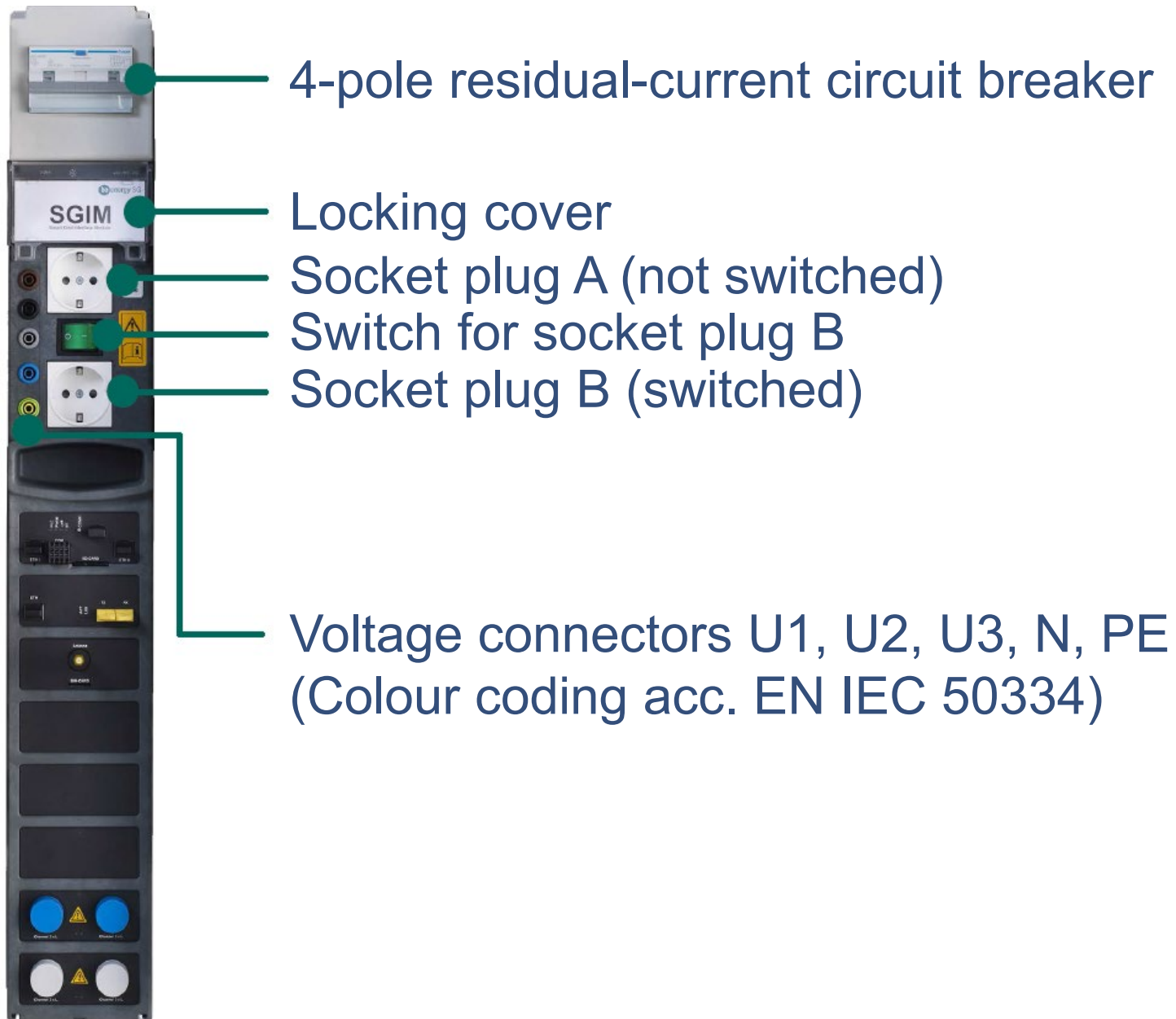
Smart Grid Interface Module

Easy and Safe Installation



Smart Grid Interface Module

Modular System

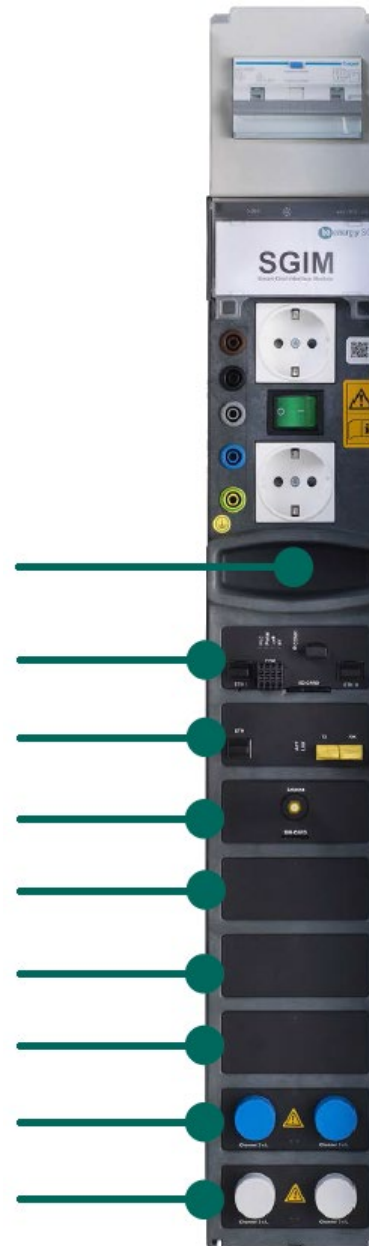


Smart Grid Interface Module

Modular System

- Modular Unit 8: SGIM CPU Module
- Modular Unit 7: Fibre-optical Ethernet Module
- Modular Unit 6: Radio Module
- Modular Unit 5: Measurement or I/O Module
- Modular Unit 4: Measurement or I/O Module
- Modular Unit 3: Measurement or I/O Module
- Modular Unit 2: Measurement or I/O Module
- Modular Unit 1: Measurement or I/O Module

Mounting Grip



Smart Grid Interface Module

CPU and Communication Module

■ CPU Module

- Ethernet Interface 0 (RJ45)
- Ethernet Interface 1 (RJ45)
- Serial Interface
- Bluetooth
- Temperature/Humidity Sensor
- SD Card

■ Fibre-optical Ethernet Module

- Ethernet Interface (RJ45)
- Ethernet Interface (fibre-optical)

■ Radio Module

(LTE / LoRaWAN)

- Antenna Socket
- Mini SIM Card



Smart Grid Interface Module

Measurement Module



■ Measurement Module CT

- Measurement through 1A CT (current transformer) of NH strip-type fuse-switch disconnectors
- Voltage measurement 3-phase
- Current measurement 3-phase
 - 2 outgoing circuits or
 - L1, L2, L3, N, PE

■ Measurement Module Flex CT

- Current range 0 – 15.000A
- Voltage measurement 3-phase
- Current measurement 3-phase
 - 2 outgoing circuits or
 - L1, L2, L3, N, PE



Smart Grid Interface Module

Power Quality Module



- Measurement Module CT or
- Measurement Module Flex CT
 - Voltage measurement 3-phase
 - Current measurement L1, L2, L3, N, PE
- Power Quality Standards
 - EN IEC 61000-4-30
 - EN IEC 62586
 - EN 50160
- Power Quality Parameters
 - Voltage | Current | Frequency
 - Voltage Dips | Swells | Interruptions
 - Voltage Symmetry
 - Rapid Voltage Changes (RVC)
 - Harmonics | Interharmonics
 - Flicker



Smart Grid Interface Module

Input/Output (I/O) Module



- Inputs (8x)
 - Scanning voltage +12VDC
 - 8 status LEDs (green)
- Outputs (2x)
 - 2 potential-free relays
 - 1 change-over contact



Substation/SCADA Integration

- EN IEC 60870-5-104
 - Standardized transmission protocol for electric power systems supervisory control and data acquisition (SCADA)
 - Transmission protocol based on internet protocol TCP/IP
 - Interoperability with all SCADA systems (SIEMENS, ABB, PSI, KISTERS, etc.)
- EN IEC 61850
 - Standardized communication protocol for intelligent electronic devices (IEDs) at electrical substations
 - Object-oriented protocol via TCP/IP for client-server communication using MMS (manufacturing messaging specification)



SGIM Portal for quick and easy Applications

■ Advantages

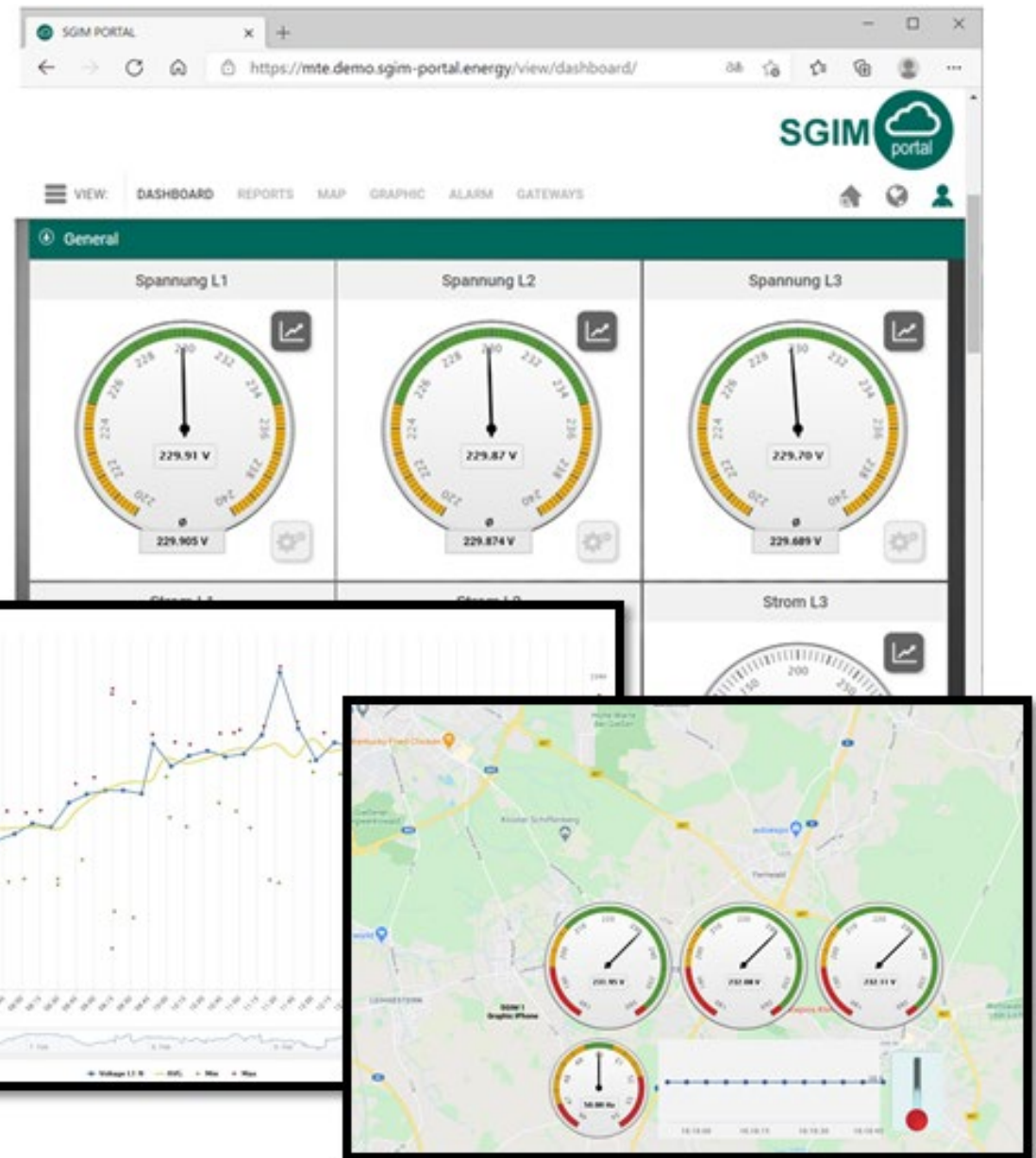
- Immediate availability of measuring data without or before any SCADA integration
- Dashboard of all important information (configurable)
- Configuration of thresholds, alerts and actions (e.g. SMS or email messaging)

■ Reporting

- Automatic sending of csv-file reports

■ Device Management

- Map view
- Remote update



Software

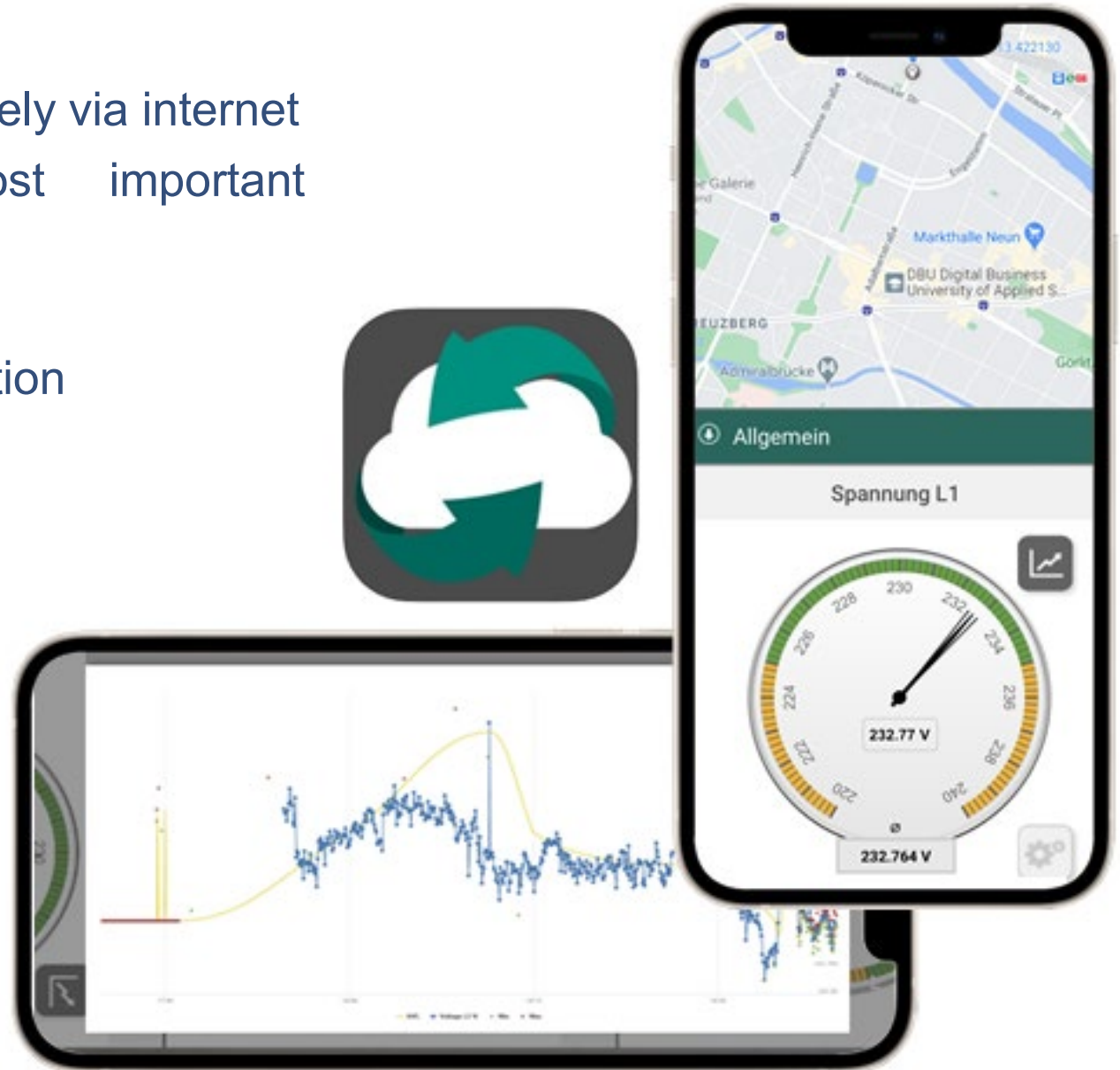
SGIM Portal APP

■ Configuration

- On-site via bluetooth or remotely via internet
- Installation with the most important communication parameters
 - Ethernet parameters
 - LTE/LoRaWAN configuration
 - Setting of real time clock
 - SGIM portal parameters

■ Visualisation

- Dashboard of all important information (configurable)
- Map view



■ Smart Meter Gateway SGIM

- integrated OpenVPN client for secure remote access (certificate-based)
- integrated IPsec protocol suite with PSK authentication
- integrated firewall
 - package filter
 - configurable access (IP address, IP port, protocol, network interface)
- digital signature/encryption of firmware/configuration updates
- communication exclusively via IP port 443 (https over SSL/TLS)

■ SGIM Portal

- full encryption of entire communication between SGIM and SGIM portal (TLS v1.2/1.3, AES128/256, PFS)
- authentication by user name and password
- high level/complexity password with blacklist comparison

■ SGIM Portal Infrastructure

■ Hosting

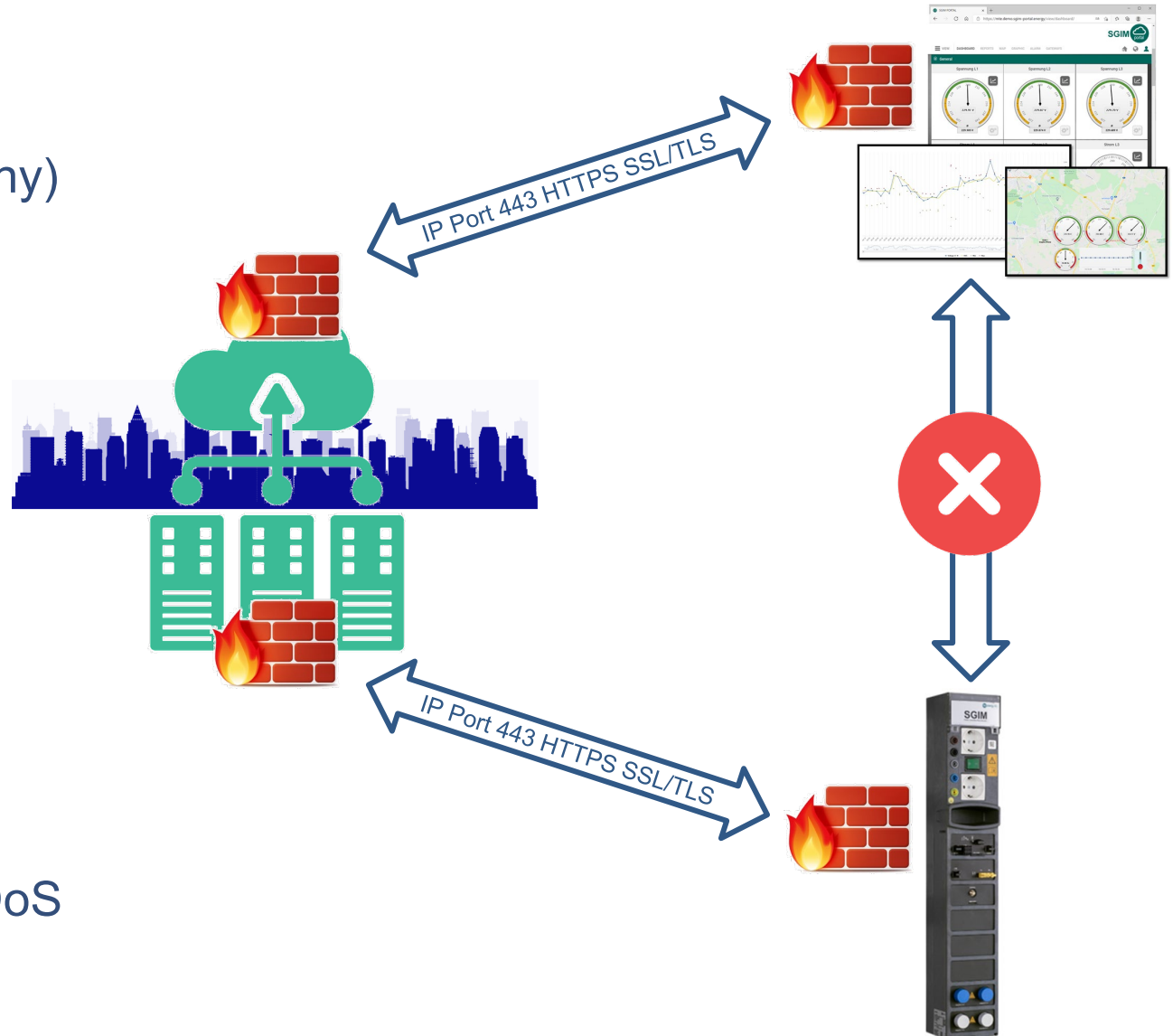
- modern datacenter
- Frankfurt/Main (Germany)
- ISO 27001 certification

■ Safety

- access control
- video supervision
- security service
- fire protection

■ Virtuality

- scalability
- firewall monitoring
- load balancing with DoS detection



Standards

■ Product Standards

- EN IEC 60947 Low voltage switchgear and controlgear up to 1.000VAC/1.500VDC
- EN IEC 61439 Low voltage switchgear and controlgear assemblies

■ CE Compatibility

- EN IEC 61010 Safety requirements for electrical equipment for measurement, control and laboratory use
- EN IEC 61557 Equipment for testing, measuring or monitoring of protective measures
- EN IEC 61326 Electrical equipment for measurement, control and laboratory use – EMC requirements
- EN IEC 301511 Global system for mobile communications

■ Power Quality

- EN IEC 50160 Voltage characteristics supplied by public electricity networks
- EN IEC 61000-4-30 Power quality measurement methods
- EN IEC 62586 Power quality instruments

■ Smart Grid Interface Module

Technical Specification



General Data

■ Dimensions

- Width 100mm
- Depth 100mm
- Height 590mm

■ Power Supply

- Supply Voltage 100V .. 240V | 47Hz .. 63Hz
- Power Consumption max. 25VA
- Overvoltage Category
TN-C Net CAT IV
TN-C-S / TN-S / TT Net CAT III

■ Environmental Conditions

- Operation Temperature -20°C .. +70°C
- Humidity 0% .. 90% (no condensation)
- Environmental Protection IP 21

Measurement

Measuring Quantity		Measuring Range	Resolution	Accuracy
Voltage		0V .. 300V	10mV	0,5%
Current	fuse-switch CTs	1mA .. 1A	1mA	0,5%
	flexible CTs	10mA .. 15kA	10mA	1,0%
Active Power /Energy	fuse-switch CTs			0,5%
	flexible CTs			1,0%
Reactive Power /Energy	fuse-switch CTs			1,0%
	flexible CTs			2,0%
Frequency		45Hz .. 55Hz	0,01Hz	0,5%

Communication

■ Ethernet

- Electrical 10/100BaseT RJ45
- Fibre-optical 100BaseLX10 SC Duplex single-mode (option)

■ Serial Interfaces

- RS232 300 .. 187.500 baud
- RS485

■ Radio

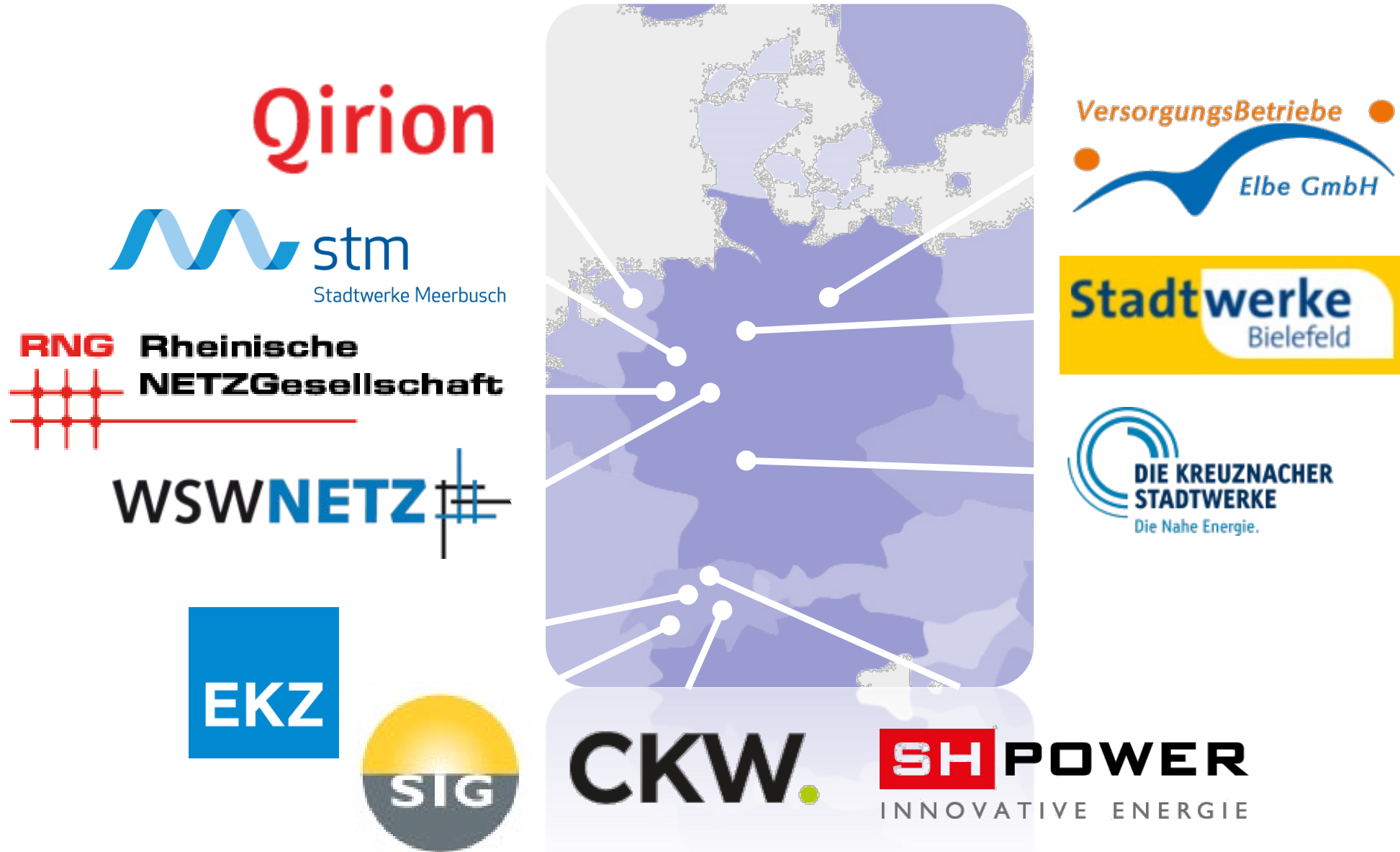
- Bluetooth 4.0
- LTE Mini SIM – SMA antenna
- LoRaWAN 868MHz – RF 2-10km – Class A 1.0.1 protocol (option)

■ Substation/SCADA Protocols

- EN IEC 60870-5-104
- EN IEC 61850

Use Cases

Overview

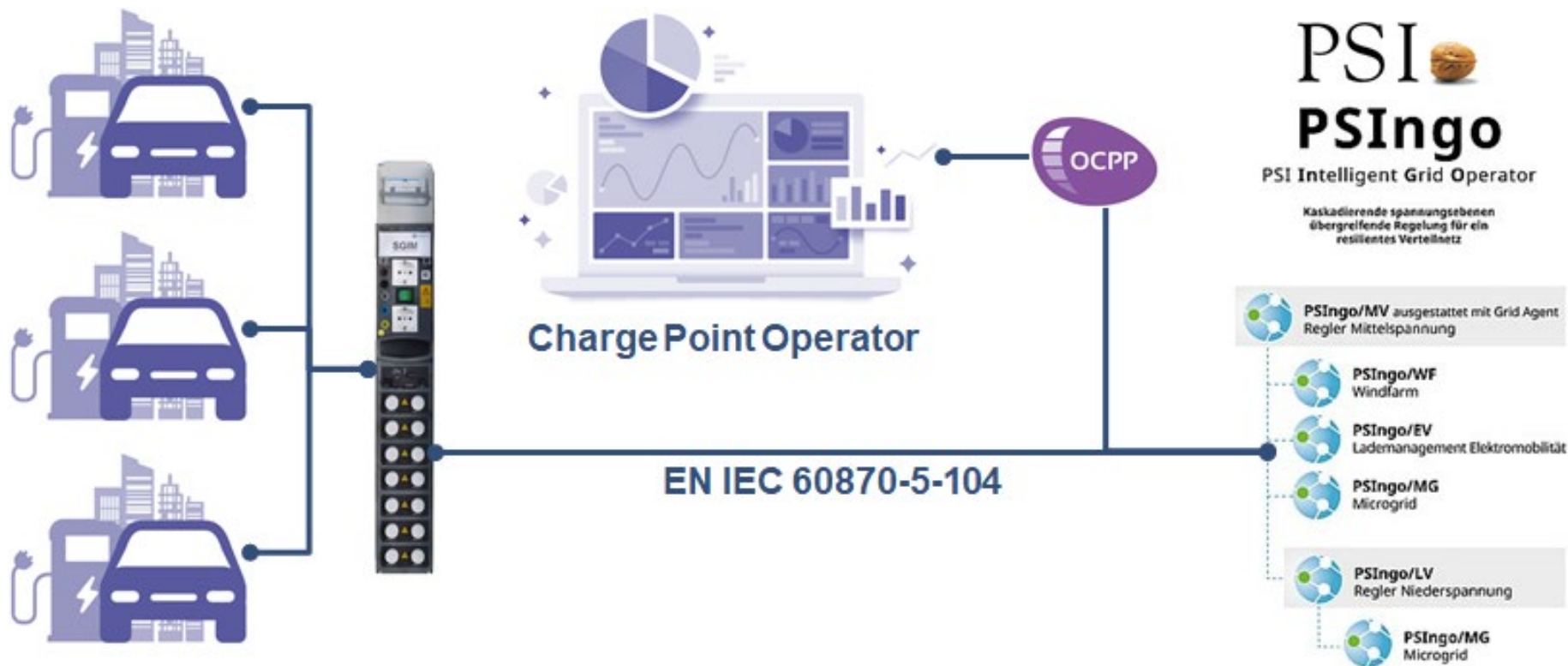


RNG Rheinische Netzgesellschaft (Germany)



■ Background

- planned massive expansion of public charging infrastructure
- ⇒ Set-up of powerful electrical load management system



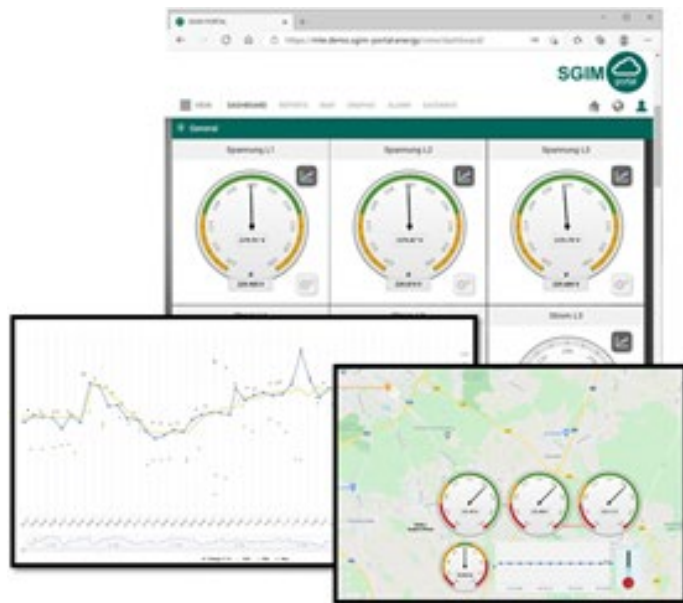
Use Cases

Stadtwerke Bielefeld (Germany)



■ Background

- Network expansion planning
 - Public lightning monitoring
- ⇒ Set-up of a low voltage monitoring system using the existing LoRaWAN communication network



Use Cases

SH Power (Switzerland)



■ Background

- Ideal expansion of regenerative energy resources (hydropower, photovoltaic) due to geographical location (Rhine falls)
 - Leading position among network operators with the fewest/shortest voltage interruptions
- ⇒ Investment in intelligent local substations and cable cabinets

