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PSI

EDITORIAL

Dear readers,

The energy transition is a huge challenge for the entire energy sector. If we looked at it as a part of a special investigation unit, examining a crime scene, we would initially focus on a network infrastructure which is insufficient to support e-mobility. In the future, e-mobility will be widely used as concluded by all relevant studies of the recent years. Only the number of simultaneous charging processes is still unknown. There is proof that efficient and quasi CO_2-neutral mobility based on renewable energy generation is possible which supports the electrification of the traffic sector.

In addition to the known challenges related to the integration of renewable energies in rural networks, the question of economic integration of the charging infrastructure is becoming increasingly important. The ob-

servation of the distribution network is a key factor for ensuring the quality of supply as well as network optimization. Therefore, the observation of the distribution network in order to determine the appripriate measures is the equivalent of a finger print.

From our point of view, we consider the steps for more transparency and controllability as very important. PSI responds to these challenges by bundling its long term Smart Grid expertise in

the new subsidiary PSI GridConnect (formerly PSI Nentec) which makes it an "enabler" for the digitization of the distribution network. We are happy to provide you with insight into our investigative work for reliable look-ahead detection of network overloads. In the current edition, we also describe the synergies based on the cooperation between operational network services and the smart grid system.

We hope you enjoy reading the Energy Manager.

Yours sincerely,

Klaus Becker   Martin Stiegler
Managing Directors
PSI GridConnect GmbH

CONTENTS

Integration of distributed network control into network system management facilitates the e-mobility transition

Hybrid Cascaded Operation of Distribution Networks

Fighting the climate change and the reduction of greenhouse gas emissions currently pose the greatest challenge for all areas of the energy supply. In particular, the electrical energy sector is changing significantly as its structure becomes sustainable. The continuously increasing number of decentralized generators and new electric consumers such as heat pumps and electric vehicles push especially the low and medium voltage networks to their limits.

In particular for urban areas, the costs for network expansion due to e-mobility are expected to be very high. Therefore intelligent distribution networks are the best approach to master the challenges of the energy transition and to delay and even avoid expensive network expansion altogether.

The new hybrid multi-voltage Intelligent Grid Operator (PSIingo) is designed as a new system platform for distribution networks which enables the integration of partially autonomous distributed network control into the network system management of network control centers. The new platform combines the advantages of a decentralized smart grid system and a powerful and reliable central control system.

Innovative System Design for the Energy Networks of Tomorrow

The platform consists of a number of different modules which can be combined with each other and connected to upstream systems. This facilitates different solution concepts depending on the initial situation and the given task definition. The solution includes the required modules for infeed-dominated rural medium and low voltage networks and for load-driven distribution networks in urban areas as well as customer-owned micro grids for the autonomous energy networks of tomorrow.

The basic structure of the platform in figure 2 shows a medium voltage ring which is controlled by the medium voltage controller PSIingo/MV with several low voltage networks which in turn are equipped with separate network controllers (PSIingo/LV). Even flexible consumers such as industrial micro grids or depots for electric busses can be controlled by PSIingo/MG and PSIingo/EV. Every module can control its area of responsibility autonomously as well as respond to the requests of the upstream system.

In addition, the system provides a connection to the control system for parameterization, updates, manual
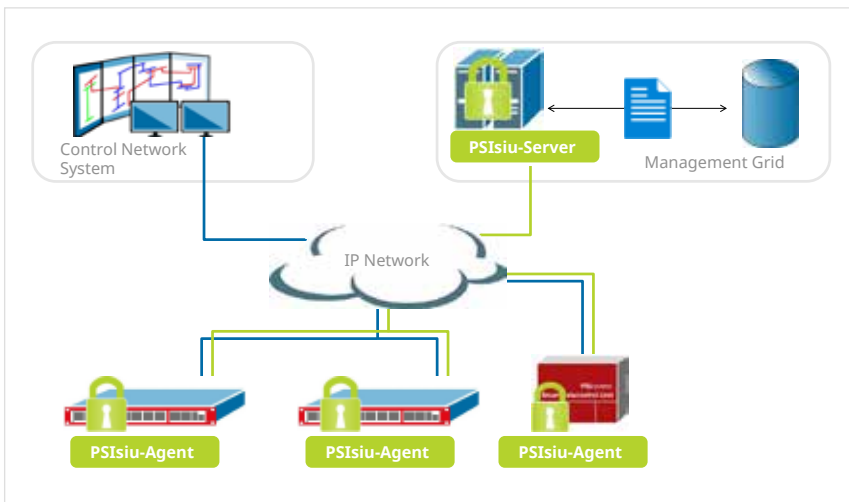
Figure 1: Parameterization and updates provided by the PSIingo/PD patch and update system

control, and upstream setting of setpoints which is secured by a next generation firewall (104 security proxy). This ensures that information such as smart meter data from the public Internet can be processed securely.

The controller design includes a decentralized OPC UA server which provides all input and output data and converts the respective communication protocols such as IEC 60870-5-104, IEC 61850, Modbus, and OCPP. Thus, the sensor and actuator communication and the connection of external devices are completely separate from the controller functionalities.

Regardless of the installation location, the hardware, and the operating system, all modules have an identical data structure which enables maximum flexibility of use. The communication between the decentralized devices and the control center is based on OPC UA.

Reliability as Key Criteria for Customer Acceptance

In order to replace conventional network expansion measures by smart grids, the latter must provide at least the same degree of availability. This requires a multi-level fallback and se-

curity concept since single IT components typically cannot provide this degree of availability.

For this purpose, the entire automation hardware is designed redundantly. The entire system is mirrored by a redundant system which can take over control of the process without interruption in case of failures. Secondly, the entire communication is also designed redundantly. Especially important connections can be provided by different communication channels such as powerline communication, public mobile radio, dedicated communication cables, or CDMA450. Thirdly, the upstream levels can take over the tasks of the lower levels; vice versa, downstream levels can operate autonomously. This provides fallback levels in both directions.

OPC UA Communication Model

The parameterization of the platform and the installation of system updates are provided automatically by the update server PSIsiu (see figure 1). The installed PSIingo component sends its location to the control system and in turn receives the set of parameters which are required for its purpose. All

required parameter data can be entered and maintained at a single location.

Cascaded Flexibility for Multi-Voltage Network Management

For controlling the distribution network, a variety of flexibilities on the respective network level and downstream network levels are usually available to the system. For example, an overload of a medium voltage cable can be resolved by controlling downstream network levels.

At all times, the medium voltage controller has a complete overview of the flexibilities of the associated low voltage controllers and of the connected charging infrastructures. Based on this comprehensive network information, the medium voltage controller assigns the required load reduction to the individual network controllers and connected actors depending on the overload location and flexibility. For example, if the charging power of electric vehicles must be reduced, then the respective network controller ensures that the power reduction can be realized without limiting the mobility of the affected users.

Integration in Existing Operations and Planning Processes

Micro grids can also be integrated in the flexibility requests. The smart grid platform provides a powerful micro grid controller which not only optimizes the customer system but also makes the existing flexibilities available to the distribution network operator.

In addition to the classic functions of the actual smart grid systems, in the future it will be required that the pro-
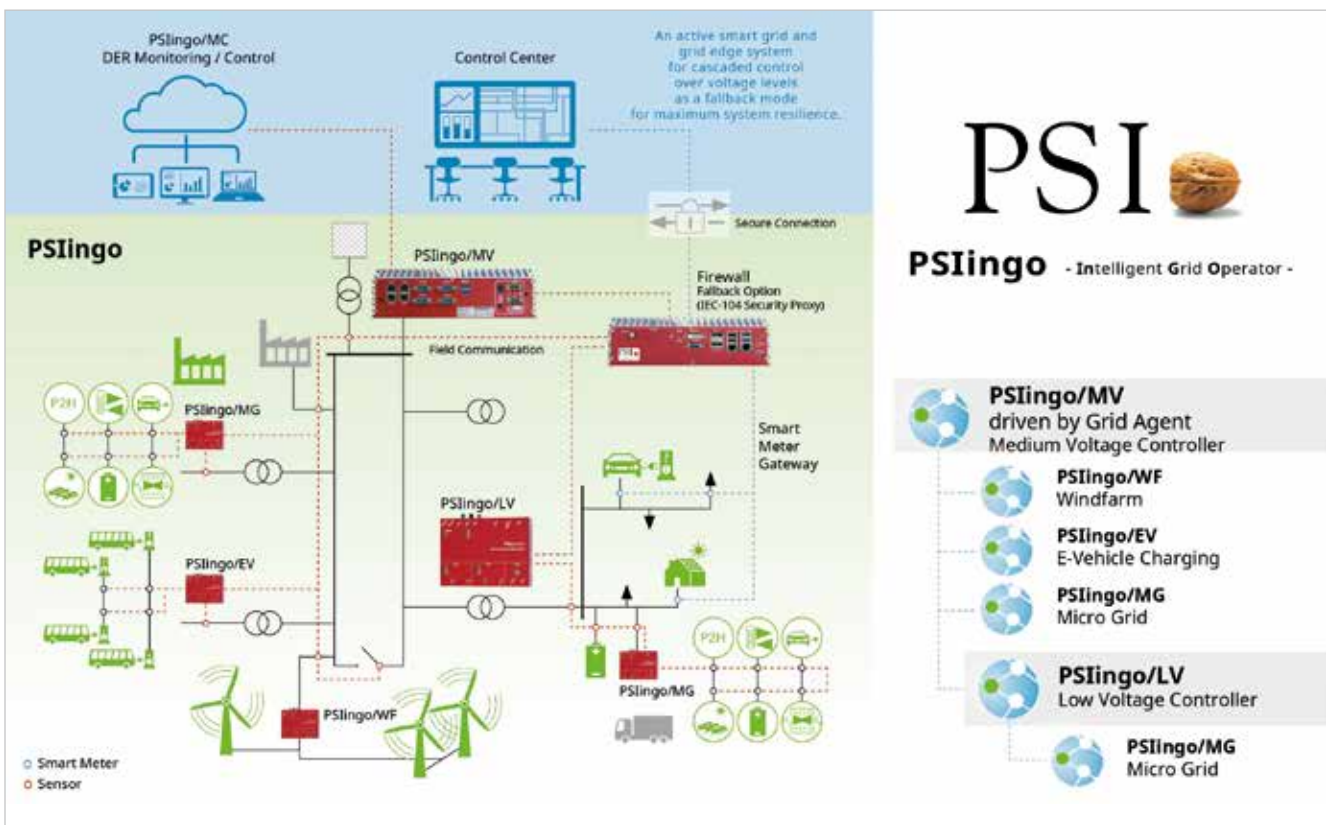
Figure 2: Structure of an interactive cascaded network management system for the operating modes "Central", "Mixed", and "Decentralized autonomous".

cesses for operational network management and network planning are also supported. PSIingo provides the tools which are necessary for these purposes.

Digital Network Operations

Usually supply interruptions are reported only by affected customers since the low voltage networks are not monitored. Based on continuous monitoring, the low voltage controller enables immediate detection of supply interruptions and notification of the emergency center in order to start the fault clearance process. Intelligent measurement systems and integration of current network state information allow precise determination of fault locations and optimized dispatching of resources for power restoration.

As a smart grid system, PSIingo also offers direct cooperation with a field force management system like PSIcommand which supports the operational staff on site with regard to switching operations in low voltage networks. The low voltage controller verifies the individual switching operations and makes optimized switching recommendations based on the actual state of the network. In case of critical network states during the switching operations, the PSI solution intervenes and resolves possible overload problems in the network.

Integration in Network Planning

In the next years, the increasing number of new infeeds, loads, technologies, and business models in the distribution network will make network planning tasks significantly more complex. Early detection of possible network congestions is becoming more important in order to develop an optimal adaptation strategy to the changing operating conditions.

Therefore, already today the network planning processes are supported by new assistance systems such as automated network expansion planning in distribution networks.

With the continuous monitoring of the networks, the PSIingo platform provides a transparent overview of the current and past operating states. In addition, it provides the required input data for other tasks related to automated network planning, the system configuration, and the network capacity management. This not only reduces the network expansion costs but also the long-term operating costs as well as the staff costs for the network planning. ◉

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Product report: Using renewable energies to generate reactive power

Reactive Power Control for Distribution Networks

The energy transition and the beginning transportation transition increase the relevance of the reactive power control on all voltage levels of the distribution network. Renewable energy can already be controlled on a larger scale and existing connections from the infeed management can often be re-used. PSI offers several product solutions for different approaches to reactive power control.
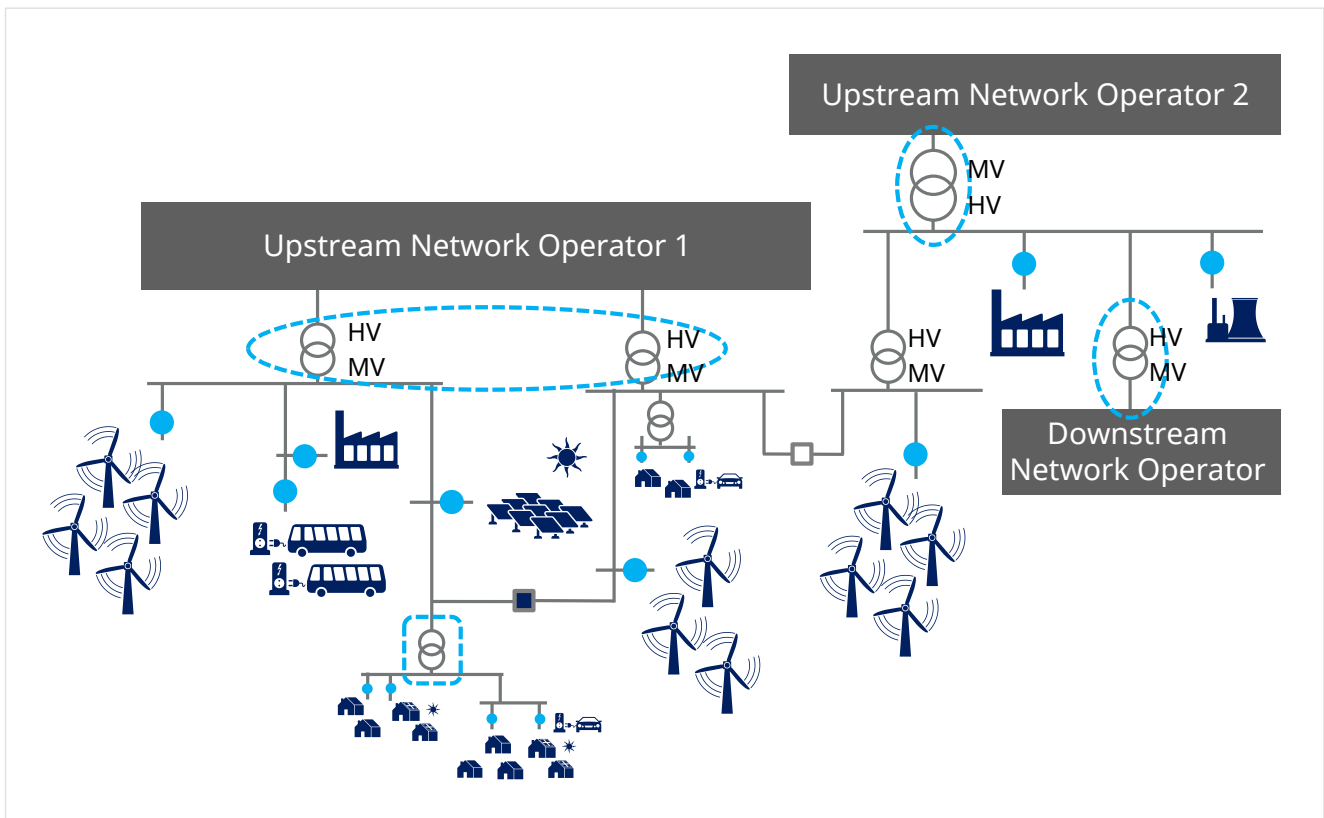
For distribution network operators the reactive power is an important tool for voltage control. The increase of renewable energies and the e-mobility makes voltage stability even more important in the future. A major yet shrinking share of reactive power is provided by conventional power plants. Since reactive power can be transported only to a limited degree, the best solution for decentralized voltage band problems are de-

centralized reactive power sources.

In addition to voltage regulation, distribution network operators must consider the supply or demand of reactive power at the transfer points to upstream and downstream networks. These are usually often defined by contracts with regard to the technical and sometimes the financial terms.

Several reactive power transfer points can also be viewed as a group as shown for the connection to "Up-

stream network operator 1" in the figure below.

Reactive Power from Renewable Energies

According to the common technical connection requirements, renewable energies can contribute to the reactive power generation. They can easily be used since they are often already connected to the infeed management and may be used free of charge to some degree as per the technical connection requirements. In Germany, new technical connection requirements based on VDE-AR-N-4110 for expanding the reactive power provisioning are being defined and rolled out.

Beyond the technical connection requirements, a significantly larger

Contractually and technically relevant interfaces for reactive power management.

amount of reactive power can be provided by renewable energies even without wind and at night. However, this can require compensation definition and payment between network operators and plant operators.

In addition, a distribution system operator can involve capital-intensive system equipment, downstream network operators, and large consumers in the reactive power generation.

Solutions for Reactive Power Management

PSI offers several products and variants for reactive power management. PSIcontrol supports numerous functions for reactive power management and control. The emphasis is on reactive power regulation for voltage stability, determination of the reactive power pool, and compliance with the setpoints at network transfer points or groups of network transfer points. As an option, the reactive power demand for compliance with agreed voltage bands is calculated in closed loop mode and the control variables are set automatically. Depending on the requirements, PSIcontrol uses OPF (Optimal Power Flow) for symmetric and asymmetric networks and sensitivity analysis.

PSIsaso/DSO 2.0 determines the future potential and exchange of reactive power with adjacent networks. This enables distribution system operators to perform look-ahead network management and optimization. For reactive power provisioning in transmission networks, PSIsaso uses fuzzy logic algorithms which assess the operational alternatives with regard to multiple economic and operational objectives.

Network Interconnection for Onshore and Offshore Wind Parks

In order to meet network connection terms, PSIingo/WF is used in onshore and offshore wind parks. The model-based controller currently manages several hundred renewable energy generators with a combined total of several Gigawatt of nominal power.

Since 2014, PSIingo/MV has been used as medium voltage controller in distribution networks. Initially the emphasis of the medium voltage controller, formerly known as Grid Agent Network Controller, was on the active power management and the dynamic peak shaving. A recently completed project realized a cascaded concept. An ongoing project in the center of Germany realizes the reactive power management for HV/MV network transfer points.

PSIingo/LV bundles the reactive power capacity of infeeds, storages, and quick charging stations on the low voltage level which are already connected to the communication system. These reactive power capacities are made available to the next higher voltage level and are used to compensate local voltage band issues.

The Optimal Solution

The optimal realization and combination depends on the specific requirements. For example, the functions which are integrated in the control system have direct access to the data model of the control system and can faster visualize the results of the operations in the control system.

For network operators without the PSIcontrol, or network operators with a decentralized, cascaded, or cellular approach, PSIingo offers individual modules. This off-loads the granular data processing and complex calculation from the central control system. Conceptually, the decentralized PSIingo controllers are increasingly interacting with the control system so that they can operate autonomously as well as part of an integrated overall solution. PSIsaso/DSO 2.0 focuses and complements the reactive power management with regard to look-ahead network optimization. ◉

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TRANSFORM 2019

Convention and Exhibition Center, Hong Kong, China

Megacities—Reliable solutions for electricity suppliers.

Maschinenfabrik Reinhausen and PSI are co-sponsors of the TRANSFORM exhibition September 25-27, 2019 and present the open standard solution ETOS® for digitization of power transformers.
TRANSFORM is the association of leading European manufacturers of transformers and transformer components.

Interview: Dr. Helmut Lorek and Dirk Noß discuss the opportunities and synergies of the ongoing merger

New Energy for Integrated Suppliers

Effective January 1, 2019, PSI Software AG has acquired the smart grid unit of BTC Business Technology Consulting AG with 140 employees and the products PRINS and GRID Agent for network controllers and wind park controllers. Energy Manager interviewed Dr. Helmut Lorek and Dirk Noß, Managing Directors of the newly founded division Integrated Suppliers of the PSI Business Unit Electrical Energy, about the opportunities, challenges, and synergies of the acquisition.

Mr. Lorek, in your new role, you are responsible for the areas sales, marketing, and controlling. As the former manager of BTC, where do you see the greatest opportunities of this acquisition?

Helmut Lorek: This closing of ranks offers a lot of great opportunities for all. Already today, we can provide organizational and economic as well as technical and professional added value to our customers based on the already ongoing integration of the products into the PSI solutions portfolio.

Both customers and employees benefit from the increased expertise, the enhanced product portfolio, and the expanded customer base. Currently, the PSI Group has 1,900 employees world-wide, half of whom work in the energy sector.

The enhanced range and the high degree of internationalization of PSI provide the best foundation for further development and expansion.

Now to you, Mr. Noß. Please tell us about your new role and your excitement about it.

Dirk Noß: First of all, I am glad about the opportunity to work with Helmut Lorek as Co-Managing Directors.

Dirk Noß (left) and Dr. Helmut Lorek (right).

We greatly complement each other. I have now worked at PSI for 25 years, most recently as one of the Managing Directors of PSI Mines&Roads. My roots at PSI are in control systems from which I never departed in the last 25 years.

But this is not the only reason why I am excited about my new responsibility for the areas technology, projects, and staff in the new division.

First of all, it will be a challenge to integrate 140 new employees into the PSI Group since this involves the merger of two rather different corporate cultures and processes. At the same time, my long term expertise will help in expanding the market for integrated suppliers.

What is the structure of the new organization?

Helmut Lorek: The staff and customers who transitioned to PSI in early 2019 have been integrated into the new division for Integrated Suppliers within the PSI. The new division Integrated Suppliers will both service existing customers and expand into new markets such as the so-called de-minimis city utilities with up to 100,000 customers. Another important market focus of the division Integrated Suppliers are infrastructure operators and industrial companies which provide good opportunities for expansion.

Under this common roof, we will bundle our competencies. We are also focusing on fast integration and networking effects within the Business Unit Electrical Energy. This is the best way for the customer and employees to benefit in the near term from the new synergies.

Could you please describe the product strategy of the future?

Dirk Noß: In the medium term, the two control system products PSIcontrol and PSIprins will be integrated into a single product line. The integrated product line—we code-named it "big product"—meets all requirements of current and future control system customers of PSI. The former BTC Grid Agent solutions have already been integrated in the intelligent grid operator platform PSIingo. The new name for the medium voltage network controller is PSIingo/MV. also Also, the wind park controller PSIingo/WF is integrated into this platform.

Currently we are working on the integration of PSIprins and the existing solutions of PSI such as PSIsaso for network state assessment (SASO—Security Assessment System Optimization) and our field force management solution PSIcommand.

What is actually changing for your customers?

Helmut Lorek: The good news for our customer is that nothing changes unless requested. No action is needed. PSI guarantees the maintenance of the current PSIprins solution for about five years.

We are working on the new releases. The next release 8 of PSIprins will be available at the end of 2019 or early 2020. In the medium term, all customers will benefit from the integrated PSI solutions portfolio.

What measures are planned for integration of your employees?

Helmut Lorek: In addition to numerous training opportunities and information events, it is very important that opportunities to learn from each other in joint projects and to exchange expertise are provided quickly to all employees based on their interests. This

enables both "new" and long-term employees to benefit from the knowledge and expertise of the colleagues. And our customers benefit from even more competence from one of the market leaders for control system solutions.

What is your vision?

Dirk Noß: Our objective is the successful integration of the existing products. In the medium term, we want to offer a common solution platform for the best control system software for existing PSIcontrol and PSIprins customers as well as new customers.

Mr. Noß, Mr. Lorek, thank you very much for your time. We wish you all the best for this exciting opportunity. ◉

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News: Infrastructure for e-mobility

The Smart Charging Station in the Smart Grid

As part of a pilot project with various partners, the badenova subsidiary bnNETZE has developed a system for continuous monitoring and control of electric charging stations in the electrical grid. It has been successfully installed and tested in the city charging yard for the fleet of electric vehicles of the Freiburg city hall.

The city of Freiburg maintains a yard with several charging stations at the city hall in the Stühlinger district. It provides a total of 26 connectors with 22kW as well as three fast chargers with up to 50kW and services the city hall's electric fleet of more than 50 vehicles.

A smart charging station in the grid of bnNETZE.

The expansion rate of the charging station network and the number of electric vehicles provides a proportional set of control and optimization challenges to the network operators. For this reason, the badenova subsidiary bnNETZE involved expert partners in the "Grid Agent" pilot project including PSI Software AG as lead partner. bnNETZE is already using PSIprins as its network control system. ◉

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News: Optimized operations by efficient utilization

Intelligent Control of Power Transformers

The continuously increasing demands on the energy networks and the higher average age of power transformers require intelligent operating resources. ETOS® (Embedded Transformer Operating System) by Maschinenfabrik Reinhausen (MR) offers the first open and modular system solution for automating power transformers. In 2018, MR and PSI Software AG entered a technological cooperation agreement. The resulting combination of ETOS® and the PSIcontrol system enables higher utilization of the equipment.

The ETOS® system consists of monitoring and safety devices, sensors and field devices for control, regulation, and monitoring for optimized operations management with maximum operational safety and reduction of life cycle costs. This system can be used for single transformers or entire transformer fleets of all manufacturers and all ages. At the transformer field level, ETOS® is the central communication and data interface between the process and control system level. This function makes it an edge computer which covers all automation functions including monitoring of all components such as the cooling system, bushings, and tap changer as well as the control of tap changer switches and the cooling system.

Due to the installation at the transformer, the acquired data can be transmitted by the network protocol and fiber link to the control system. In contrast to conventional connection via copper cables, the wiring cost is significantly reduced and the data transmission security is increased at the same time.

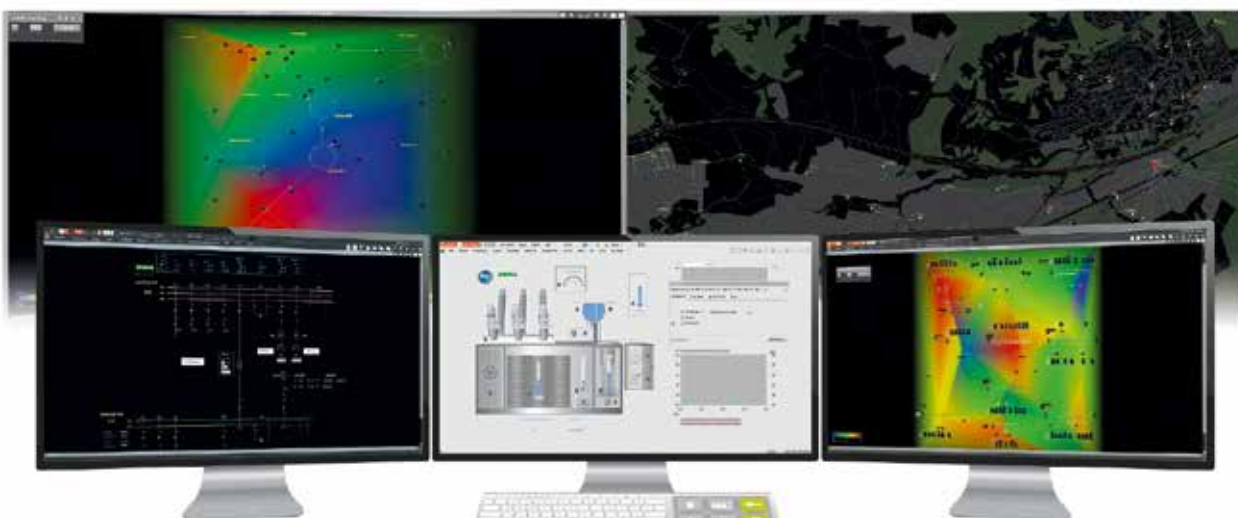## Standardized Interfaces for Transformers

The integration of standardized interfaces such as IEC 60870-5-104 and IEC 61850 allow simple connection to the PSIcontrol system. The combination of algorithms, artificial intelligence, network management information, and operating resources information provides new opportunities for optimized operations by more efficient utilization of the transformers.

Calculation of Dynamic Transformer Overloads

Congestions are one of the daily challenges for network operators. In these cases, unplanned interventions are often required in order to ensure supply security. For this purpose, the generators must adjust the scheduled electricity generation, reduce renewable infeeds, and implement switching measures which involve significant costs for the network operators.

By using intelligent network control and detailed operating resource information, these interventions can be reduced and the operating resources can be optimally utilized. By combin-

Intelligent connection between PSIcontrol and ETOS®.

ing the PSI system and the MR system, transformers can be more efficiently operated with ETOS® and the re-dispatching costs can be reduced to a minimum.

Starting with the network calculation results based on the infeed and load forecasts of the PSI system as well as current measured values, the dynamic overload capability of the transformer for the next 24 hours can be calculated in the ETOS® based on the thermal model of the transformer including intelligent cooling system control. The respective overload capacity can also be determined on the basis of these results. The maximum overload capacity is limited by the current heat capacity, the current load, and the health status of the transformer.

The PSI system calculates the re-

quired overload capacity for transformer outages for the case N-1. This way, the combined realization of the required overload factor (PSI) and the dynamic operating limit of the transformer (ETOS®) is used for optimal equipment utilization. ◉

Multiple benefits for network operators

- Higher network utilization by using dynamic thermal operating limits (while complying with N-1 criteria)

- Reduction of switching operations, reduction of re-dispatching costs

- Increased life cycle of the transformer and the indirectly involved switching devices

- Basis for decision making

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- Forecast ambient temperature
- Forecast load profile

- Dynamic thermal operating limit based on thermal model with intelligent precooling

ETOS®

News: Updating the existing standard PSI applications and multiple functional extensions

Control System Upgrade for GASCADE Gastransport

PSI Software AG has been contracted by GASCADE Gastransport GmbH to upgrade the existing PSIcontrol/Gas network control system. The upgrade consists of updating the existing standard PSI applications as well as multiple functional extensions.

Based on the Gas Management Suite, the core modules PSIcontrol/Gas, PSItransport and PSIganesi/Online simulation for the monitoring, control and balancing of the gas network will be implemented. In addition, PSIreko will be used for the tracking of gas characteristics for invoicing purposes. The upgrade also includes general product maintenance, in particular, the continuous development in the field of IT security.

PSI was originally contracted in 2013 by GASCADE with the upgrade of the network control system. It has been successfully operated on a number of geo-redundant sites since 2014. GASCADE Gastransport GmbH, headquartered in Kassel, one of the largest natural gas transportation companies in Germany, operates a transportation network of some 2400 kilometers.

The GASCADE pipeline network directly connects five European countries via border crossings. ◉

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GASCADE Infrastructure.

News: Upgrade of gas network control system at terranets bw to PSIcontrol 7.9

New Functions and Higher IT Security

PSI Software AG has been contracted by terranets bw GmbH with upgrading the gas network control system to version 7.9. In addition to updating the existing standard applications, the upgrade consists of a number of functional extensions as well as the further development of IT security.

The PSI standard applications for monitoring and controlling the gas network as well as for gas quality tracking for invoicing purposes have been in use at geo-redundant sites at terranets bw since 2011. With the upgrade of the core modules PSIcontrol/Gas, PSItransport and PSIganesi/Online Simulation as well as PSIreko, the efficient control of the gas network will be even further optimized. Moreover, IT security will be increased so as to meet the high security requirements imposed on operators of critical infrastructure.

terranets bw GmbH, headquartered in Stuttgart, has been an independent transport network operator of gas for over 50 years. The company operates an extremely modern 2000 km network and high-pressure gas system in Baden-Württemberg. More than two-thirds of all cities and communities in Baden-Württemberg as well as parts of Switzerland, Vorarlberg and Liechtenstein are connected to the network. ◉

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Event: PSIcontrol user group meeting at Avacon Netz GmbH in Salzgitter, Germany

Expansions for Gas and Pipeline Management

The annual meeting of the PSIcontrol User Group provides a platform of open dialog and exchange about market requirements and expansions of the PSI solution portfolio for control and monitoring of gas networks as well as gas and oil pipelines. This year, the users met June 4 and 5 at Avacon Netz GmbH in Salzgitter.

In addition to numerous expert presentations and workshops, the work results of the PSI user forum and future release plans—based on current customer requirements and the standardization of the applications—were presented and discussed.

The new features of PSIcontrol release 7.9 include TASE.2, standardized operations for tables and curves, a Dark Theme visualization alternative as well as other functions which are migrated to the new release as standard features or options.

Presentation of the work results of the PSI user forum.

For gas network simulation, the visualization of pigs in the topology display was presented. Besides the current location, the user can parameterize additional information such as pig speed and distance to the sending and receiving stations. Various functions were updated and the handling was simplified, for example, the routing algorithm in the location diagram function.

New approaches and initial results for the new Master Data Management were presented as part of the development framework for new releases which is based on the group-wide Java-based PSI platform. The meeting also included a tour of the Avacon network control center and ALSTOM's company museum. ◉

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News: Nowega GmbH Receives Upgrade for their Gas Management System

Efficient Control of the Gas Network

PSI Software AG has been contracted by Nowega GmbH with the delivery of a network control system upgrade to version 7.9. The core components consist of PSIcontrol/Gas, PSIganesi/Online-Simulation and PSIprognosis for the monitoring and control of the gas network, PSIreporting and a Tase.2 coupling as well as integrating the data-point definition and support from the Kopolt application.

The new standard software version of the control system contains a number of functional extensions which further increase the efficiency of controlling the gas network. In addition, the upgrade increases the IT security to meet the current requirements for users of IT solutions in critical infrastructure environments.

Nowega GmbH is a remote network operator headquartered in Münster. They operate and market about 1500 kilometers of high-pressure gas lines.

The network stretches from the Dutch border through Lower Saxony and parts of North Rhine Westphalia into the Wendland. Nowega fulfils all tasks of a modern gas transportation company: from supporting its customers in the registration process and booking transportation capacities to its provision and invoicing of fees as well as the allocation of costs. ◉

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User report: Reliable monitoring and control of the underground storage of Gazprom UGS

Control of Underground Gas Storage

Since 2016 "Gazprom UGS" in Russia has been using a multi-level dispatching system based on the PSI gas management software to monitor its underground gas storage. This year the company moved from Moscow to St. Petersburg. PSI successfully supported the move of the system without any interruptions.

As a wholly owned Gazprom subsidiary "Gazprom UGS" (Underground Gas Storage) was founded in 2007 as the new storage operator, responsible for over 22 autonomous storage companies operating 26 underground gas storages.

vious bi-hourly manual data entry at each location. The purpose of this automated and modern solution was the compliance with the realtime operations requirements as well as the time zone requirements for four time zones in different regions of Russia.

pean market and its first successes in Russia, "Gazprom UGS" selected the gas management suite of PSI as their software basis. The project was realized by an international team consisting of "PAO Gazprom Avtomatizatsiya", OOO "PSI", and AO "ATGS" and was coordinated by the IT service provider "OOO Gazprom Inform". PSI supplied the required software extensions in addition to the standard software.

The system included important functions such as the acquisition and processing of real-time information, the status assignment of the underground storage units including unified characteristic numbers and data visualization as well as balancing. It also provided visualization and archiving of alarms and important events, the operational planning for the underground storage units and daily, monthly, and annual company performance.

The international expert team in a work meeting.

Previously, the gas storages were operated by different gas transport companies. The plans called for a new central dispatching system for "Gazprom UGS" as well as a local dispatching system in each of the 17 UGS subsidiaries. These systems were designed to be connected and to replace the pre-

Central Dispatching

In 2009, the specification of a requirement catalog and a concept for the new system were developed under the name "Information and Control System for Underground Storage" on the central and local levels. Because of PSI's excellent references in the Euro-

Automated Data Exchange

The data is locally acquired in real-time and aggregated as bi-hourly, daily and monthly values and transmitted to the central system for generating planning and control settings. These settings can be coordinated as dispatching tasks between the center and the local storage companies. The data exchange between the dispatching centers of Gazprom UGS and Gazprom is fully automated. Gas storage-spe-

"Gazprom UGS" salt caverns in Kaliningrad.

cific requirements and the multi-level architecture required extensions of the PSI gas management suite modules. Functions for table processing and for sending and receiving dispatcher tasks were added to PSIcontrol. PSIcompact is used for the local dispatching systems and PSItranstore was extended with functions for storage balancing. PSIstorage was developed specifically for assessing the potential performance and the current capacity of the storage locations. This unique and currently largest management system in the world for underground storage is based on an open architecture and is continuously expanded by adding new underground storages. The strict requirements related to the move in 2018 were jointly coordinated by the IT department of "Gazprom UGS" and PSI. It was realized as a solution concept and successfully implemented. Starting April 30, 2019 all Russian underground storage units have been operated by the new central control center in St. Petersburg. Due to the supplier requirements regarding the localization of software products in Russia - which went into effect in 2014 - the support and development of the dispatching system are provided in-country by the Russian experts of OOO "PSI". ◉

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News: PSI and eXept conclude cooperation for test automation

Efficient Quality Assurance for Users

The Electrical Energy business unit of PSI Software AG and eXept Software AG have concluded a cooperation for test automation. Thus, PSIcontrol systems users can obtain access to the same testing environment that PSI uses.

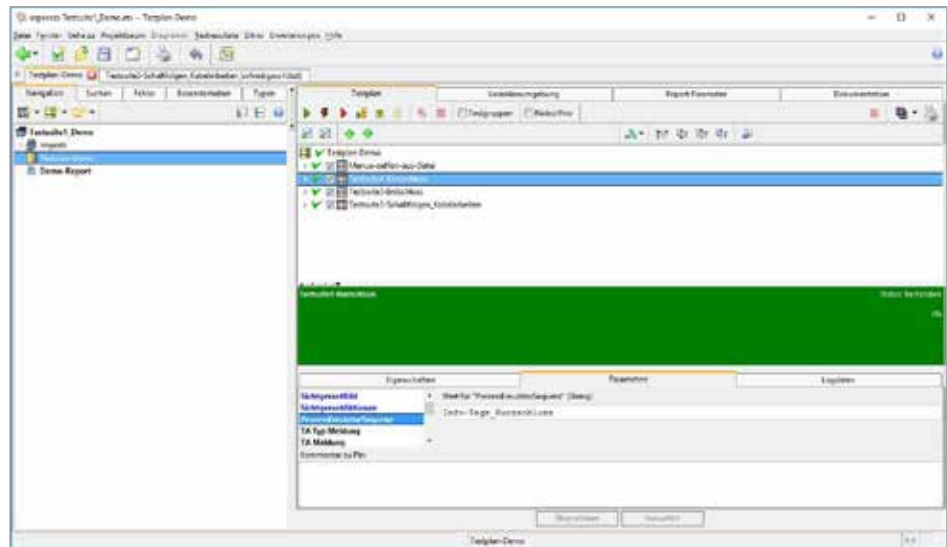Automatic product tests are standard for software development. For reasons of security, a new release requires testing of the entire system. In addition, there are tests following improvements and corrections of software already in operation in which potentially impacted software sections have to be checked with a smoke test.

In the future, panel tests, complex workflow tests as well as cross-technology tests between rich-client applications in C/C++ or Java, web applica-

tions and mobile applications will be automated. The direct tracking of results in the flow diagrams allows easier and quicker analysis and identification of problem areas. During acceptance tests, the functionality of the entire system can be tested reproducibly and quickly.

At the PSI EE Info Days in Aschaffenburg, customers were already able to inform themselves about test scenarios for network control applications. PSI continuously expands the available test cases and enables operators of PSI systems to test in their own IT environment. Precisely this goal is achieved with the cooperation with eXept—reusability of the test cases directly at the customer's site.

Complex test suite for short circuit simulation via process emulator.

With the product suite expecco, eXept Software AG provides a flexible framework for test automation and test management. The high rate of reusability of the test cases across all the stages of testing leads to a drastic reduction of the maintenance costs. www.exept.de. ◉

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News: PSI delivers new multi-utility network control system to NEW Netz GmbH

Standardized Functions in PSIcontrol 4.6

PSI has been contracted by NEW Netz GmbH with the delivery and implementation of a new multi-utility network control system for electricity, gas, water and sewage networks on the basis of PSIcontrol 4.6 for the Mönchengladbach site. The new standardized PSIcontrol 4.6 will replace the presently used network control system.

Along with the SCADA functions, the system also includes network calculations for electricity, gas and water, forecasts, and comprehensive functions for distributed renewable energy resources management as well as a completely integrated Operator Training System.

With the new PSIcontrol 4.6, NEW Netz GmbH will get a modern, extensible and function-rich control system that completely covers the required functions, protecting the investment long-term.

NEW Netz GmbH, headquartered in Geilenkirchen, is a distribution network and metering service pro-

vider in the region of Heinsberg, Mönchengladbach, Viersen and parts of the Rhine district of Neuss. The network area covers about 10,000 km of electricity lines, 4,100 km of gas pipes as well as 3,000 km water pipes. NEW Netz GmbH is a subsidiary of NEW AG, a communal utility with strong roots in the Lower Rhine area. ◉

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News: Fast realization of powerful charging structures for the mobility turnaround

AI-based Network Control

With the new smart grid platform Intelligent Grid Operator PSIingo, PSI offers sustainable integration of decentralized renewable energies into distribution networks and thus supports the rapid implementation of efficient charging infrastructures for the mobility turnaround. The comprehensive automation solution uses advanced intelligence for network monitoring and control of distribution networks with the help of artificial intelligence (AI). For the first time, PSI is employing self-learning algorithms.

Based on the experience of the smart operator software and the unique combination of neural networks with Deep Qualicision, PSI has developed a learning method for AI-supported network state estimation, which also handles incomplete network state information. It uses only situational knowledge and measurements from the network, such as from intelligent measurement systems or charging infrastructures.

The behavior of the distribution network is continuously being learned through essential parameters such as network load, power consumption and power generation in combination with additional external information like weather forecasts. Thus, the system recognizes critical network situations in good time, determines the optimal decision from the possible alternatives, and derives control commands. Since overload situations in local networks do not occur constantly, but only spo-

radically for a few hours per day, there is a high potential for flexibility. The network operator can thus avoid not only current violations and thermal overload of operating resources, but also the otherwise necessary expansion of the distribution networks.

By integrating information from intelligent measurement systems, PSIingo requires very few to no additional measurements in the distribution network and enables fast, scalable, and economical digitization of the distribution networks. In addition, the innovative algorithms for network control offer direct integration into the work processes of network management and network planning. ◉

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R&D: LINDA concept received ISGAN award for intelligent electricity networks

Renewable Energies for Emergency Electricity Supply

The LINDA concept (Local island supply and accelerated network restoration with decentralized generating plants after large scale outages) can especially be used for emergency power supply for critical infrastructures.

The LEW Verteilnetz GmbH (LVN) and its project partners from the industry and the science community have proven that decentralized generating plants such as solar, hydro, or bio mass power plants can be used to supply emergency power in case of blackouts. As one of the partners, PSI Software AG has pro-

Awarded project partners.

vided the control system software solutions.

On June 11, 2019, the International Smart Grid Action Network (ISGAN) has awarded the prestigious ISGAN award for seminal smart grid projects to the LINDA project partners in Vancouver, Canada. Already in November 2018, the Bavarian Energy Award for "Energy Generation—Electricity, Heat" was awarded to LINDA. ◉

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News: PSI and VisoTech establish partnership for Algo-Trading systems

Synergies for Automated Short-Term Trading

PSI Energy Markets GmbH and VisoTech Softwareentwicklungs-ges.m.b.H. have entered into a strategic partnership in the field of algo-trading systems. With the autoTRADER from VisoTech integrated into the energy trading system PSImarket, PSI and VisoTech customers can now possess a powerful and comprehensive solution for automated energy trading, portfolio and risk management.

With the autoTRADER, VisoTech offers the leading tool for fully automated energy trading in the volatile spot markets. A wide range of relevant intraday markets are supported, amongst others EPEX SPOT, Nord Pool and BSP SouthPool, and with PEGAS, also a marketplace for spot trading of gas.

"With the connection of PSImarket and the autoTRADER, our customers have an integrated, powerful and configurable solution enabling them to define their own trading algorithms," explained PSI Energy Markets Managing Director Michael Haischer.

Fast and Cost-Efficient Implementation and Integration

With the integration, customers benefit from numerous synergy effects, especially through a fast and

cost-efficient implementation and integration of the solution. In addition, the many years of experience

of the two companies mean that further developments can be carried out quickly and efficiently and international market launches can be accelerated.
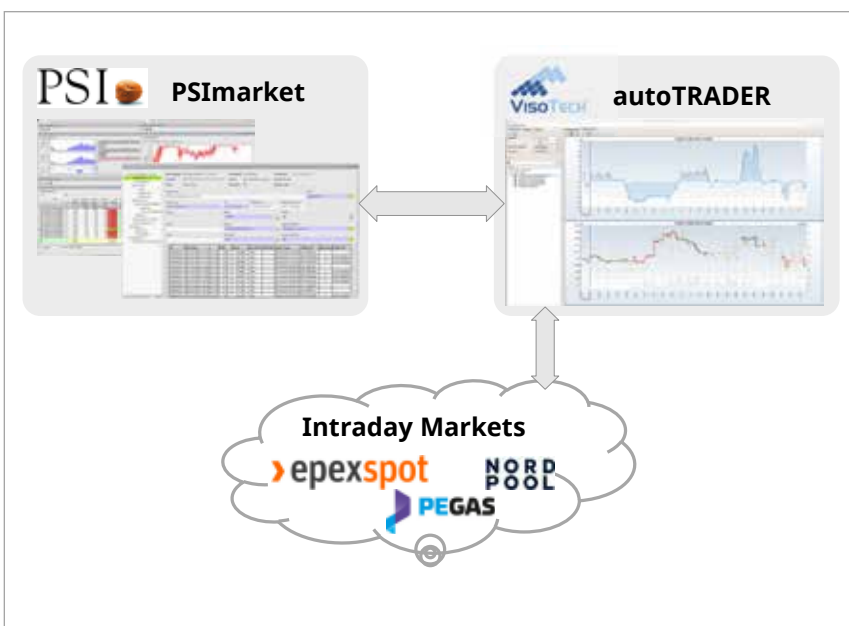
"With PSI we have a strong, reliable partner," says Jürgen Mayerhofer, Managing Director of VisoTech. "Together we provide our customers with the tools they need to benefit from today's demanding and rapidly changing energy market".

> *Together we provide our customers with the tools they need to benefit from today's demanding and rapidly changing energy market.*
>
> **Jürgen Mayerhofer**
> Managing Director VisoTech

Synergies for Optimized Customer Benefit

The Vienna-based software company VisoTech GmbH, founded in 1999, is the European market leader in fully automated spot trading of power and gas with its Periotheus autoTRADER solution.

With the new partnership, the two leading software manufacturers, PSI Energy Markets and VisoTech, strengthen their market position in the field of energy trading systems and optimize the customer benefit of their solutions.

PSImarket   **autoTRADER**

Intraday Markets

epexspot   NORD POOL

PEGAS

Integrated solution for fully automated energy trading in volatile short-term markets.

News: From a pioneer in process control to a global software product supplier

PSI Celebrates 50th Anniversary

PSI Software AG celebrates its 50th anniversary. The software company was founded on 12 May 1969 as PSI Gesellschaft für Prozesssteuerungs- und Informationssysteme GmbH in Berlin by a group of former employees of the AEG software institute. As a pioneer in process control, PSI started with first orders from the steel and logistic industries. Today, PSI is one of the leading global software suppliers for optimizing the flow of energy and materials.

The modern PSI technology platform combines the best of 50 years of software experience of the PSI Group and provides a proven basis for the successful use of e. g. artificial intelligence (AI) in industrial applications.

"After all, for almost 50 years the company primarily supplied and maintained turnkey real-time solutions. Now, customers can also modify the PSI products, sector suites and standard platform modules themselves and can even design their own applications. Thus,

Electrical energy control room at Stadtwerke Aachen 1973.

our customers benefit from modern, highly efficient and open technology world standards in order to be optimally equipped for the future." Chairman Dr. Harald Schrimpf summarizes.

Please find more information regarding the PSI history here:
https://www.psi.de/en/psi-group/history/50-years-psi-software/

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DATA PROTECTION

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EVENTS

www.psi.de/en/events

11.–12.09.2019	PSI Open Days 2019	Karlstad, Sweden
18.–19.09.2019	PSIprins Customer Council at ENERVIE Vernetzt GmbH	Hagen, Germany
25.–27.09.2019	TRANSFORM 2019	Hong Kong, China
01.–04.10.2019	9th St. Petersburg International Gas Forum 2019	St. Petersburg, Russia
23.–24.10.2019	Asset Service Days 2019	Aschaffenburg, Germany
23.–24.10.2019	PSIprins Thüga Customer Meeting at Stadtwerke Stade GmbH	Stade, Germany
12.–13.11.2019	CONSULECTRA 2019	Hamburg, Germany
12.–14.11.2019	European Utility Week 2019	Paris, France
26.–28.11.2019	GAT 2019	Cologne, Germany