

# ENERGY manager

Newspaper for energy suppliers



Successful start-up of the dispatching system M ASDU ESG at Gazprom

## Largest gas transport system in the world

### Product report

Safe and cost-optimised  
transport of liquids and gases  
Detect and avoid leaks

### Product report

Multi-criteria decision  
making with Qualicision  
Optimised control of virtual  
power plants

### User report

PSIcontrol enables fast  
responses to events  
New control system for  
Westnetz

## EDITORIAL

Dear readers,

The digitisation and the energy transition are progressing continuously. Even the industry association BDEW sees the energy industry in a dual transformation.

In the PSI business unit Oil and Gas, we are also completing a dual transformation in mid-2017. After thirty years, Dr. Martin Bürgel, the long-time managing director, will enter a well-deserved retirement. We are particularly thankful for his outstanding expertise which he used to expertly manage the business unit in times of continuous change in the oil and gas



industry and to advance the development of new solutions.

With the passing of the baton to me at the end of July, we will continue on

this basis and reiterate our support to our customers in the face of multiple digital challenges. Here our gas and pipeline management suite offers future-proof solutions which can be optimally adapted to the requirements of our customers.

I hope you enjoy reading this edition of the Energy manager.

*Simone Bauer*

Dr. Simone Bauer  
Managing Director Business Unit  
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## CONTENTS

### TITLE STORY

Successful start-up of the dispatching system M ASDU ESG at Gazprom.....	1
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### NEWS

Leak detection and location systems for Lukoil.....	6
PSIcontrol controls new Gazprom pipeline.....	9
Development of new software solutions for PAO Gazprom.....	11
New systems, upgrades, multi-utility systems and comprehensive cyber security technology.....	12
Sale of energy network software and network management as a service in Scandinavia.....	16
Solid year-to-date for PSI due to strong order intake from industry.....	18

### PRODUCT REPORTS

Quality assurance of reconstruction results based on Monte Carlo simulation.....	8
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Safe and cost-optimised transport of liquids and gases.....	10
Continuous enhancements in PSIcontrol.....	13
Multi-criteria decision making with Qualicision.....	17

### USER REPORT

New control system for Westnetz: PSIcontrol enables fast responses to event.....	15
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### EVENTS

22 <sup>nd</sup> Meeting of the PSIcontrol user group at terranets bw.....	9
Review of Neftegaz 2017 in Moscow.....	11
Asset Service Days in Aschaffenburg.....	14
New network control solutions at CIRED 2017 in Glasgow.....	16
PSI presented comprehensive enhancements at E-world 2017.....	19
Event calendar.....	19



Successful start-up of the dispatching system M AS DU ESG at Gazprom

## Largest gas transport system in the world

The magnitude of the Russian natural gas transport system is more than impressive. The overall length of the gas transport pipelines of just PAO Gazprom is 171 200 km including 250 compressor stations with a total power of 46 200 MW. In 2015, the companies of the Gazprom group produced 418.5 billion m<sup>3</sup> natural gas and associated gas from 138 gas fields. At the start of the 2016 winter season, 72.1 billion m<sup>3</sup> natural gas were stored in 22 underground storage facilities with a daily withdrawal capacity of 801.3 million m<sup>3</sup>. These technological capacities are the basis for Gazprom's integrated gas transport system (ESG RF) which is controlled by a central dispatching system (M AS DU ESG).

As part of interconnected production, more than 30 subsidiaries of PAO Gazprom are responsible for the supply of natural gas to gas distributors and major consumers as well as for the export to international customers. In addition, a number of independent natural gas producers and foreign partners cooperate with PAO

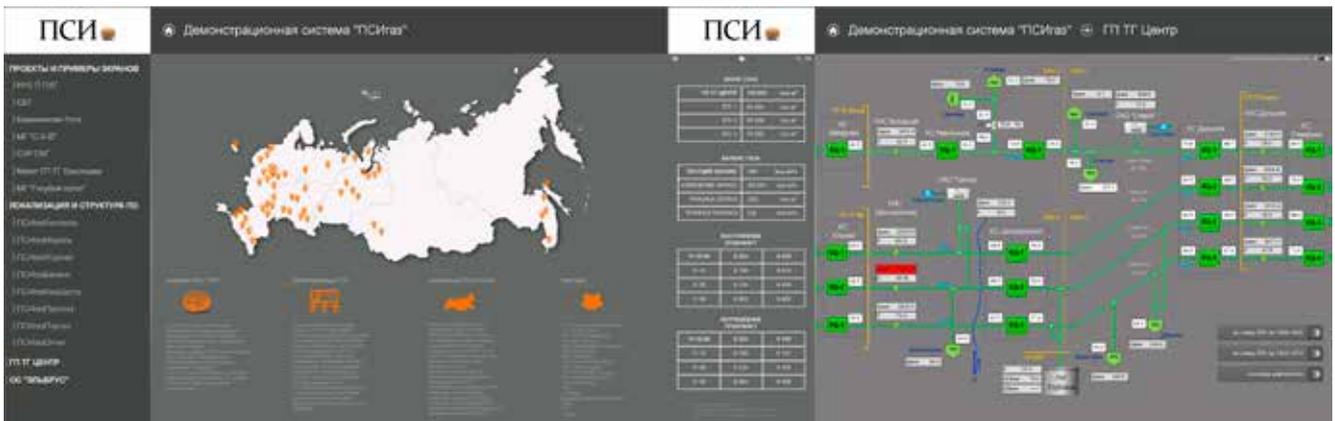
Gazprom. All operations and processes of the gas transport are planned and coordinated by the dispatching centre (CPDD—Central Production and Dispatching Department).

The comprehensive modernisation of the dispatching system required a software solution with high availability and processing capability for very high data volumes. Furthermore, optimal

support for data communication as well as flexibility for functional adaptations and expansions was essential. After a public call for tenders and an extensive selection process, the PSI gas management suite with the core modules PSIcontrol, PSIcomcentre, PSItransport, and PSIportal was chosen. The PSI software has an excellent reputation among the European gas network operating companies and partners of Gazprom. The official start of the new dispatching system (M AS DU ESG) of PAO Gazprom was in December 2016.

### Short historical review

The first central dispatching centre for the gas industry was called "Unified dispatcher control" and set up on April 12, 1961 in the former USSR. The setup was required due to increas-



The core modules of the PSI gas management suite were enhanced for M ASDU ESG.

ing coordination tasks and capacities as well as increased gas production and world-wide gas deliveries. The first automated control system was installed in 1978. In the early 90's, a dispatching system based on the state-of-the-art of that time was implemented as part of Gazprom's move to new offices. Among other things, this system enabled uninterrupted data exchange between the Gazprom departments.

### Unique project—Unique solutions

At the end of 2000, the system had been in operation for 15 years and had

to be replaced. Due to the special requirements for the new system with regard to expanded functionalities and the integration of various applications, finally the PSI software was selected. The flexibility of the software solutions enabled adaptation to special customer requirements and allowed the realisation of the dispatching system which was unique in the world at the time.

### Data transmission in real-time

M ASDU ESG is an integrated and scalable system with numerous control objects. Data from gas production,

gas pipelines, underground storage facilities, transport and gas deliveries to contract partners are acquired and processed. Data are transmitted in real-time by Gazprom subsidiaries as well as foreign Gazprom partners in Europe, Central Asia and other regions. The special prerequisites for these objectives have been fulfilled by PSIcontrol/CPDD which has been designed specifically for this purpose. The communication for data processing and the data transfer to the interconnected partners and subsidiaries played a special role. A special set of rules for secure exchange of large



Development team in the OOO "PSI" office in Moscow.

amounts of data was created and the software module PSIcomcentre was modified accordingly.

### Balancing in the integrated gas supply system

The Gazprom balancing requirements for transported and stored gas in the new M ASDU ESG also required comprehensive extensions in PSI-transport. These extensions include optimal time scheduling and numerous technical and organisational measures in order to comply with the specified requirements for the configuration of the balancing.

### Visualisation and integration

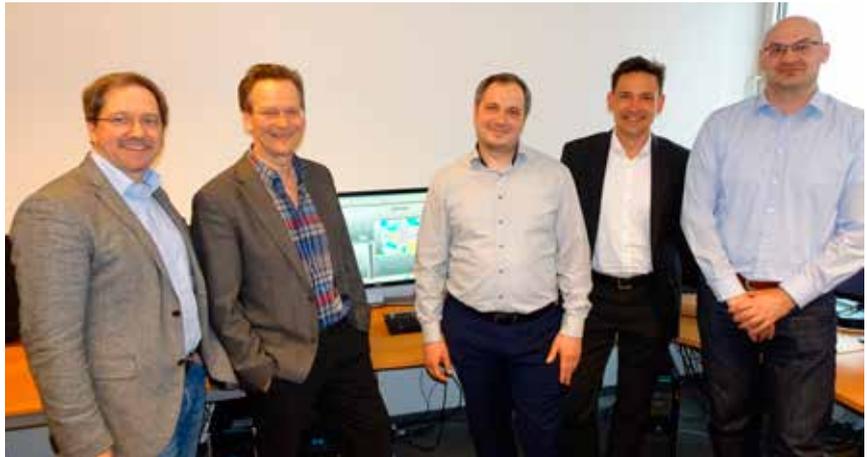
The data visualisation was also expanded significantly. In order to monitor the operational modes, M ASDU ESG uses both the traditional schematics and tables to display information. The corresponding extensions were implemented in PSIcontrol/CPDD.

Since third-party solutions are also used in addition to PSI software, a unified master data (NSI) system and central data storage were developed for optimal interaction of all components.

The M ASDU ESG was designed and realised as a high-availability and redundant system using standard backup functions of the PSI software as well as special extensions.

### Joint project of an international team

This large project was realised by an international expert team of the involved companies PAO Gazprom avtomatizatsiya (system integrator), PSI and other companies during several years. PSI was mainly responsible for supplying and adapting the basis soft-

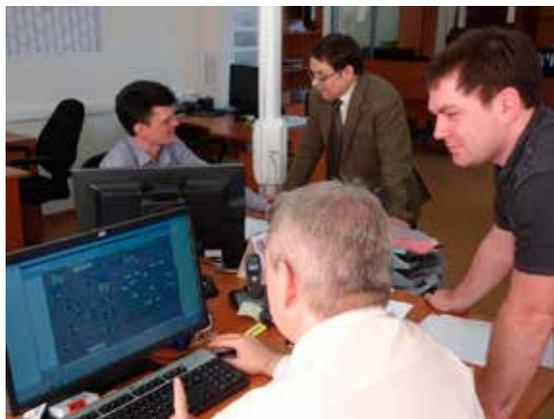


PSI test system team in Berlin.

ware. Configuration and testing of M ASDU ESG was performed jointly by Gazprom avtomatizatsiya and PSI. PSI was also responsible for the configuration of the data transmission and processing data with regard to M ASDU ESG including balancing and

ments, a dispatching system was developed which is world-wide unique in the international gas industry. The acquired expertise regarding the Russian gas market as well as new technologies and software solutions can also be used in future projects. The M ASDU ESG project also laid the foundation for the cooperation between PSI and Gazprom avtomatizatsiya. This resulted in starting the new joint company OOO Gazavtomatika Dispetcherskiye Syste-my in 2016 which is focused on new challenges in the Russian market.

In addition to enhancing the system, PSI will continue to support users and IT specialists with regard to the system operation. For creating large and high-availability solutions for dispatching systems, the new M ASDU ESG now provides a platform to test and to implement new ideas and technologies. ☺



Project meeting in Moscow.

assigned various subtasks to its daughter companies.

The successful start-up of the system is largely due to the very close cooperation with the end users in all areas. In the last phase, the work was performed primarily at the Gazprom site.

### Globally unique dispatching system

After successful analysis of the high-level and very complex require-

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PSIpipelines meeting high safety standards on offshore platforms

## Leak detection and location system for Lukoil

The new leak detection and location system as well as the hydrocarbon balancing system had been successfully implemented for the offshore platform of the Korchagin oil field in the Caspian Sea. It is located on the Russian side of the Caspian Sea at a depth of 11 to 13 m. The distance to the nearest shore in the Wolga delta is about 120 km, and the nearest ports are Astrakhan (175 km) and Makhachkala (250 km).

**P**roducing oil and gas offshore involves stringent environmental requirements. One of the key tasks is the early detection and location of oil and gas leaks. Further-

provided a solution to this challenging task. The monitoring system for leak detection and location for sub-sea and onshore pipelines is based on PSIpipelines, and the system for cal-

### Leak detection and location

PSIpipelines monitors the integrity of the oil and gas pipelines using different methods based on an advanced real-time transient modelling system. The different methods make full use of the existing measurement instruments. The measured pressure, temperature, flow and other values are acquired and contemporaneously sent to PSIpipelines. The Real-Time Transient Model (RTTM) uses the meas-

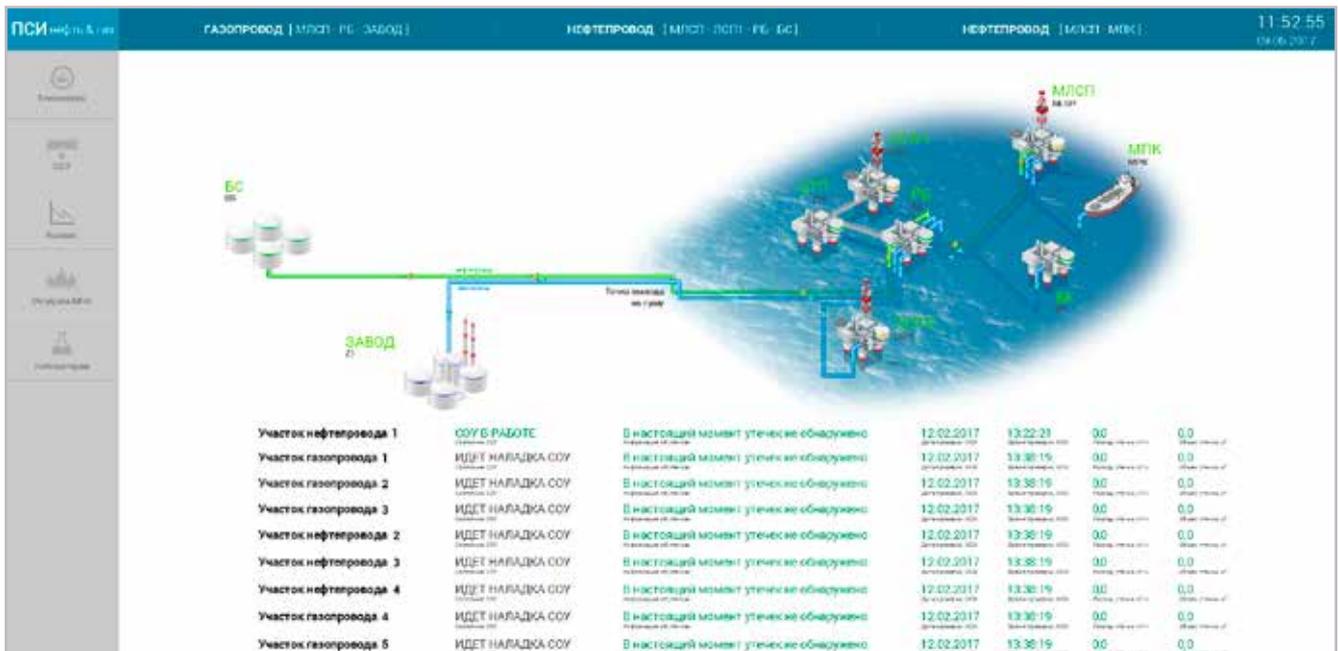


Lukoil offshore platform in the Caspian Sea.

more, the safe operation of the offshore platforms as well as the associated pipeline systems must be ensured. A PSI expert team successfully pro-

culating and monitoring the hydrocarbon balance is based on PSIcontrol. Both systems are successfully operating at Lukoil.

ured values to calculate the exact hydraulic states of the pipelines and provides these states to the leak detection and location system.



Pipeline monitoring overview.

Deviations between the calculated and measured values are analysed and classified; they provide the basis for reliable leak detection and location.

### Calculation and monitoring of the hydrocarbon balance

The expanded functionality "Calculation of the hydrocarbon balance" was implemented as a PSIcontrol application. This provides conclusions about the efficiency of individual technical system components as well as additional information for detect-

ing possible leaks in oil processing equipment.

### Start-up and testing on the offshore platform

Prior to production operation of the PSI application on the offshore platform, a large number of tests had to be successfully completed in order to obtain certification for the applications. Furthermore, the leak detection and location system required registration with the shipping registry of the Russian Federation. The project was

jointly realised by the international PSI team in Moscow, Berlin, and Poznan. Several specialists carried out the start-up and test procedures on the offshore platform itself which included completion of the mandatory safety and emergency training. The project success is also due to the close and focused cooperation with Lukoil regarding relevant issues.

### Meeting high environmental and industrial safety standards

Lukoil actively continues the development of their Caspian Sea fields. The Filanovsky oil field began operation at the end of 2016 and the Rakushechnoye oil field will be the next to start production. PSI will continue the cooperation with Lukoil and support the company in meeting the high environmental and industrial safety standards. ☺



Schematic representation of the Korchagin oil field.

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Quality assurance of gas quality reconstruction results based on Monte Carlo simulation

## Calculation of measurement uncertainty

The calculation of measurement uncertainty is an important part of the quality assessment of measurements. For systems calculating gas composition for calorific billing, the measurement uncertainties for calorific values, standard density and carbon dioxide have to be determined in order to address the following questions.

**W**hat is the quantitative influence of the measurement uncertainties of the input data and the uncertainties of the topology parameters on the calculated results? Do uncertainties of input data and topology parameters exist which amplify each other? Are there critical areas in the gas network where the uncertainties of the input data and the topology parameters particularly influence the calculated results?

### Solution approach

Due to the high complexity and dynamic of gas networks, a non-steady-state calculation method is used in the reconstruction systems for calculating the billing-relevant results. This eliminates the need for an analytical method for calculating measurement uncertainties due to the high number of measured values, topology parameters and non-linear relations. Therefore the Monte Carlo method is recommended for calculating measurement uncertainties. This method performs a large number of similar calculations with different uncertainties of input data and topology parameters. The calculated results are analysed using special assessment functions.

### PSIrekomu for calculating measurement uncertainty

The National Metrology Institute of Germany (Physikalisch-Technische Bundesanstalt) considers the calcula-

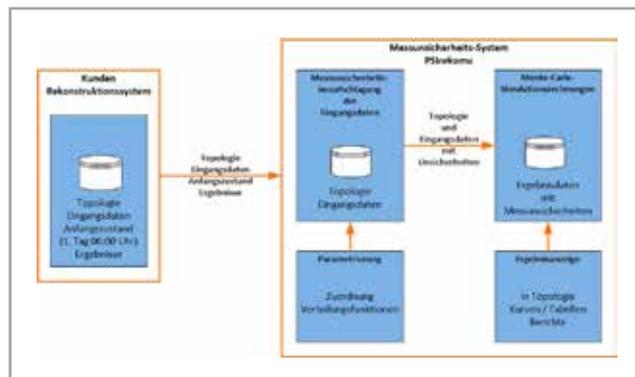
are supplied by the existing customer reconstruction systems and used in PSIrekomu to calculate the measurement uncertainties. Uncertainty ranges and their distribution functions (normal distribution, uniform distribution) are parametrised for calculation of the random distributions. These parameters are used to vary the input data for an entire billing month and to archive the results of the reconstruction calculation.

The calculations such as varying of input data, reconstruction calculation for a billing month and archiving of results are frequently repeated. Each calculation run provides different results for each time step for calorific values, standard density and carbon dioxide as well as pressure and flow at the topology elements. They are all used

in calculating the measurement uncertainty for each topology element.

### Representation of the results

Then the calculated uncertainties can be displayed by a replay function in the gas network topology as well as in curves and tables. The measurement uncertainties for calorific value, standard density and carbon dioxide for the relevant billing periods are also used for calibration purposes. ☺



PSIrekomu as separate stand-alone solution with high-performance methods.

tion of measurement uncertainties for gas composition reconstruction systems as a useful and necessary technical development. PSI uses these procedures in the PSIrekomu system to calculate the measurement uncertainty of reconstruction results. Due to the high calculation load, PSIrekomu is designed as a separate stand-alone solution with high performance processes. The figure shows this approach.

### Calculation of result uncertainties

The required input data such as gas network topology, initial state, input data and results for a billing period

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22<sup>nd</sup> meeting of the PSIcontrol user group at terranets bw

## News about the gas management and pipeline suite

The annual meeting of the PSIcontrol User Group was held June 13–14 at terranets bw GmbH, the gas transport network operator in Baden-Württemberg.

At the meeting, the new features of the gas management suite and the pipeline suite as well as the release schedule of the control system and simulation applications PSIcontrol, PSIGanesi, PSIREKO and PSIPipelines were presented. The release schedule is based on the current customer requirements

and the ongoing standardisation of the applications.

The annual user group meeting is characterised by open communication about market requirements and enhancements of the PSI portfolio of solutions for controlling and monitoring gas networks as well as oil and gas pipelines. Special control system

and simulation topics were presented and discussed in workshops. Technical presentations provided in-depth information to customers regarding application enhancements. New features were presented and discussed hands-on with live exhibits. ☉

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Ribbon cutting ceremony for the transport gas pipeline “Bovanenkovo—Ukhta” in Russia

## PSIcontrol for new Gazprom pipeline

The official start-up ceremony for the second branch of the transport gas pipeline “Bovanenkovo—Ukhta” took place in early 2017. It is operated by OOO Gazprom transgaz Ukhta, a 100% subsidiary of PAO Gazprom.

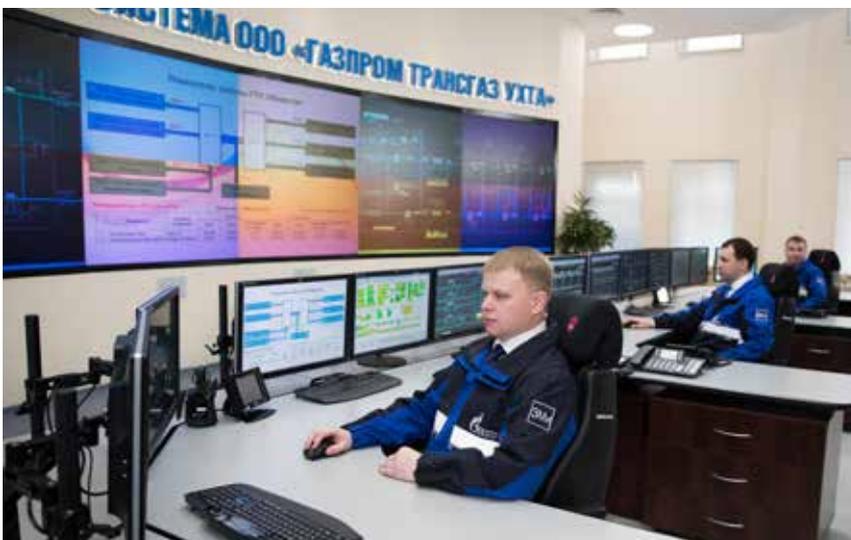
Based on PSIcontrol, the automation of the dispatching control was implemented by

PAO Gazprom avtomatizatsiya. The new pipeline transports up to 115 billion m<sup>3</sup> natural gas annually. With

a length of 1 260 km, a diameter of 1 420 mm and an operating pressure of 120 bar, it is designed for the natural gas transport from production sites on the Yamal peninsula to the central regions of Russia as well as for export.

### Around-the-clock monitoring and controlling

In addition, the dispatching systems which are based on PSI software provide around-the-clock monitoring and controlling of all facilities and equipment of the 15 400 km gas transport system of OOO Gazprom transgaz Uchta. ☉



Dispatching centre of OOO Gazprom transgaz Uchta.

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Safe and cost-optimised transport of liquids and gases

## Detect and avoid leaks

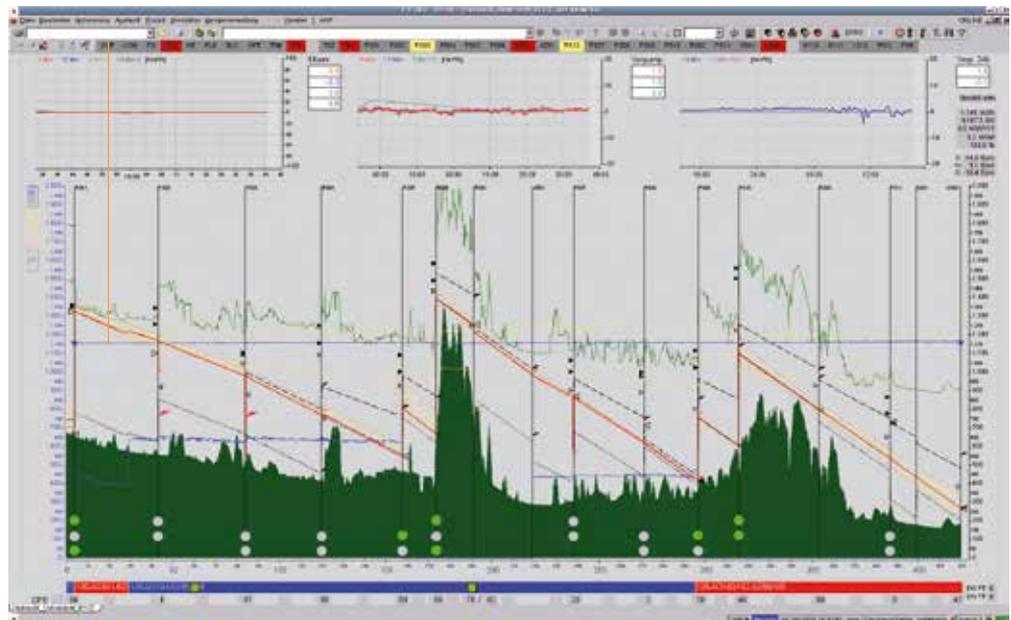
An increasing number of users are using the PSIpipelines software system to monitor pipelines for the safe transport of liquids and gases. A unique feature of the system is its capability to support pipeline operators to quickly identify abnormal situations in order to prevent leaks and to proactively minimise the chances of one occurring in the first place.

PSIpipelines provides one of the most advanced real-time transient modelling (RTTM) systems to simulate the hydraulic and thermodynamic behaviour of the flow during the transport of crude oil, natural gas, refined products and chemical products. More than 50 hydraulic profiles, for example for pressure, temperature, density and flow are calculated every second to provide pipeline operators a complete set of plausible data at each point of a pipeline and in particular in un-metered areas.

The “Look-Ahead Simulation” and the “What-If Simulation” applications are important tools to identify in advance any negative drift to undesirable hydraulic conditions and to determine the consequences of operator-initiated actions.

### Model-Compensated Mass Balance and Negative Pressure Wave leak detection methods

The PSIpipelines Leak Detection System is approved by the independent experts of TÜV and fully complies with industry and international standards.



PSIpipelines provides a single overview for all relevant information.

The Model-Compensated Mass Balance method provides excellent sensitivity under all operating conditions. The Negative Pressure Wave method can detect leaks very fast and provides excellent capabilities to locate a leak. Both methods help to drastically reduce the consequences of incidents. In combination with its high-end RTTM, PSIpipelines reduces false alarms and improves the location accuracy.

The PSIpipelines tracking system enables precise tracking of pigs and batches to their destinations as well as the tracking of different fluid compositions and drag reducing agents. Precise batch cutting requires detailed information about volume, location in

the pipeline and commodities to reduce transmix volumes.

PSIpipelines collects and analyses all pressures and switching operations and permanently provides information about the remaining lifetime of the

pipeline. Deposit formation in pipelines may impact optimal operations. Pumping power must be increased in order to maintain the required throughput. The system continuously measures the operational efficiency and informs the operators in good time to initiate appropriate actions.

The software suite provides more than 30 applications to implement tailor-made solutions based on individual customer requirements. ☺

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Development of new software solutions for PAO Gazprom

## Establishment of a joint venture

In early 2017, PAO Gazprom avtomatizatsiya and OOO "PSI" established the joint venture Gazavtomatika Dispetcherskiye Systemy in Russia.

OOO "PSI" holds 33 percent and PAO Gazprom avtomatizatsiya holds 67 percent of the new company. The joint venture was established due to the demand of Gazprom and the Russian government to reduce imports of technological products which state-owned and energy industry including Gazprom have to comply to. The software which shall be jointly developed shall fully comply with

these guidelines. The initial focus is on enhancing the software solution under the product name "Potok-DS"



for exclusive use by Gazprom. The joint venture also provides the technical support and software maintenance of the systems which are already in operation. OOO "PSI" and PAO "Gazprom avtomatizat-

siya" already signed the memorandum about establishing a joint venture at the Neftegaz in April 2016. PAO "Gazprom avtomatizatsiya" is a market leader for development and installation of automation systems with whom PSI Software AG and OOO "PSI" have successfully cooperated since 2009. 

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Review of Neftegaz 2017 in Moscow

## International oil and gas projects

Following its tradition, the Oil and Gas business unit of the Russian PSI subsidiary OOO "PSI" has exhibited again at Neftegaz 2017 which was held April 17–20, 2017 in Moscow.

The booth provided a comprehensive overview of the PSI solution portfolio for

controlling and monitoring gas networks as well as gas, oil and oil product pipelines to the expert vis-

itors. In addition, PSI presented its new oil and gas reference projects in Russia and abroad.

### High interest in solutions for monitoring off-shore pipelines

Many visitors were interested to learn more about PSIpipelines and how to monitor oil and gas off-shore pipelines. The gas industry focus was the introduction of the new joint venture "GA Dispatching Systems". 

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The PSI booth design again received a reward.

New systems, upgrades, multi-utility systems and comprehensive cyber security technology

## PSI awarded significant energy industry orders

PSI Software AG has been awarded important contracts in the energy sector for new as well as extensions and upgrades of existing control systems. In addition PSI received contracts from several transmission system operators for load frequency controlling and field force management, as well as from enercity Hannover for an upgrade including functions for controlling pipeline networks.

lations, which was a decisive factor in many cases for awarding the upgrade contracts. In addition to the technical system measures, PSI has also implemented an in-company Information Security Management System

**M**VV Netze and enercity Hannover have been operating PSI network control systems for many years. The combined energy control system at the Mannheim network operator is to receive an extensive upgrade in the electricity, gas, water and district heating divisions. The combined energy control system at enercity Hannover will also be extended to include functions for controlling pipeline networks.

The load frequency controller at a transmission system operator's is to be upgraded to the new system version. For the first time, the PSICommand Field Force Management System will be used by a transmission system operator.



Orders for new control systems and expansions as well as system upgrades.

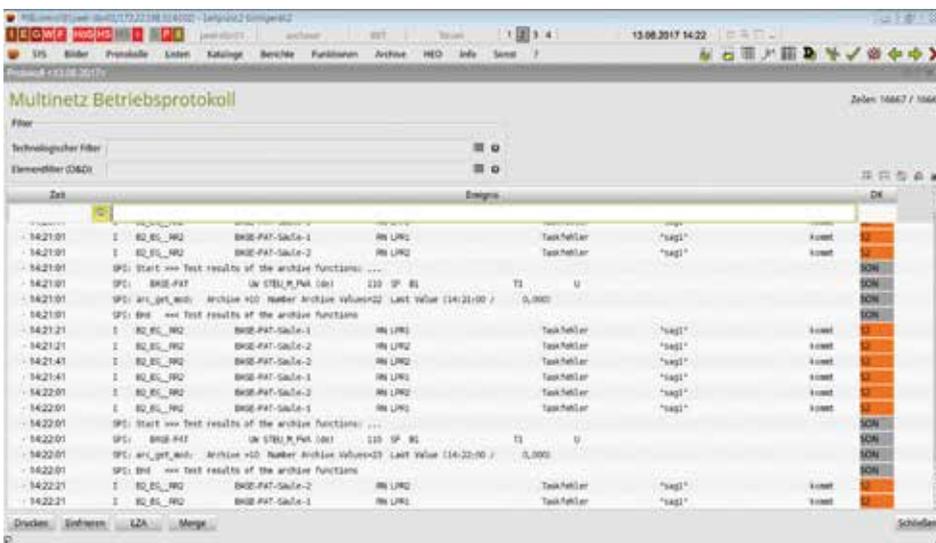
### Information Security Management System

In each of the new projects, the latest PSIControl version will be applied with its respective IT security technology based on the BDEW/ÖE regu-

(ISMS) which was subsequently certified by TÜV Süd.

### PSI secures and enhances strong market position

In late 2016, PSI had already received system upgrade contracts from the Austrian Energienetze Steiermark GmbH in Graz, Energienetze Mittelrhein GmbH & Co. KG in Koblenz, and another major distribution system operator. All in all, this enables PSI to further secure and expand its strong market position. In line with the good order situation, the division also strengthened its staff. ☺



Combined log of several networks for multi-network operation.

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Version 4.5 with extensive new features and outlook to version 4.6

## Continuous enhancements in PSIcontrol

PSI Software AG continuously enhances the PSIcontrol system for electrical networks, multi-utility systems and railroad electricity. Version 4.5 has been available for new projects since the end of 2016. Existing clients can obtain the upgrade to version 4.5 in mid-2017.

Visitors of the PSI Info Days in November 2016 already received an overview of the functional scope of the current release. At the same time, the work for version 4.6 is already in high gear.

### Faster resupply after outages

In case of outages, the fault analysis just added to PSIcontrol 4.5 provides switching suggestions for isolating the network area with the fault and for resupplying the deenergised network areas. This reduces the outage duration and increases the supply quality. The system also supports the user in generating the outage report by including the fault analysis result in the outage report.

### Automatic notifications

This new function allows automatic notification of on-call staff members in case of network faults or control sys-

Betriebszustand		Aktion		Bezeichnung				
E	AMP04EN	NS Bergstraßenstr.	20	HF	AMP04EN	G1	Nachfahren	aus
E	AMP04EN	Uw AMP04EN	20	SF	3015	G3	Belehi	aus
E	AMP04EN	Uw AMP04EN	20	SF	3015	G2	Belehi	aus

PSIcontrol includes the fault analysis result in the outage report.

tem infrastructure issues. The notifications can be sent by SMS or e-mail as desired. Then the on-call staff member acknowledges the notification via SMS. If the recipient does not respond within a specified timeout, then the next staff member will be notified.

### Master data maintenance in PSIexchange

Today the master data of control systems are no longer maintained by only by the control centre staff or

the data administrator. The current version of PSIcontrol supports modification of master data outside of the control centre via browsers and

the web portal and via web services, followed by import into Data Engineering. This is very useful for mass data processing, for example in Excel. A function in PSIexchange for exchanging information between corporate IT and the control system is used for this purpose. This function also provides the necessary cyber security.

### Picture data models and variables

PSIcontrol 4.6 is scheduled for release at the end of 2017. The focus of the enhancements is on updating the picture data models and the picture variables. PSI customers provided very positive feedback to being able to modify the picture variable display themselves. The technical prerequisites have already been realised in PSIcontrol 4.5. The conversion of the picture variables to the new technique will be completed in the autumn of 2017. ☺

Priorität	Name	Vorname	Telefonanschluss	Telefonnummer	Typ
1	Hopfergarten	Alfons	1	0171 99988777	Mobiletelefon (Geschäft...

Fault reports are forwarded by SMS or e-mail.

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Efficient work scheduling—Strategic analysis—Workforce management with PSIcommand

## Asset Service Days in Aschaffenburg

Energy utilities not only provide efficient supply of energy and raw materials. In order to service customers, utilities also operate expensive and maintenance-intensive infrastructure and employ operating departments and a significant number of field staff.

actively using “Field switching operations”. Now the focus of the utility companies is turning to the modeling of the low voltage networks and

The following questions need to be addressed daily: How much idle time with technicians waiting for permissions from the control centre can be avoided? What are the effects of an upcoming new construction project on the daily scheduling and what happens if a dispatcher is unavailable unexpectedly for a week?

### Optimisation of asset maintenance

The PSI business unit Electrical Energy will present solutions to these questions during the Asset Service Days on September 20–21, 2017 in Aschaffenburg.

In this event, the broad scope of the use of the PSIcommand system will be demonstrated. Attendees will be informed about topics such as work scheduling, optimisation and automation potential of dispatching, on-site work support, and strategic bottleneck resolution by capacity planning.

### Support for switching operations

The efficient organisation of isolation operations is another emphasis. Today a large part of the medium voltage and low voltage networks cannot be tele-controlled yet. Companies are faced with the choice between spending significant time for switching-re-



Efficient work scheduling and workforce management with PSIcommand.

lated communications and knowing the current state of the network, and saving that time at the expense of not knowing the network state. The latter is usually true in low voltage networks.

The benefits of a well-known network state increase with every generation of control system technology. New systems now provide functionalities for addressing economic issues in low voltage networks which so far have been used only in higher voltage networks. Only the acquisition of switching states is not yet resolved. PSI has addressed this issue with the function “Field switching operations”. Medium voltage customers are already

the updating of performed switching operations.

### Bridge between operational efficiency and secure network management

The PSI Asset Service Days are intended to provide a bridge between operational efficiency and secure network management in order to optimally use synergies and to provide the best possible solutions. ☺

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PSIcontrol enables fast responses to weather and infeed changes

## New control system for Westnetz

The system management of Westnetz GmbH, the largest German distribution network operator, is responsible for monitoring and controlling electricity, gas and water networks for an area of about 50 000 square kilometers. More than 200 staff members work at eight locations in switching management, network control centres and phone centres for outage reporting.

**T**hree Westnetz locations in North Rhine-Westphalia and Rhineland-Palatinate

have just been set up with the new and unified network control system PSIcontrol version 4.3. Infeed, cyber

Westnetz is the main electricity and gas distribution network operator in the west of Germany. The company with its 5 100 staff members is located in Dortmund and a 100 % subsidiary of the energy company innogy SE. The distribution network operator also operates networks belonging to multiple other owners which are made accessible to all market participants without restrictions.

Westnetz constructs, manages and operates a network from the Emsland area to the Hunsrück mountains and from the Dutch border to the Weser Upland.

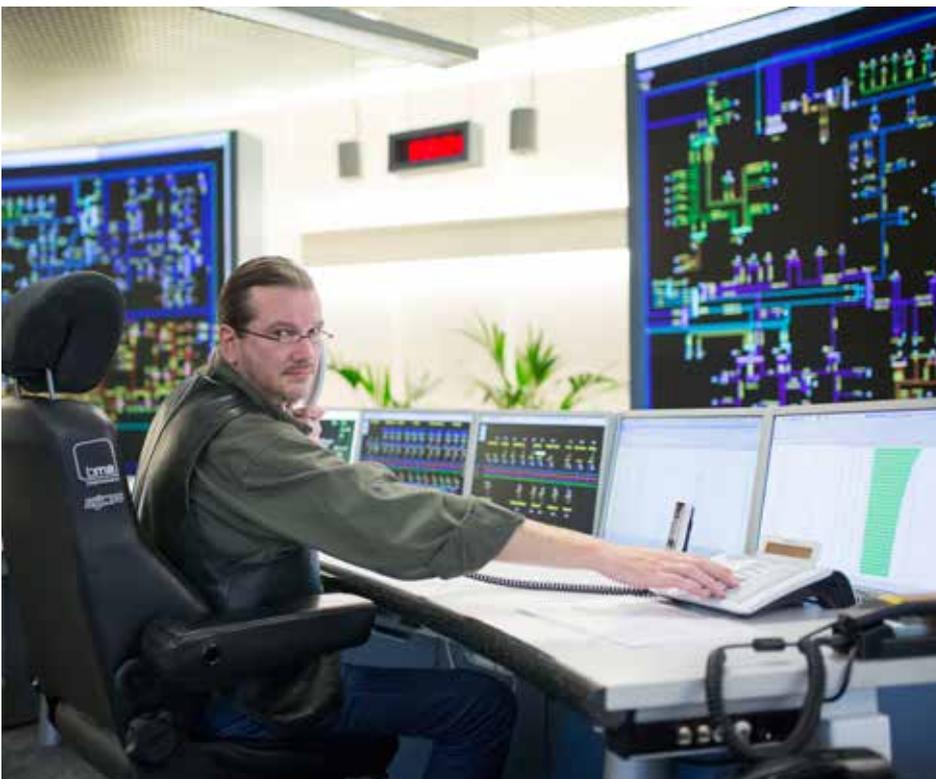
security, reporting—the increasing number of network management challenges also means more control system requirements. These numerous reasons made an update necessary.

### The automated, networked and digital world

New functions support the staff in responding quickly to chang-

*“The PSIcontrol network control system provides a state-of-the-art tool to our staff.”*

**Jörg Brand**  
System Management Director  
Westnetz GmbH



PSIcontrol enables Westnetz staff to respond quickly to events.

ing weather and infeed situations. These also include network security management, integration of lightning and weather data and monitoring overhead powerline temperatures.

“The PSIcontrol network control system provides a state-of-the-art tool to our staff”, says Jörg Brand, System Management Director. He also emphasizes, “Our new control system is a big technological step towards an automated, networked and digital world.”

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Review of CIRED 2017 in Glasgow

## PSI systems support distribution network operators

The PSI Electrical Energy business presented the new releases of PSI software solutions for control and workforce management at the CIRED in Glasgow, Scotland from 12 to 15 June 2017 (booth B02). The presentations also included examples from current projects for distribution networks, the SASO system and the Smart Telecontrol Unit.

The current release 4.5 of the PSIcontrol system offers improved fault analysis, integrated monitoring of overhead lines, expanded control functions for decen-

tralised distributed infeeds, data management and CIM master data importing through PSIXchange. Furthermore, PSI presented the network control system PSIcontrol used by the Danish customer Visue in Jutland that is currently being used by thirteen client companies for the control of the distribution network including low voltage.

The workforce management system PSIcommand supports the central and local personnel in the maintenance, construction and fault clearance processes and is suitable for application in any infrastructure. The switch support from the field was presented, either as planned switching

measures or in an automated resupply as well as the integration of the FNN Forum (Network Technology/Network Operation) report according to scheme A with combined support from PSIcontrol and PSIcommand.

The SASO system (Security Assessment and System Optimization), originally developed for transmission network operators, is also as suitable for distribution networks. It provides the network operator with a concentrated network status assessment and offers suggestions for the elimination of existing or expected disruptions.

The Smart Telecontrol Unit (STU), an intelligent process coupling unit with all the decentralised control functions required for smart grids, has been also presented.

The CIRED is held every two years and is the world's leading conference for distribution network operators. ☉



The booth provided in-depth information about the PSI solutions to the expert visitors.

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Sales of energy network software and network management-as-a-service in Scandinavia

## PSI establishes subsidiary in Sweden

In the first quarter, PSI established the subsidiary PSIAG Scandinavia AB in Karlstad, Sweden. The initial emphasis is sales and marketing of energy network software and network-management-as-a-service in Scandinavia.

The PSI Group sees great potential in Northern Europe and North America for sales of network software with stabil-

ity functions for networks with a high degree of fluctuations and capacity congestions. Karlstad is located near the intersection of two major Euro-

pean roads: E45 (Gothenburg–Mora) and E18 (Stockholm–Oslo). ☉

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Multi-criteria decision making with Qualicision

## Optimised control of virtual power plants

The optimal control and commercialisation of virtual power plants (VPP) poses significant challenges to the operating and sales groups of virtual power plants. Various economic and technical criteria as well as environmentally friendly energy generation can result in conflicting objectives and complex decision situations which often have to be resolved quickly or in real-time in order to operate a VPP. The decision making for prioritisation of different objectives and the realisation of the resulting optimal plant production and commercialisation requires intelligent optimisation and effective visualisation tools.

ers for intuitive modification of priorities for different operating modes and strategies. The system responds to plant and communication failures by selecting and starting up other plants based on the priority list as needed. For Qualicision-optimised business processes, the interactions are captured in impact matrices based on

The PSI solution PSIVpp for virtual power plants integrates energy generators and consumers in the network and in the energy market. The pool controller integrated in PSIVpp monitors and controls the various energy systems which are combined into so-called pools. This requires determining the priorities for different objectives and operating strategies and their automated realisation for efficient plant operation.

### Pool optimisation calculates optimal control

The pool controller of the VPP controls the technical units (generation and consumption plants) based on the stored plant properties and the specified priorities of the technical units. The pool optimisation calculates the optimal plant control based on the plant properties, schedules, and sales sur-

Stufen	Kosten	Arbeitspunkt	Schalthäufigkeit	Reserve	Anlagenstrategie
Schedule01	+++	+	++	-	0
Schedule02	++	++	++	0	++
Schedule03	++	+	++	0	+++
Schedule04	+	-	-	-	-
Schedule05	+	+	0	-	0
Schedule06	0	++	++	+	-
Schedule07	-	-	+++	+	+
Schedule08	-	+	+++	0	-

Relevant values and impact matrix.

charges for short term and control energy as well as user-defined optimisation objectives (KPI) and the current status information from the plant control.

The technology used by PSI provides easy-to-use sliders to decision mak-

the process data. A mathematic conflict and compatibility analysis uses the impact matrices to determine the correct decision for achieving the process objectives as closely as possible. In technical terms, the conflict and compatibility analysis reduces the so-called combinatorial variety of control options in order to allow optimisation of the KPIs. 

Nummer	Name	Bezeichnung	Priorität
1	Kosten	Wirtschaftlichkeit	1,00
2	Arbeitspunkt	Berücksichtigung optimaler Arbeitspunkte	0,50
3	Schalthäufigkeit	Minimierung der Schalthäufigkeit	0,30
4	Reserve	Verteilung Reservekapazität	0,12
5	Anlagenstrategie	Anlagenstrategie	0,60

Overview of the effects on the utilisation of the generating plants.

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Solid year-to-date for PSI due to strong order intake from industry

## Order intake marks new record

The PSI Group increased its new order volume by 11% in the first quarter of 2017 to a new record value of 78 million euros. The order backlog on 31.3.2017 was, at 163 million euros, 4% above the figure for the previous year. Primarily thanks to growth in industrial business, group sales improved by 3% to 43.8 million euros, EBIT improved by 20% to 2.6 million euros, while the group net result improved by 27% to 1.8 million euros.

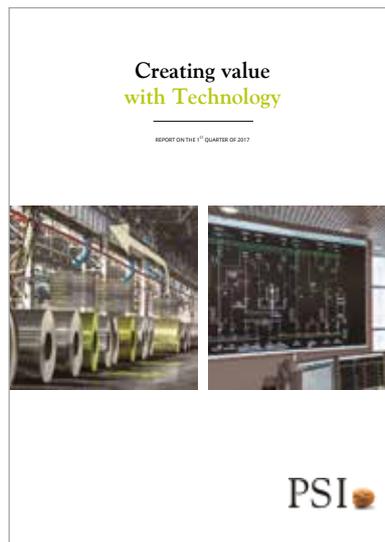
The segment Energy Management (energy networks, energy trading) attained 1% higher sales of 15.9 million euros in the first quarter. The EBIT for the segment improved to 1.5 million euros compared to the previous year. As a result of the regulatory “shadow year”, the Electrical Grid business recorded a new order value slightly below that of the previous year but succeeded at significantly improving sales in the area of higher combined energy systems and sector coupling.

### Roll-out of first multi-client capable management system

The first multi-client capable management system (network control as a service) was rolled out with a pilot customer on completion. In the USA, PSI was awarded its first two orders for network application software.

After establishing a joint-venture with our long-term partner Gazprom avtomatizatsiya, Gas and Oil recorded a revival of new orders in Russia.

Sales in Production Management (raw materials, industry, logistics) in the first three months, with 23 million euros, were 8% above the level for the previous year. The EBIT improved by 7% to 1.6 million euros. The Metals and Automotive Industry businesses were able to increase their volume of



orders, particularly through follow-up orders from group-wide contracts with further potential. In the form of the Mining, Metals Industry, Automotive Industry and Logistics businesses, all areas of Production Management contributed towards improving sales and earnings. All products of the segment have been presented at the Hanover Fair 2017 as an integrated Industry 4.0 cloud-based solution.

In Infrastructure Management (transportation and security), sales decreased by 13% to 4.8 million euros, while the EBIT improved to -0.1 million euros. Nevertheless, PSI anticipates an improvement over the course of the year and recorded significant progress in Smart City software projects while continuing to actively push

the reduction of old risks in countries with a high dependence on raw material prices.

The number of employees in the group decreased to 1,613 on 31.03.2017. Last year’s capacity adjustment in South-east Asia is offset by a growth initiative with new hires in Germany and other industrial countries.

The first quarter saw PSI establishing a subsidiary in Sweden whose initial focus is on distributing energy grid software and network control as a service in Scandinavia. PSI envisages major potential in both Northern Europe and North America for distributing the grid software offering many functions for stabilising networks characterised by fluctuations, capacity bottlenecks and, particularly in the USA, outages. In Production Management, the Industry 4.0 trend is increasingly evolving from an innovative topic to a real sales product.

### Anticipation of further rollout orders from framework agreements

Over the coming quarters, PSI anticipates further rollout orders from framework agreements with major electricity and gas network operators, steel companies and vehicle producers, requiring the development and expansion of teams for implementation at customers and partners. ☉

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PSI presented comprehensive enhancements at E-world 2017

## Smart software solutions for the energy industry

At Europe's growing energy exhibition E-world on February 7–9, 2017 in Essen, Germany, the PSI concern successfully presented numerous new features to the energy industry.

These included software solutions for energy trading, sales and portfolio management as well as control and optimisation of virtual power plants. The energy trading system PSImarket which provides new functions and options for comprehensive performance opti-

misation was presented to numerous visiting experts.

Furthermore the new enhancements of the PSIcontrol network control system and the PSIcommand field force management system were shown. The exhibition also included the PSI gas management suite with

its new features for smart operation, smart processing and smart configuration.

### PSI exhibits at E-world 2018

This year's E-world focused on digital solutions for the energy transition and was attended by about 710 exhibitors from 30 countries and about 25 000 visitors. PSI will exhibit again at the upcoming E-world 2018. ☉



Numerous expert visitors viewed the current PSI solutions.

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## EVENTS

[www.psi.de/en/events](http://www.psi.de/en/events)



27.–30.06.2017	Moscow International Oil & Gas Exhibition (MIOGE) 2017	Moscow, Russia
13.–14.09.2017	CONSULECTRA Network Control System Symposium 2017	Hamburg, Germany
03.–05.10.2017	European Utility Week 2017	Amsterdam, Netherlands
28.–30.11.2017	GAT 2017	Cologne, Germany
05.–08.12.2017	Elektroseti	Moscow, Russland

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