CAMILLE BAUER

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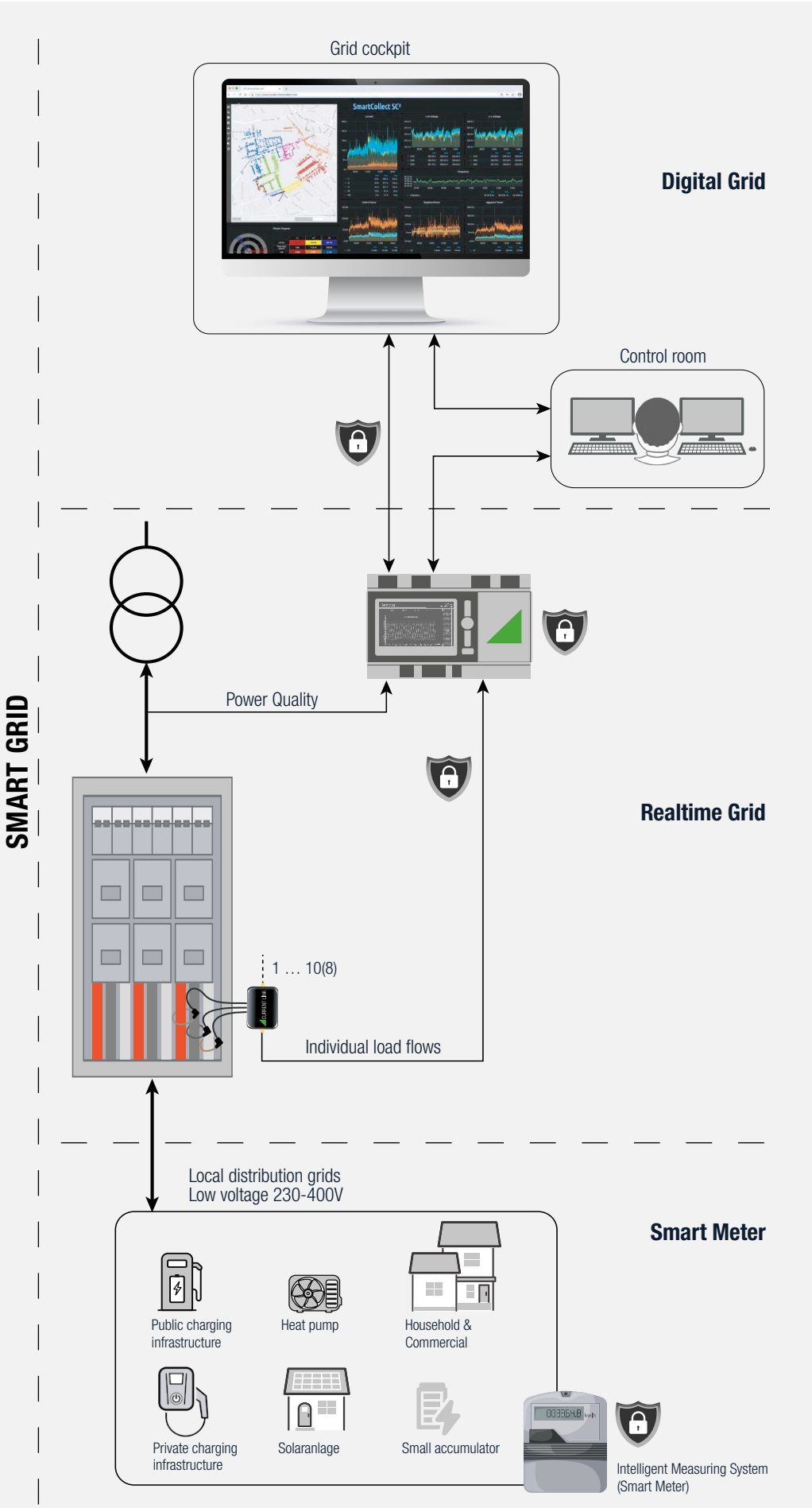
SCALABLE SMART GRID APPLICATION

COMPANION TO DIGITAL GRID MANAGEMENT



THE COMPANIONS

CAMILLE BAUER

High-quality and basic measurement data with maximum flexible connectivity

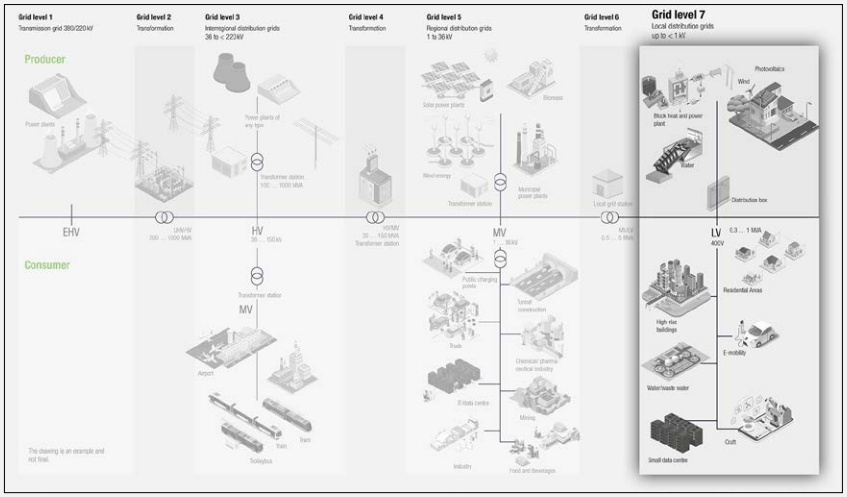
Camille Bauer Metrawatt AG is a Swiss medium-sized company for the development, production and marketing of industrial measurement technology. Camille Bauer offers customer and application-oriented solutions in the field of electrical monitoring and position sensors. This includes a high understanding of the needs for electrical power generation, energy distribution as well as industrial consumers. With its Swiss claim to the highest quality and its high innovative strength, Camille Bauer Metrawatt AG provides its customers with measurable benefits.

FICHTNER
IT CONSULTING

Fichtner IT Consulting designs and implements information logistics

Fichtner IT Consulting GmbH is the IT competence center of the globally active Fichtner Group. We advise on and implement high-performance IT solutions for technical networks, facilities and infrastructure. We combine our industry knowledge and process know-how with the latest technological expertise to deliver innovative and cost-effective solutions for your success. The acquisition, structuring and linking, as well as the targeted preparation and presentation of information - also in a spatial context - are the key to efficient and effective business processes. Our concepts and solutions ensure that your company is optimally positioned for digitization.

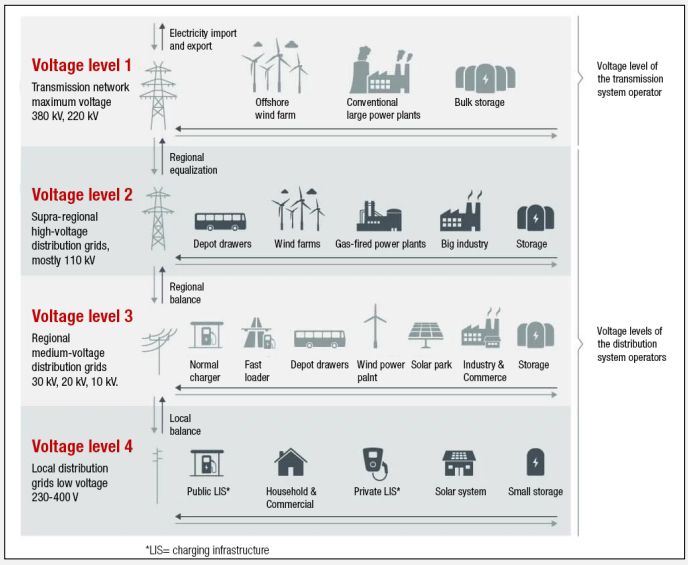
THE BASIC NEED



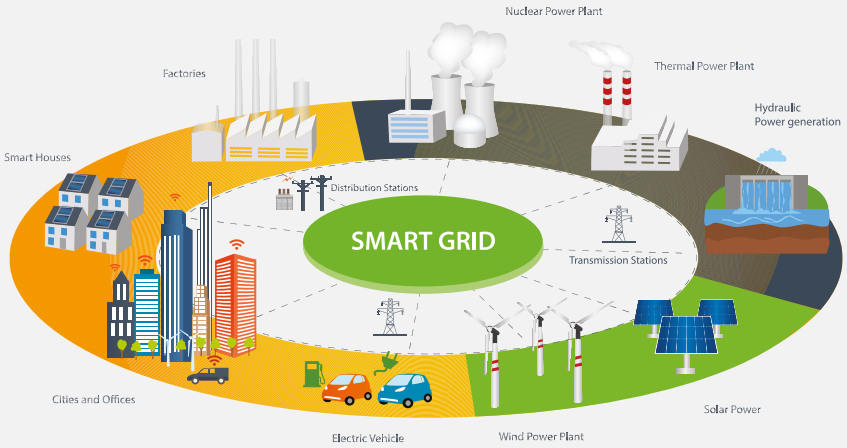
Due to the increasing changes in electrical grids, load flow information is becoming more and more important, for distribution grid operators in particular also in combination with power quality data. For many distribution grid operators, corresponding information at grid level 7 (low voltage) is either not available at all or only insufficient. Without a proper smart grid solution, this would be equivalent to «flying blind». Since many consumers are increasingly also producers, i.e. so-called prosumers, new technical as well as commercial solutions are increasingly in demand. Intelligent metering systems (smart meters) are of no help here, as they are only suitable for grid management to a limited extent due to data protection rules and also insufficient performance, among other things.

The new challenges

One of the great challenges is that the formerly centralized electrical energy world has developed into a highly dynamic as well as very complex decentralized system. In this context, it must be possible to systemically process new but relevant information in a targeted handling of data. In addition, there is the enormous increase in energy demand (e.g., through e-mobility, heat pumps, etc.) versus the shortage of energy sources (e.g., natural gas/oil, lignite, nuclear fuel rods) due to geopolitical as well as environmental policy measures.



Graphic: National Platform Future of Mobility



Our derivation from this: A SMART GRID

A smart grid is an electrical system that intelligently ensures the exchange of electrical energy from various sources with consumers of different demand characteristics by incorporating measurement and mostly digital information and communication technologies. Such a system should take into account the needs of all market players and society. The use and operation of the system can thus be optimized and made more efficient, costs and environmental impact can be minimized, and the quality and security of supply can be guaranteed to a sufficiently high degree. [1]

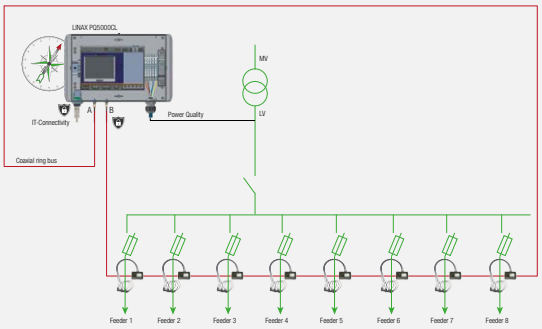
[1] *Source: Federal Office of Energy*

YOUR WAY TO DIGITAL GRID MANAGEMENT IN 4 STEPS

Particularly in the distribution grid, where the feed-in and withdrawal of energy is subject to major changes, measures for more active grid control and forward-looking grid management are becoming necessary. The present concept of the two established companies Camille Bauer and Fichtner IT Consulting describes a safe path based on well-founded and market-tested components.

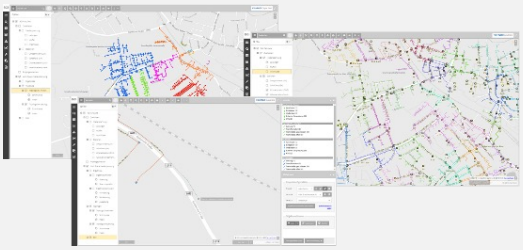
Step 1: Safe measurement

Certified and safe power quality measurement and power analysis with up to 32 currents in the sub-distribution.



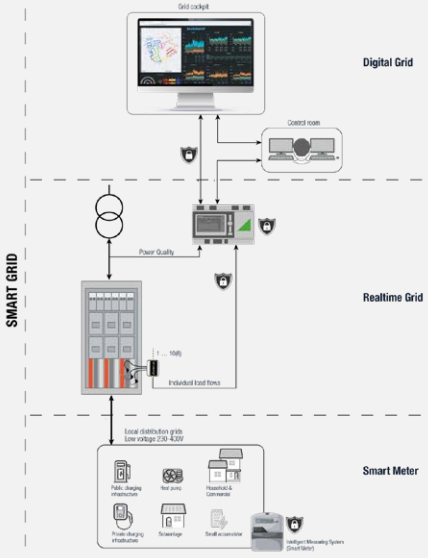
Step 2: Digital grid image

Derive grid situation and topology from existing sources into a digital grid image.



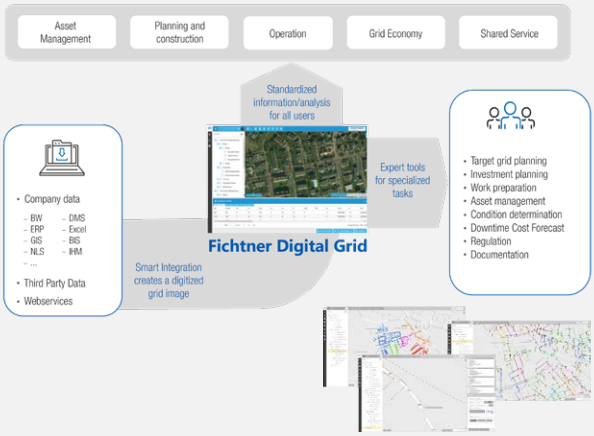
Step 3: Comprehensive grid cockpit

Interactive visualization of the measured values at the measuring points and the resulting grid situation in the grid diagram.



Step 4: Topological final result

Provision of analyses and forecasts of further developments in the grid for the specific departments.

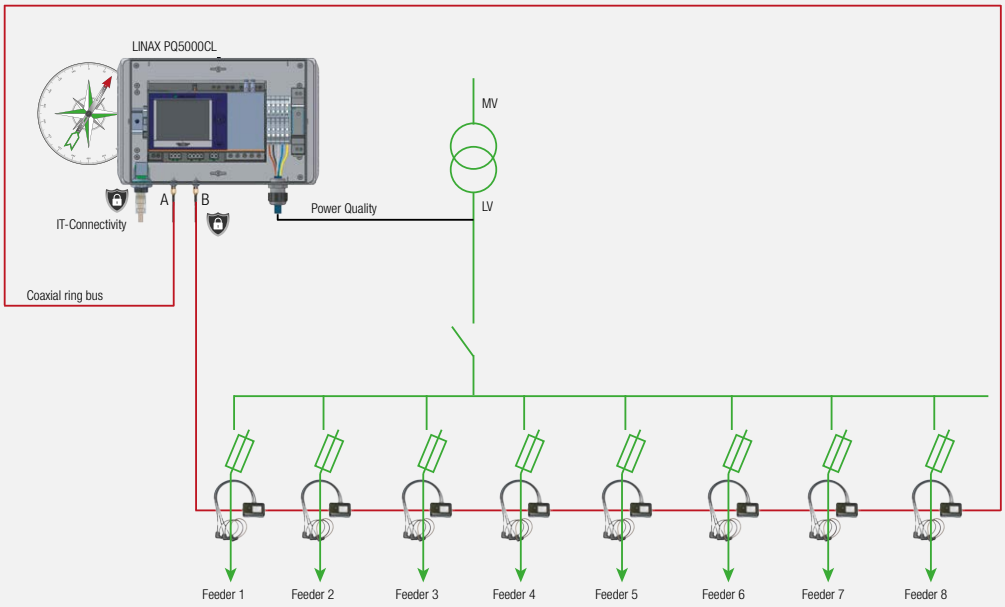


Your benefit

- Transparency about what is happening at any point in the grid (e.g., load peaks, continuous overloads, grid quality, etc.)
- React to special situations at an early stage
- Act proactively through analysis and forecasting
- Increase grid stability and reduce balancing measures
- Targeting budgets where they are most effective for the grid
- Establish a modular and future-proof digital grid management system
- Integration of switching requests, messages to consumers and authorities
- Recording of faults with forwarding to a third-party system

STEP 1: ZERO BLIND MEASUREMENT

Fundamental measurement technology from «bottom up» forms the basis for cellular energy systems and thus also smart grids to be able to stabilize grids (e.g. due to prosumer behavior, disconnection of cables and lines, etc.). Not only scalability is important, but also absolute future viability, e.g. due to flexible connectivity, function adaptations, etc.
We propose a certified power quality measurement and power analysis up to 32 currents in the cable distributions and the LV distributions of the transformer stations. The signal processing is implemented on the LINAX® PQ5000CL series meter. There, the respective current measured values of the so-called Current Link modules are processed. Thanks to Current Link technology, the individual Current Link modules and their sensors (Rogowski) are grided in a scalable manner by means of a signal loop via coaxial lines. This reduces the installation effort to an absolute minimum and ensures proper cable routing. In addition, this measuring system for determining power quality and load flows is extremely cost-efficient and metrologically certified on top. Thus, the scalable measuring instrument virtually combines the areas of transducers according to IEC 60688, power metering and monitoring according to IEC 61557-12 as well as power quality instruments according to IEC 62586-1.



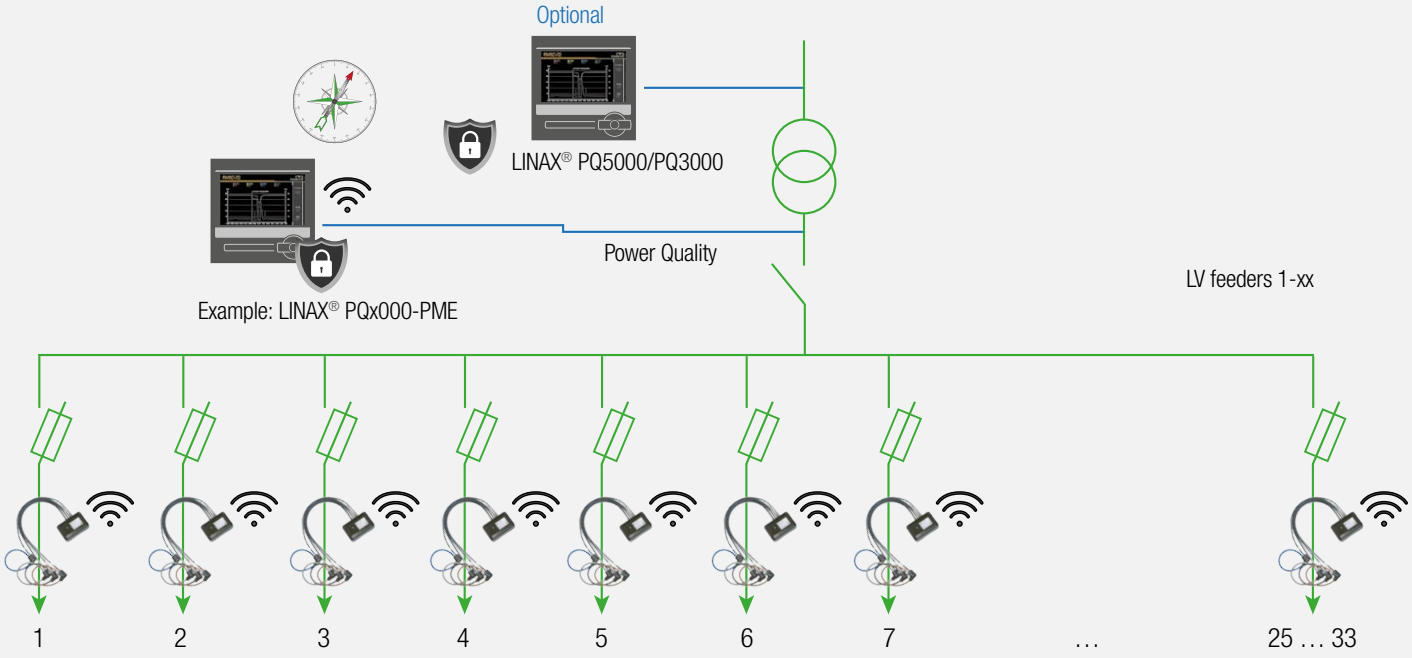
LINAX® PQ5000CL in field housing with connected Current Link modules 3PN

LINAX® PQ5000CL

- Metrologically certified PQI according to IEC61000-4-30 Ed. 3 class A as basic device
- A scalable system for the areas of certified power quality as well as for load and efficiency management for up to 10 feeders (32 Leaders)
- An optional basic current measurement (e.g. directly after the transformer) with a high accuracy due to current transformer sensors
- 3 or 4 channels via Current Link per feeder (max. 32 currents)
- Simultaneous measurement of multiple feeders instead of traditional per feeder measurement
- Direct compliance reporting and event display by PQEasy reporting via web browser (e.g. according to EN50160)
- Time-synchronous fault recording of voltage events with currents of the individual channels (IEC61000-4-30 Ed. 3)
- Time synchronous load management for U/I/P/Q/cosϕ
- Current measurement per Current Link channel «IN1 (typical/maximum) of 400 A / 1'000 A» and «IN2 (typical/maximum) of 8'000 A / 20'000 A»
- Grid tariff meter P & Q (purchase & delivery)
- System management by means of a user-friendly multi-device tool for easy commissioning and efficient maintenance
- Low space requirement due to single voltage measurement
- No need to shut down the plant for installation of the measuring system due to the non-invasive Rogowski measuring technique
- Very high robustness due to proven coaxial principle
- Current values are time synchronous to voltage (IEC61000-4-30)
- Various communication interfaces (Modbus TCP/IP, Modbus RTU, REST API, IEC61850, Cloud with MQTT, Webbrowser) allow high connectivity flexibility to parallel as well as higher-level systems
- Fast roll-out with robust measurement technology
- Sampling rate 54 kHz (zero blind technology)

STEP 1 (OPTION): STABLE MEASUREMENT WITH RADIO TECHNOLOGY

If the extremely high technical performance of hard-wired Current Link technology can be dispensed with in the smart grid application, a scalable solution via radio is also possible. The radio solution has wireless sensors - the so-called PME modules (Power Monitoring Energy), which transmit wirelessly to the PME base station. A major advantage is that up to 100 currents (individual conductors) can be measured per base station. In addition, 5 PME systems can be operated at the same location. The PME base station consists of a standard device of the SINEAX® AM, SINEAX® DM, LINAX® PQ or CENTRAX® CU series with a corresponding additional option. This solution is not only extremely space-saving and efficient, but also good for the budget.



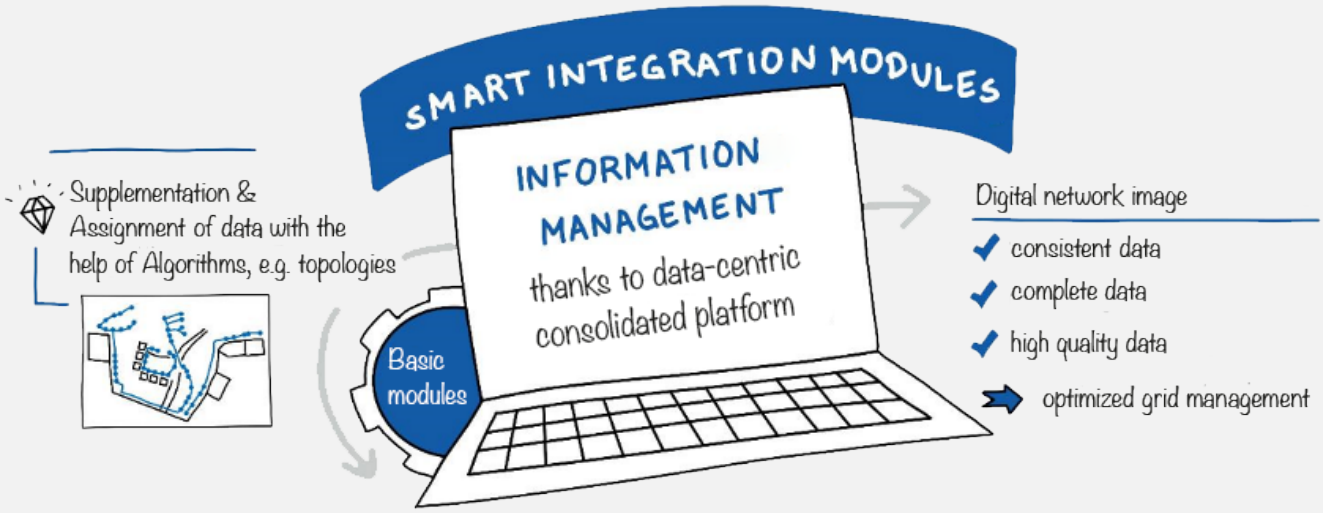
Base station with SINEAX® AM, SINEAX® DM, LINAX® PQ or CENTRAX® CU series, incl. integrated Power Monitoring Energy Module (PME) and PME sensors for acquisition of max. 100 currents via radio signal.

PME system

- Efficient base station from the standard SINEAX® AM, SINEAX® DM, LINAX® PQ and CENTRAX® CU series.
- PME sensors with Rogowski coils and configurable ranges (250 A, 500 A or 1000 A)
- Sensor and PME central unit have a UUID (Universally Unique Identifier) derived from the Bluetooth address of the radio module
- Secure protocol for communication between current sensors and central unit (Advanced Encryption Standard AES-128, standard for WLAN communication)
- 3P or 3PN by means of PME per feeder (max. 100 currents)
- Very fast roll-out due to easy sensor registration via QR code
- Power supply via battery (runtime up to 10 years) or USB-C
- Anti-collision detection allows up to 5 PME systems at the same location
- Channel monitoring ensures that no frequency channel is used that is already occupied by another device (e.g. Bluetooth or WLAN device)
- Access to sensor data via Modbus RTU or TCP/IP, REST API, CSV export
- Measurement interval 1s of the PME sensors
- ...and even more features that we can take over from the Current-Link technology

STEP 2: DIGITAL GRID IMAGE

Interactions between effects of individual grid points and the impact on the overall grid condition are only transparent if the measured values are seen in the topological context of the distribution grid.
The concept provides for the creation of a topologically correct grid image from the data sources already available in your company (GIS, NIS, technical documentation, switching documentation, plans). To ensure safe and efficient grid operation, disconnection points and switching status in the LV grid are displayed and, if necessary, feeders from the transformer stations are colored differently.
The basis for this is provided by Smart Integration modules, which contain numerous support and test functions so that this task can be solved quickly. Backend systems are integrated and intelligent algorithms are used to fill in incomplete topologies and match master and transaction data. Data gaps can be detected and supplemented by learning methods. The result is a consistent, complete and high-quality data basis for grid management. The result is a consistent, complete and high-quality data basis for grid management, as well as a fundamentally computable grid that will also serve as the basis for grid expansion planning and simulation calculations in the future. The correctness and accuracy of the grid calculation is ensured by the use of PowerFactory, the world's leading integrated grid calculation software. If required, other existing calculation software can also be used.



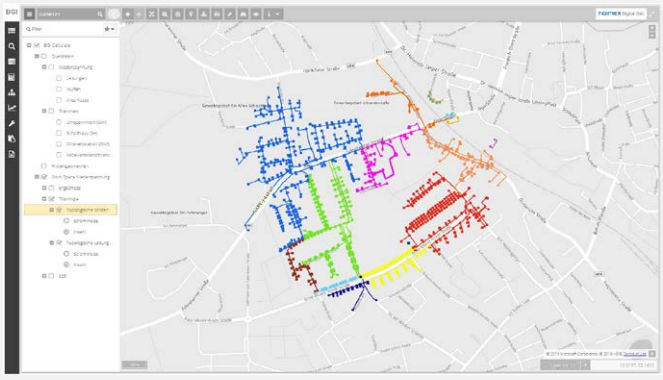
The Smart Integration Modules of the Fichtner Digital Grid Platform generate a verified, digital image of the grid, enriched with relevant additional information.

The result is as follows:

- Heterogeneous output data are integrated and linked
- Context and additional information are available through the integration of real-time data and third-party services
- Grid and plant data are plausibility checked, corrected and supplemented
- The digitized grid is computable, optional monitoring and feedback functions are implemented

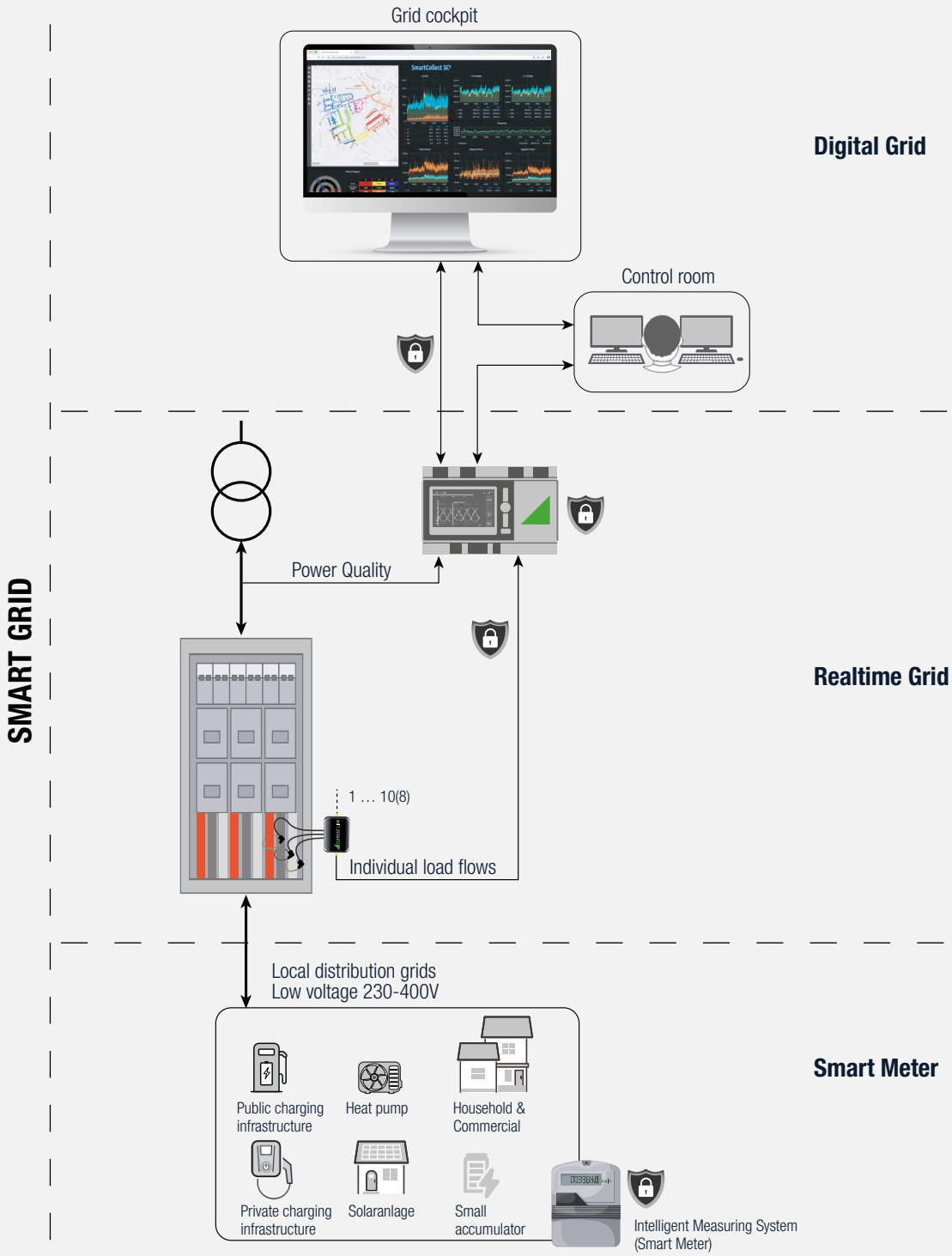
Smart Integration

FDG Import
FDG Connect
FDG Enhance
FDG TopoManager
FDG CheckBack



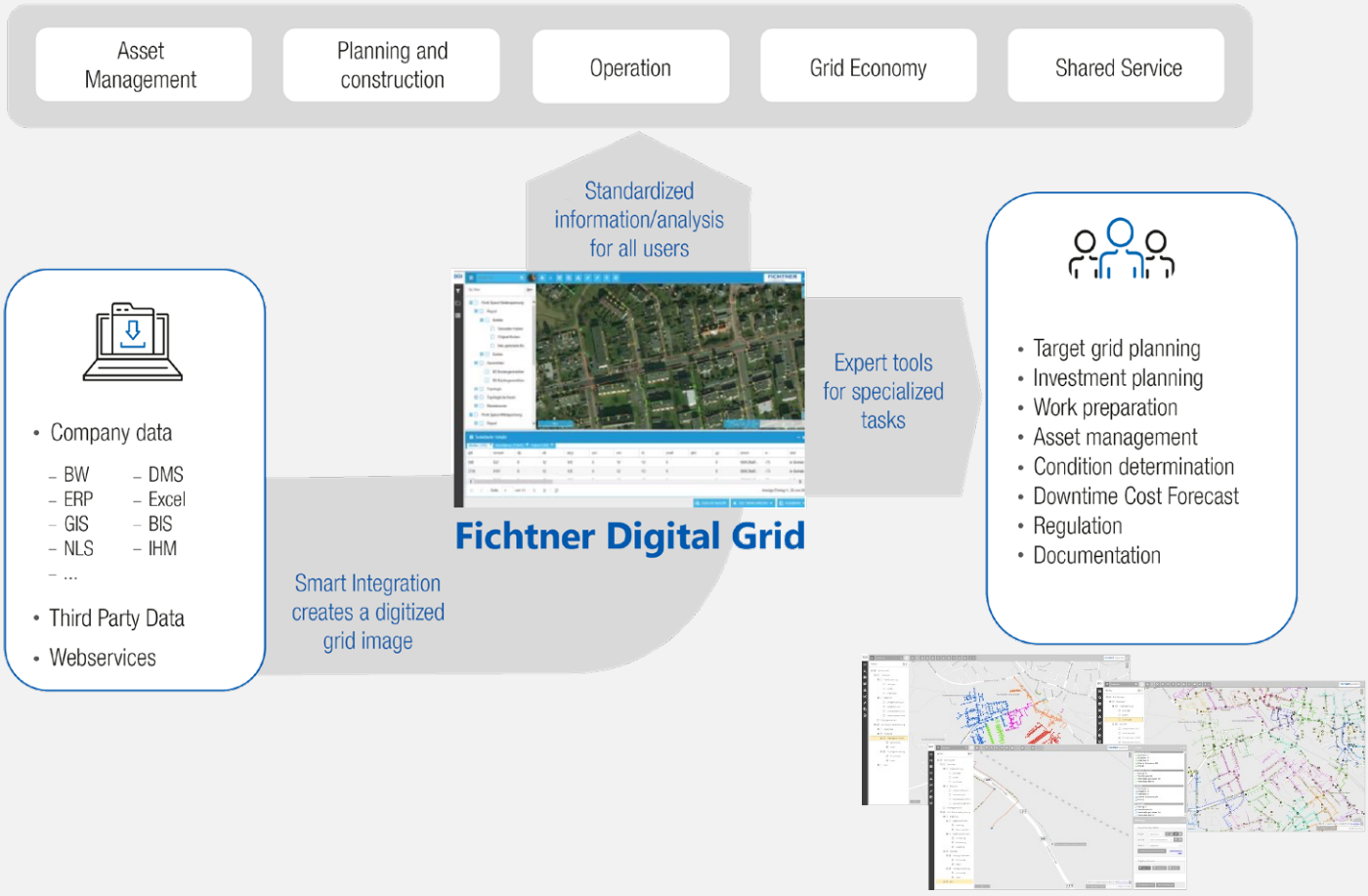
STEP 3: A COMPREHENSIVE GRID COCKPIT

The results of the first two steps can be connected to existing grid control systems (control room) and made available to the grid operation. The grid cockpit is fully functional without coupling to the grid control system and supports the grid operation. The use of mobile devices in the field is possible at any time, the technician in the grid can change his disconnection points independently and thus always keeps track of the grid status. A grid cockpit is essential for a more cost-efficient and flexible use of the results. Our concept offers a comprehensive grid cockpit based on a modular, web-based 2D/3D graphical user interface. The focus is on flexibility and user-friendliness. Depending on the function, assigned access rights and activity, users can retrieve and monitor grid data or are proactively informed about events and deviations from norm corridors. Targeted, interactive displays are available for visualization, e.g. conveniently controllable geographical or schematic displays of the grid, as well as detailed graphics of measured value progressions, quantity diagrams and dashboards for event and device display.



STEP 4: THE TOPOLOGICAL END RESULT WITH ANALYTICS & PROGNOSTICS

With steps 1 to 3, a comprehensive cockpit for digital grid monitoring and alerting/notification is now available. Transparency in the distribution grid has thus been achieved. In order to be able to leverage further economic added values and to control the grid development in a forward-looking manner, further components are useful. Our concept allows to build up a targeted analytics in order to simulate certain grid states, to better forecast the grid development and to find optimal strategies for further development and budget prioritization. These tasks include, for example, grid utilization, which uses AI-powered techniques to determine spatial e-mobility growth and its impact on your distribution grid, and to identify specific capacity expansion needs. The life cycle of the assets can be predicted from aging, technical parameters, operational data, environmental information, and local empirical values, and the resulting probability of failure can be predicted. This results in well-founded statements about the security of supply in the coming years. The replacement and expansion strategy can be optimized in a targeted manner along available budgets.



Asset & Aging Management

- Modules Smart Data Integration, Calculate: construction of topological grid model, grid calculations (coupling PowerFactory)
- Maintain module: maintenance (interface to IT system of fault management or directly via message from measurement)
- Analytics module: Impact analysis in the event of equipment failure (e.g., own analyses by the utility (in planning))
- Optnet module: Determination of condition of equipment (aging)
- Module Failure Monitor: Active messages and display in municipal portals in the event of failures & recommissioning

Flexibility Management

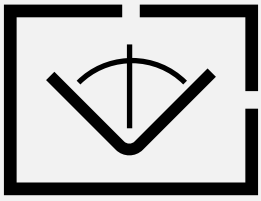
- LV grid traffic light next day: Input forecasts for next day (e.g. 24h), calculation of feed-in adjustments for next day.
- Real-time grid traffic light: Calculation of necessary load/feed-in corrections or shutdowns (based on real measured values)
- Real-time switching operations: Camille Bauer control channel for smart meter gateway or similar when the real-time grid light is red (this is currently only possible via a different, relatively cost-intensive device)
- Forecast for the LV grid based on the measured values and SMGW to avoid balancing energy
- Freely configurable interfaces, for example to ripple control and CLS channel (FNN control box)

PORTFOLIO OF CAMILLE BAUER

Measuring and Displaying

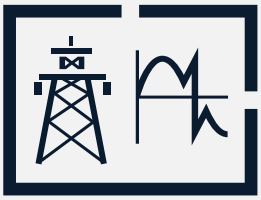
Grid management and equipment monitoring require precise and reliable information of different grid variables. For this purpose, we offer a wide range of high-quality instruments to acquire all variables of the electrical grid.

Position sensors



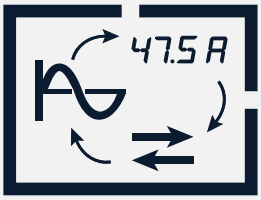
With our portfolio of POSITION SENSORICS we offer solutions for angle, position and inclination measurement. Here, the offer ranges from simple built-in devices to the robust devices for applications in harsh environments. The angle and inclination measuring systems serve as an important link between mechanics and control.

Power Quality

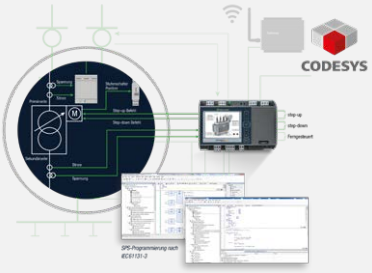


Modern power electronics and non-linear consumers increasingly impair the electrical grid which is the reason why alternating current has not shown the original sinusoidal characteristic already for a long time.
This bears heavily on electrical devices and machines and extends to higher thermal losses, increased energy consumption through to the disturbance and downtime of plants. Our solutions ensure that problems are early recognised, even before they occur.

Monitoring and controlling



We offer the unique possibility of not only acquiring all variables of the electrical grid precisely and reliably, but also processing them directly via a PLC integrated into the device and controlling processes. This enables us to realise process controls directly at the measuring point. You thus save a separate PLC or you realise an autarkicly working redundant solution.

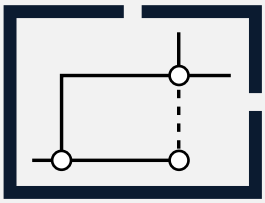


Software und Systems

We create modular as well as customer-specific monitoring (SCADA), analysis and EMS solutions and systems that can be expanded at any time, regardless of the manufacturer. Thanks to our non-proprietary interfaces, integration into existing applications and systems with components from a wide range of manufacturers is also no problem.

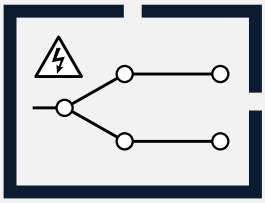
PORTFOLIO OF FICHTNER IT CONSULTING

Target grid planning



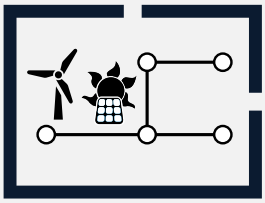
In view of increasingly decentralized power generation, power feed-in is shifting from the transmission grids to the distribution grids. These are becoming area power plants in which the direction of power flow can be reversed. The increase in battery storage to optimize self-supply as well as the charging of electric vehicles is also influencing the distribution grids, whose role is fundamentally changing. Old established user profiles are losing their validity and the predictability of load flows and grid load is becoming an increasingly complex task. Against this background, the planning of distribution grids requires new principles, which we support you in implementing.

Asset Management



The modern challenges in asset management can only be met on the basis of an up-to-date, reliable information base. More and more complex decisions have to be made and the time windows are getting narrower. The digitization of operating resources and interactions with new players are adding to the pressure. In addition to ever shorter planning and production cycles, those responsible must ensure the availability of plant and machinery, using the latest methods and techniques while keeping costs under control and safety in mind. In numerous projects, we have proven for our customers that we deliver the decisive added value for the successful design and implementation of IT solutions around „Digital Asset“.

Connection test

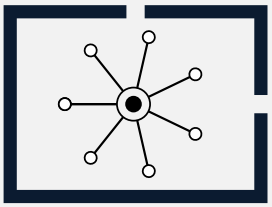


Fichtner EasyConnect, a member of our Fichter Digital Grid family, enables fast and simple technical verification of the steadily increasing number of reportable connection requests for RE plants or e-mobility in medium and low-voltage electrical distribution grids. Without loss of testing accuracy and documentation quality, the operation is carried out by a standardized, easy-to-use web-based interface and is possible by simply trained personnel in the customer center or by the customer himself.

Flexibility management

Increasing volatilities in generation and feed-in make technically and economically optimal operation of distribution grids increasingly difficult. A prerequisite for compliance with technical limits in grid operation is sufficiently accurate forecasts of load and feed-in behavior and the calculation of their technical impact on the grid at suitable time intervals. Ongoing work on research and Redispatch 2.0 projects can provide support here with a wealth of experience. Technically secure distribution grid operation - if necessary in combination with energy system modeling for optimized operation - is a fundamental prerequisite for participation in future flexibility markets.

Consulting and IT solutions



We advise the energy industry on all aspects of digitization - from IT strategy and system selection to project management. We support New Work concepts and implement individual solutions on Microsoft365. We increase process efficiency in grid planning, grid service and operation through customized IT systems that integrate optimally into the existing IT landscape. Our concepts and solutions ensure that your company is optimally positioned for digitization.

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