2 / 2014

production manager

Journal for logistics & production

Contents

Logistics networks

Ready for Industry 4.0

With the structural changeover to Industry 4.0, traditional production and supply chains are also changing. Even now, future-orientated software systems are enabling companies to implement important steps.

Wise restraint or a missed opportunity? "Germany is lagging behind in Industry 4.0, and the smart factory concept has been slow to become established." This was the conclusion drawn by management consultants at PricewaterhouseCoopers when they published the results of a recent study about six months ago. They went on to say that "only one in five companies co-ordinates and controls the processes in its production and operational facilities using networked IT systems."

The analysis of the results reveals several surprises. On the one hand, Industry 4.0 has only been the focus of attention among scientists and users for around four years. The name itself expresses the fact that, after the loom, the assembly line and computer technology, the manufacturing economy is now undergoing

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PSI

News ticker

+++ To bring the company name in line with future target markets, the name of PSI Production GmbH was changed on 21 March 2014—The new company name is PSI Mines&Roads GmbH +++ Integrated Control System North—New Major Contract from Deutsche Bahn for PSI: DB Energie GmbH has commissioned PSI AG with the renewal of the network control centre for the Hamburg city rail electricity supply and its integration into the Lehrte Central Switching Station (CSS) for the Integrated Network Control System North +++

IMPRINT

Publisher
PSI AG
Dircksenstraße 42–44
10178 Berlin (Mitte)
Germany
Phone: +49 30 2801-0
Fax: +49 30 2801-1000
produktionsmanagement@psi.de
www.psi.de

Editorial team
Bozana Matejcek, Annett Pöhl,
Beate Wesenigk, Dolores Poblenz

Design
Heike Krause

Printing
Repro- & Druck-Werkstatt

SOURCES

Pages 1, 8–11: Thinkstock
Pages 2, 3, 5: PSI Logistics
Page 4: Gettyimages
Pages 7, 16–17: PSIPENTA
Pages 12, 13, 14 bottom, 15: PSI Metals
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Page 18: PSI

Editorial

Dear readers,

E-commerce and Industry 4.0 are the current drivers of growth for the economy and for the technology sector. The advances in communications and information technology, as witnessed at the Hannover Messe trade fair (see page 16) and CeMAT 2014, are now being demonstrated in both systems engineering and hardware. However, it is software that is providing the basis for process and resource efficiency, as well as for inter-company networking to enable data exchange and process control. In light of this, this issue focuses on the future-oriented project "Industry 4.0".
On page 18, a brief analysis of the 2013 consolidated annual report shows that, thanks to the company's investments and product developments in these formative growth segments of the future, PSI is well positioned. In this issue of production manager, we look at a number of perspectives relating to the importance of software in implementing Industry 4.0, and show you what options are now available to make your IT infrastructure future-proof. In addition, there are interesting project reports from various sectors, demonstrating how users at different levels can develop their potential for optimisation with the IT products offered by PSI subsidiaries. Current background information on the development of the PSI group in general, with a particular focus on product developments, round off the range of topics covered in this issue.

We think that this latest issue of production manager will again offer you a stimulating range of topics. We hope you find it an informative read.
Regards,

Dr Giovanni Prestifilippo
Managing Director
PSI Logistics GmbH

Sascha Tepuric
Managing Director
PSI Logistics GmbH

◀ *Continued from page 1*

its fourth industrial revolution—which is proving to be an evolutionary process. At the same time, Industry 4.0 is a project for the future. Regardless of the fact that conventional systems will not be sufficient to meet future requirements for adaptability and dynamic growth, it seems somewhat premature to want to quantify the degree to which Industry 4.0 and the smart factory have been implemented in companies at present—not to mention references to "lagging behind". While it is true that many companies are still in the orientation stage in terms of Industry 4.0, only those who know where they are going can choose the most efficient transport system and the ideal route.

On the other hand, the results of the study are quite remarkable in that they identify a lack of IT networking of processes in production and operational facilities. This is because, comparatively speaking, IT networking is the segment of production control and intralogistics where it is currently easiest to align the process of evolution characterised by Industry 4.0 in a manner that is both future-proof and provides investment security. The objectives of Industry 4.0—increased adaptability and flexibility, resource efficiency and integration capability—are the main focus points for logistics software.

Logistics IT ensures that technical units, products, sites and people are networked, both in the intralogistics sector and in the supply chain. It makes the efficient design and the complexity of logistics networks and systems transparent and manageable, supports the exchange of information, controls processes and determines key performance indicators.

Designed to meet the requirements of Industry 4.0

The clear uncertainty that still persists in many companies, and the accompanying need to educate people, is something that PSI confronts in its day-to-day work.

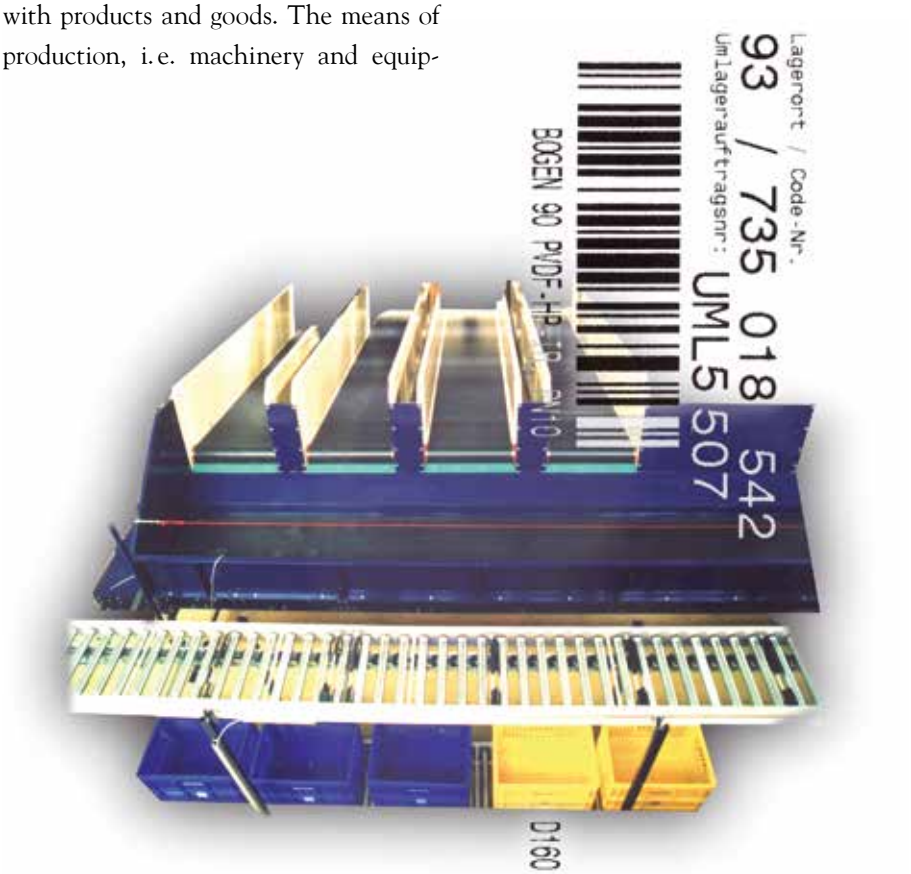
As one of the most experienced software companies in Germany, PSI possesses long-standing expertise and offers products that cater for the entire production and logistics processes on all levels. With its extensive solution portfolio and growing industry knowledge, the PSI Group has begun to design the products offered by its various divisions to meet the requirements of the future-orientated Industry 4.0 concept, even at this early stage. This means that PSI solutions already meet the requirements of future trends, and are an essential tool for the structural change necessary for Industry 4.0. PSI solutions also provide users with a wide range of operational and strategic benefits, as well as a high degree of investment security.

Approaches towards the Internet of Things and cyber-physical systems serve as a theoretical, scientific and technological starting point. These two concepts, as well as their corresponding technologies, form the basis of technologies such as automation technology—one of the most important elements for Industry 4.0 processes, which is characterised by the introduction of intelligent procedures for self-diagnosis and self-optimisation. The key factor in this respect is the ability of the components involved to communi-

PSI*global: Planning, control and optimisation of global logistics networks.*

cate with one another in order to co-ordinate the organisation of operational processes independently.

The Internet of Things describes the development of material flows based on networked, decentrally organised intelligence. It involves networks and systems in which machines communicate with products and goods. The means of production, i.e. machinery and equipment, are able to adapt their behaviour to changing order and operating conditions through self-optimisation and reconfiguration.



RFID: Automated picking.

Real-time communication across organisational boundaries

The approach of cyber-physical systems sees science and manufacturers involved in the development of technologies and market-driven products. The intention is that, by integrating recent developments in the fields of RFID, sensor systems and image recognition, the requirements of an Internet of Things will be met and, through an iterative process, further optimisation of the means of production and the development of technologies will be promoted. The result is a gradual technical migration of systems and equipment in which the rapid development cycles of information and communication technologies, and of materials technology, accelerate change. The demands of Industry 4.0 require, in particular, real-time solutions for the communication of production systems across organisational boundaries. PSIPENTA covers the relevant requirements in the field of Enterprise Resource Planning (ERP) and Manufacturing Execution Systems (MES) for production control.

PSI Logistics systems control the storage, transport and supply chain as a whole. The standard systems used in intralogistics factories, logistics centres and distribution warehouses for industry, trade and service providers employ intelligent algorithms to ensure optimised stock management and process control, for example with sequencing and picking strategies based on a broad range of criteria, thus improving made-to-order production, mean lead times and resource efficiency. In addition, with their multi-site capability, they now provide a basis for the site-wide and company-wide exchange of information and the integration of all parties involved.

This is done by continuously aligning the systems in terms of the integration of decentralised information structures and the design of innovative process chains through the use of cyber-physical systems. The update and release capability of the standard systems play an essential role in this process, as it ensures that PSI products keep pace with the latest technological developments and also guarantees long-term investment security.

At the same time, the challenges of Industry 4.0 take the software into new dimensions. Firstly, procedures for integrated modelling and simulation need to be provided and adapted for the new process chains. PSI Logistics offers this kind of procedure, for example, by means of the scenario technology used in the PSI*global* strategic planning, control and optimisation system. This technology allows complex structures, such as when designing an efficient supply chain, to be verified by means of simulation calculations and altered to provide the optimum solution.

Investing in a future-proof IT infrastructure

Another aspect concerns the integration and usability of various types of poly-

structured data from heterogeneous IT systems in the form of integrated service models. The architectural basis for this is the Java-based architecture of PSI Logistics software systems. These systems enable functions with which, for example, PSI*global* can be used in big data concepts as the central data hub and meta-system for the harmonisation and analysis of polystructured master data from a variety of sources.

With the implementation of Industry 4.0, traditional supply chains will increasingly be converted to digital supply chains and then to flexible value chains. The functional performance and future viability of the IT programs used play a central role in the creation of flexible corporate networks and further increases in the transparency of the value-added process. Using PSI's standard systems, commercial enterprises can already implement important steps towards Industry 4.0, and at the same time invest in a future-proof IT infrastructure. In doing so, the systems, with their wide range of functionality, not only increase the efficiency and flexibility of existing application options but also generate additional ones, right through to the development of new business areas. The conclusion is that no one in Germany should lag behind when it comes to Industry 4.0.

Industry 4.0 changes global supply chains.

▶Your contact

Dr Giovanni Prestifilippo
Managing Director
PSI Logistics GmbH, Dortmund
Phone: +49 231 17633-270
g.prestifilippo@psilogistics.com
www.psilogistics.com

Product report: Detail planning of production processes

10 steps to the successful launch of a planning control centre

The PSI*penta* finite capacity scheduling system is used in conjunction with a leading ERP system to improve the production process. The system is suitable both for planning different production typologies and maintenance planning. If a finite capacity scheduling system is to be introduced at a company in order to implement detail production planning, this usually takes place within a wider context. The following points and questions aim to stimulate in advance an examination of all the necessary aspects related to the introduction of finite capacity scheduling.

1. IT system environment

A finite capacity scheduling system works in conjunction with other software components. The ERP system provides the finite capacity scheduling system with the planned work order data. The planned processing sequences for each workplace in the finite capacity scheduling system are forwarded to the shop-floor data collection (BDE) system, and status and processing progress messages are sent from the BDE to the finite capacity scheduling system. If all of the ERP and MES components used come from a single supplier, then interaction is not a problem. If this is not the case, the following questions may apply: What is the system platform (operating system, database etc.)? What facilities for interface connection do the current systems have?

2. Work order data

Work order data transferred from the leading ERP system forms the basis of planning in the finite capacity scheduling system: What is the structure of the work orders in a specific case? Does the work order data include information on setup durations, processing durations, transfer times etc.? Is it specified which jobs are permitted for a specific operation from a technological perspective? What other boundary conditions for planning will be transferred from the ERP system, e. g. rough-cut planning or key deadlines?

3. Resources

A key task of a finite capacity scheduling system is the scheduling of work orders in line with actual resource availability: What resources need to be taken into account in planning (machines, operating resources, tools, personnel, materials etc.)? Which of these resources actually have limited availability? Where is information available on when and to what extent the respective resource is available?

4. Planning rules

The planning of a finite capacity scheduling system determines optimised processing sequences for each job and machine: What characterises good planning for a specific production process? What are the specific rules according to which planning is to take place; what criteria are to be taken into account? Are there any related features in the work order data that can be used for setup optimisation, e. g. key deadlines or setup IDs/setup matrices? Is the desired level of automa-

tion for planning fully automatic, semi-automatic or manual?

5. Feedback

On the one hand, the processing sequences determined in the finite capacity scheduling system can be communicated to the operators on the shop floor via the BDE. On the other hand, BDE feedback is returned to the planning system, allowing the current status and processing progress on the shop floor, and their effects, to be extrapolated: Which BDE is to be connected? What is the processing speed in production? As a consequence: How often is feedback necessary to gain a realistic picture of the current production situation in planning?

6. Planning levels

A finite capacity scheduling system can be used on several planning levels as part of staged planning: In the current case, is there a distinction between, for example, strategic planning, long-term planning, medium-term planning, short-term planning and production control? What are the definitions and characteristics by which these levels are distinguished from one another?

7. Multi-plant structure

In the context of a multi-site structure, planning can be carried out for several separate plants and sites if a finite capacity scheduling system is installed: In this case, is it necessary to reflect such a multi-plant structure during planning? Are there any cross-plant production activities? Are external service providers also to be connected in this way? To whom are competences to be granted in this multi-plant structure?

Using the finite capacity scheduling system, the user can carry out manual, semi-automatic or fully automatic sequence planning.

8. Organisational breakdown of overall planning

In addition to differentiating planning according to the planning level and multi-plant structure, overall planning can be broken down into further logistical aspects: In specific cases, are there subdivisions into different planning areas with responsible planners for each—e. g. for mechanical pre-production, electrical pre-production or final assembly? Which planning area may influence another, and how? How do problem situations in an upstream area affect the downstream planning areas?

9. Provision of information for the planner

The finite capacity scheduling system is a central tool designed to optimise planning as effectively as possible. In this respect, planners should have at their disposal all of the information required to enable them to react to conflict situations in a way that is appropriate in terms of planning: What information do planners require? Where does this information come from, and which system could provide related information?

10. Openness when interacting with other modules

As described under point 9, information from surrounding IT systems can be used: Which systems are these? What are the technical options for connection? How often is the respective information needed, and how much effort is required to connect a surrounding IT system?

▶*Your contact*

Beate Wesenigk
Marketing Manager
PSIPENTA Software Systems GmbH, Berlin
Phone: +49 30 2801-2127
bwesenigk@psipenta.de
www.psipenta.de

Product report: Strategies for launching software at multiple sites with PSI*metals*

Small steps versus master plan: An overview of rollout processes

If companies with multiple sites introduce product management solutions, then in addition to the functional tasks that need to be resolved using IT tools, decisions on process standardisation also play an important role. Many customers prefer the use of one software solution for all plants so that production workflows and business processes can be streamlined, sites compared in economic terms and, as a result, resources exchanged and costs reduced. If a decision in favour of a software solution is taken as a company standard, there are two implementation strategies for the software rollout: a step-by-step definition of business processes for each site versus a master plan for all sites. PSI Metals presents an overview of both options.

The most important prerequisite for introducing PSI*metals* as a software standard for multiple plants is comparable production processes. Usually, such a decision is preceded by a process and system analysis performed by the customer.

The process analysis identifies standard processes in production and determines what is already comparable or can be made comparable with little effort. Such processes can later be supported by the software to be introduced, for example by specifying a new common working method. However, it is also necessary to define which processes always vary from plant to plant and therefore cannot be changed. Plant-specific differences will then find their place in the local system requirements of a site.

The system analysis also describes which systems are in use at which level and how their functions are separated. The analysis contains specifications for existing systems and systems that are to be integrated, and their interfaces.

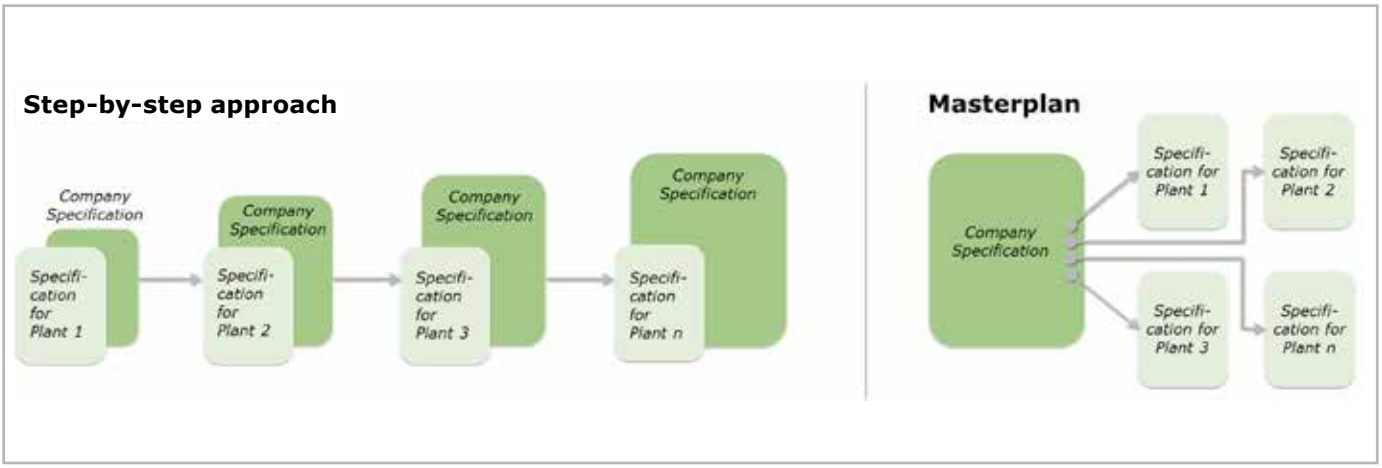
The way in which the production processes defined in the analysis shall be integrated to be implemented with PSI*metals* is drawn up in detail within the specification. This specification describes the customer solution that is to be introduced and contains the processes covered by the standard scope of PSI*metals* functionality, as well as additional customisation with global and/or local relevance.

There are two different approaches defining when, how and with what adaptations the customer standard and its plant variants are rolled out across the sites.

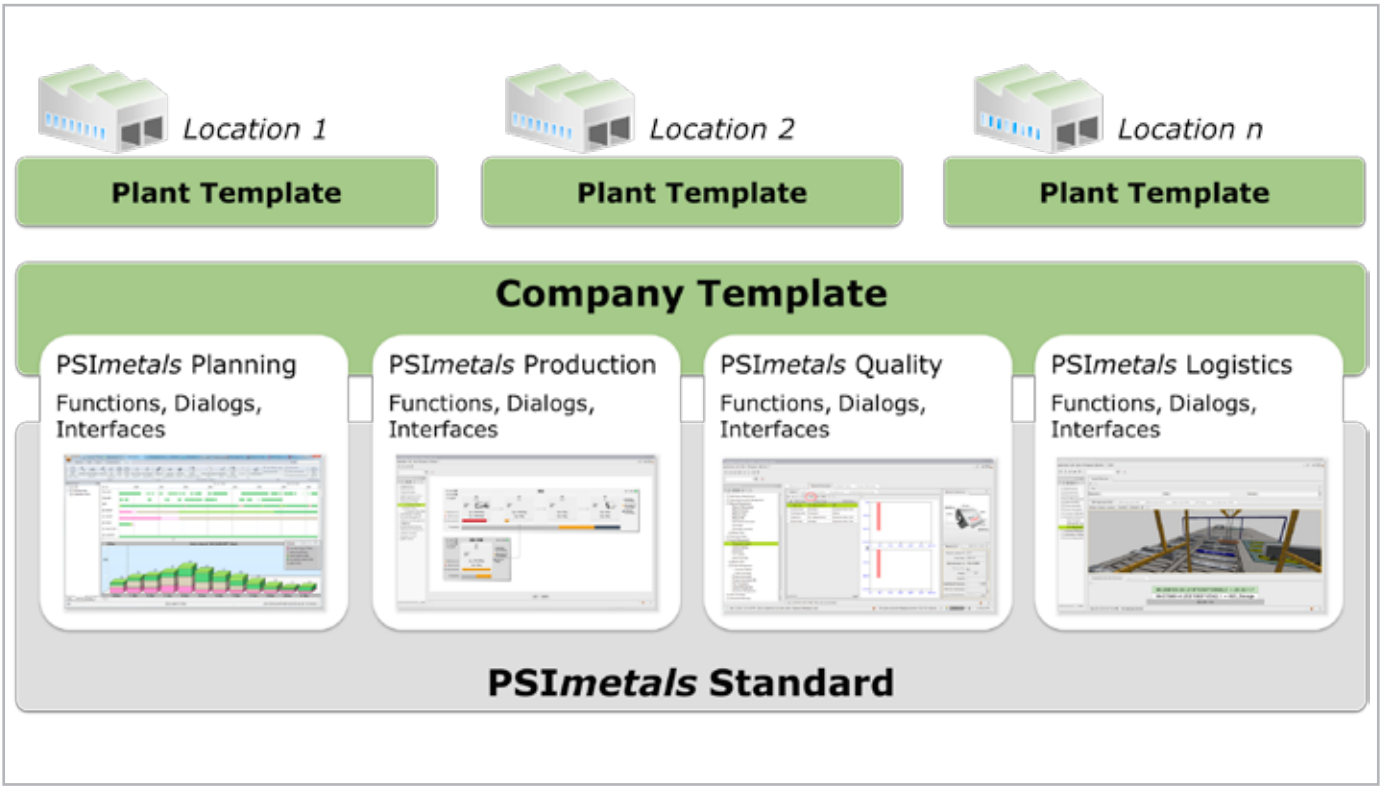
Two paths towards the goal

In the step-by-step approach, the specification is initially developed with one plant, in individual steps according to the project needs. Business processes, dialogues and interfaces are only described and then implemented in the software if they are required for the current plant. After successful introduction, the probability increases with each plant that specific issues have already been resolved in a previous plant and that these will be available in the proven software, including interfaces and dialogues. The argument is that a system that is already running in five plants should also work in the sixth one.

The second way is to create a master plan. In this case the specification contains a description of all business processes for all plants, detailing how they should be implemented in the software. All future software functions are there-



Definition of the business processes for each site versus a master plan for all sites.



Template management for the implementation of software in multiple plants.

fore available when the software is introduced in the first plant. In the subsequent plants, only the functions that are still required in each case are activated. During the specification phase, this method requires a high level of coordination and communication between the departments and sites involved. Due to longer design and development phases, it takes more time before the software gets rolled out for a first time, so it can be tested with all its functions, screens and interfaces in a production environment.

Working with software templates

Regardless of which method a company opts for, where multiple plants are concerned, it is recommended that the software is always introduced with the help of software templates. These templates define what is the PSI*metals* product standard, what is customer-specific but globally valid (company template) and what is plant-specific (plant template). All of the definitions in a template always concern business processes, user interfaces and interfaces. For example, the PSI*metals* standard generally enables material tracking both for single pieces and for bundles. If a customer only requires bundle tracking, only this feature is activated during customisation. The company template describes this specification as an expression of the product standard, but universally applicable to all plants. It therefore includes the description of all core processes, including typical production processes, required functions and their implementation in user interfaces. In addition, it defines the division of labour between the systems being integrated, including standard interfaces (ERP/level 2). The plant template describes all deviations from the company template due to site-specific requirements.

To ensure release capability, naming conventions for software packages and interfaces, as well as structural guidelines for storage and versioning, are specified within the templates. This is necessary since the software is introduced in several plants over a lengthy period of time, and different software versions will therefore inevitably be in use at different sites. For all templates, release management describes what version of the software is running where, and which variant is being used.

PSI Metals has worked with both entry-level variants. Which method should be prefered for a customer depends on the customer's corporate structure and organisation, its processes and resources.

▶*Your contact*

Annett Pöhl
Marketing Manager
PSI Metals GmbH, Berlin
Phone: +49 30 2801-1820
apoehl@psi.de
www.psimetals.de

User report: One for all

Intersnack uses PSI*global* for analysis and reorganisation

Snack manufacturer Intersnack uses the PSI*global* strategic planning and optimisation system to analyse and reorganise a standardised, optimised transport network without involving external experts.

Exploiting synergies and increasing efficiency are always hot topics during company mergers. Company philosophies must first be brought into line to allow synergies in production facilities and transport structures to be tested. This is the challenge that faced Intersnack Group GmbH & Co. KG, Düsseldorf, after their 2008 merger with Europe's largest nut company—The Nut Company.

Today, the group is one of the leading European manufacturers of salty snacks. Twelve subsidiaries are responsible on the continent for the operational activities of successful brands such as funny-frisch, chio, Pom-Bear or ültje. Their products are distributed in 70 countries around the world. After the merger, the logistics network in Germany needed to be analysed and optimised. "Co-operation with consultancy firms in the past entailed lengthy project turnaround times, in addition to the costs incurred", explains Jeffrey Hipp, Group Supply Chain Director at Intersnack Group. "After projects were completed, there was also a lack of internal expertise and we were unable to verify the distribution network ourselves in the event of changes, for example in the shipment structure. Consulting projects were therefore often unable to honour our concept to permanently optimise our logistics network."

> *PSI*global* offers us a comprehensive tool for reviewing and optimising the logistics processes throughout our entire supply chain—from production through to point-of-sale.*
>
> **Jeffrey Hipp**
> Group Supply Chain Director, Intersnack Group

Tools for optimising the supply chain

In mid-2013, the corporate management used an internal company department to plan and optimise the supply chain. The decision-makers counted on PSI*global*—the planning, control and optimisation system for logistics networks from PSI Logistics—as an ideal IT tool for analysing and reorganising a standardised network. At the end of 2013, the Berlin-based software company received the contract to implement the solution.

Processes and transport chains can be designed, reviewed and optimised using the integrated scenario technology and analytical models in PSI*global*. During this process, the main factors and sensitive areas were also identified. In model investigations, for example, the optimum number and position of sites, or the transport structures, can be determined in order to reduce storage and transport costs. Mathematical procedures also allow future expected quantity structures or labour cost developments to be included in the planning, and enable the networks to be calibrated accordingly. In addition, PSI*global* offers a facility to compare the value of various calculated logistics networks.

Effects of fluctuations taken into account

This is also the case with Intersnack, where the system first had to prove itself during the design and optimisation of the logistics network for the German sales organisation. In intensive practical training over several weeks, PSI Logistics

supported the logistics planners in the implementation of the first optimisation project with PSI*global*.

Based on a year's historical data, PSI*global* first carried out an actual analysis of the German distribution network. The results were then used to consolidate the production and logistics sites—incorporating forecast data and varying quantities—and to review the bundling methodology. Further calculation models were then used to optimise the sites. In parallel with this, the supply chain department at Intersnack generated a cost-optimised transport network. To achieve this, PSI*global* calculated the efficiency and cost structures of different models and carried out sensitivity analyses for the site variants and logistics networks generated in each case. All models take into account the impact of fluctuations on the logistics, as well as varying effects of different product groups. "After the system briefing and intensive training on the specific project, we were able to carry out the follow-up activities independently in a timely manner", says Hipp. "The computer models enabled a large number of different alternatives and variants to be tested, and their weaknesses established, quickly and conveniently. The scope of the analysis has since been extended to include export markets, where Intersnack is putting its distribution network to the test. A further step looks at a regular, or possibly even permanent, optimisation of the logistics network."

The success of the network study means that word of PSI*global*'s capabilities spread within the group of companies. The networks of the European subsidiaries are now also gradually being optimised using the system. Planners at Intersnack also intend to use PSI*global* to generate a pan-European logistics network for a fully integrated analysis of company-wide transportation.

►*Your contact*

Beate Wesenigk
Marketing Manager
PSI Logistics GmbH, Berlin
Phone: +49 30 2801-2127
bwesenigk@psi.de
www.psilogistics.com

User report: Minimisation of errors and reduction of buffer stocks

A mobile ERP system at Formel D

In the early 1990s, OEMs in the automotive industry began to look for new ways to optimise production. The intention was to outsource cost-intensive processes and hand over their implementation to specialist service providers.

The employee scans the vehicle to see which parts need to be fitted, and in which warehouse and at which location the parts are found.

Against this background, the company Formel D was founded in 1993 in Troisdorf, Germany, with a total of 60 employees as a service provider for the automotive and supplier industry. At that time, the main focus was on technical documentation and related services such as the creation of graphics and translations. Today, around 3300 people are employed in 65 branches worldwide, providing a wide range of services for the automotive industry. This includes the creation of pre-sales and after-sales processes, training and quality activities for production processes, the development of audio-visual communications, and work on vehicles.

Mobile documentation

In order to optimise the work processes and ensure a high level of quality, an ERP system was used from the outset. Firstly, the software had to be compatible with the OEM's computer system; secondly, it needed to be possible to illustrate the different variants by means of a complex breakdown of bills of materials. "That's a requirement that only a few system suppliers meet", says Thomas Kappek, Head of Logistics at Formel D. Not least because of an existing interface to the ERP system of the car manufacturer, the final decision was in favour of the PSI*penta* ERP standard from Berlin-based PSIPENTA Software Systems GmbH. Since 2013, the system supplier's mobile solution has also been introduced for further optimisations in incoming goods, warehouse movements, picking and stocktaking.

If FORMEL D is to convert a standard production model to a customised ve-

hicle, the process begins three weeks before the car is delivered. The OEM transfers an order from its ERP system to equip a specific vehicle with an additional package based on the customer's wishes. The ERP system collects the data and immediately generates the corresponding bill of materials and work orders. In addition, it creates a picking card and a vehicle support card, on which all of the commissioned work and all performed work must be recorded. To make the documents machine-readable, they are given a barcode that consists of the manufacturer's vehicle identification number. Immediately after delivery, the vehicle is checked to see that it is in proper condition. Subsequently, the work steps carried out are documented in the ERP system and the numbers of the fitted parts are scanned. This ensures batch tracing and the identification of all picked and fitted parts for each individual vehicle. Storing the batch number of a fitted item is also a prerequisite for product recalls.

Mobile scanners changing processes

"The introduction of the mobile solution and scanners has changed our work processes completely", says Mr Kappek. Today, employees scan the vehicle to see which parts need to be fitted, and in which warehouse and at which location the parts are found. Since all parts are prescribed, employees cannot book out anything else. "As a result, we have been able to reduce our buffer stocks significantly", says Kappek. The parts and the sheets are available directly at the installation location; however, for the most part, operators assemble them on a picking trolley. To do this, they take the picking document on which the different parts are printed and scan the barcode using their hand-held device. This gives operators a full list, including the relevant storage locations, directly on the scanner, without the need to write or type anything. Previously, operators needed to know the location of each part, note down the batch manually and stamp it in the warehouse to ensure traceability. Now, the scanner shows them the precise location and batch.

> *The introduction of the mobile solution and scanners has changed our work processes completely. As a result, we have been able to reduce our buffer stocks significantly. Now, when booking in goods, we make a significant time saving on each delivery.*
>
> **Thomas Kappek**
> Head of Logistics, Formel D

Not only saves time

Specifications from the German Automobile Industry Association require automotive suppliers to apply certain labels to their deliveries. These labels also contain the respective prefixes for various numbers.
For example, the delivery slip number has the prefix N, so the barcode also contains an N before the number, which is automatically inserted into the correct field in the scanner screen when it is scanned. This makes it impossible to scan the numbers incorrectly.
Incorrect deliveries can also be identified immediately because the scanner compares the delivery against the order data in PSI*penta*. This means that when loading, unloading or picking, each employee immediately has all of the data on the spot and can detect any stock shortages straight away.
"Now, when booking in goods, we make a significant time saving on each delivery", Thomas Kappek reflects. When the product is scanned in, the ERP system also automatically prints out a label containing information such as the delivery number, item number, batch number, colour and number of delivered items. This label is affixed to each package unit, thus simplifying the checking of stock and the inventory. The success of the system can be seen in the significant reduction in the number of errors. Thomas Kappek has listed a whole series of other effects brought about by the introduction of the mobile solution from PSI*penta*. These include process reliability in all processes and the saving of many unnecessary trips, the optimisation of orders, improved parts control and reduced buffer stocks.

Author: Volker Vorburg

▶Your contact

Beate Wesenigk
Marketing Manager
PSIPENTA Software Systems GmbH, Berlin
Phone: +49 30 2801-2127
bwesenigk@psipenta.de
www.psipenta.de

Solution: Caster scheduling with PSI*metals* Planning

Multi-width steps for each casting ladle: Casting small orders efficiently

Excess capacity, strong competition and price-sensitive customers are forcing metal producers to order in smaller quantities, shorten lead times and reduce batch sizes. The technical implementation of smaller production volumes enables modern casting technologies with multi-width steps within a ladle. In order to optimise the planning of small orders with different widths and grades of steel within a ladle automatically, PSI Metals has extended the planning algorithm for caster scheduling in PSI*metals* Planning. Initial customer results show that the new "mini-ladle algorithm" reduces the scheduled times for small order books and at the same time increases capacity utilisation.

Steel producers must produce orders for their customers on time, and in doing so take into account technical conditions of the casting systems as well as operational conditions (steel plant, slab yard etc.). In order to cast as profitably as possible, the planning of continuous casting should support the following objectives:

- Producing the longest possible casting sequence lengths
- Minimising unallocated slab stocks
- Reducing changes in width and grade
- Ensuring maximum utilisation of the continuous casting plant

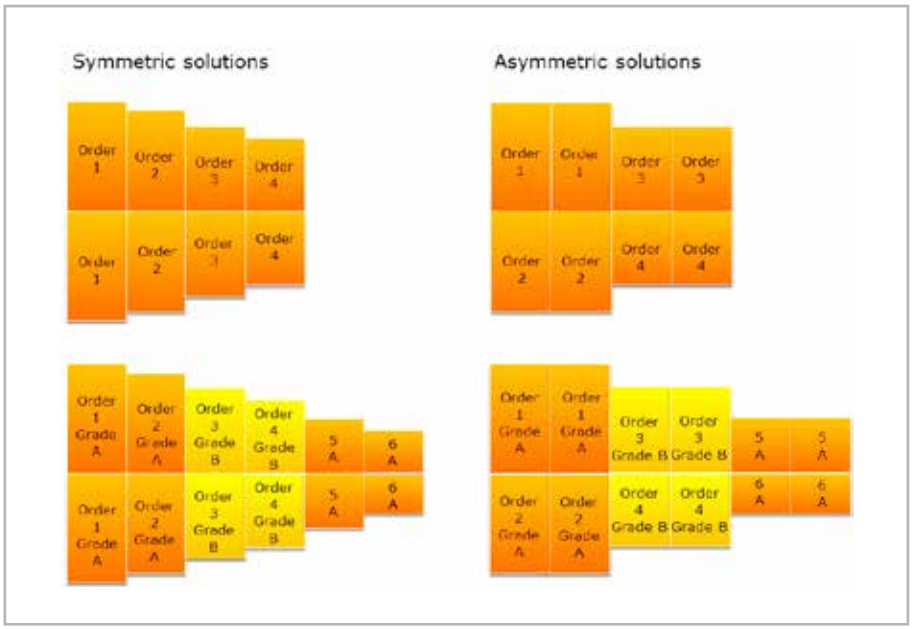
In principle, the underlying planning algorithms are designed to optimise these objectives automatically and in a coordinated manner, as far as possible, in order to minimise the need for manual planning corrections.

In addition, proven algorithms enable faster adjustment of the production schedule in the event of changes to day-to-day operations.

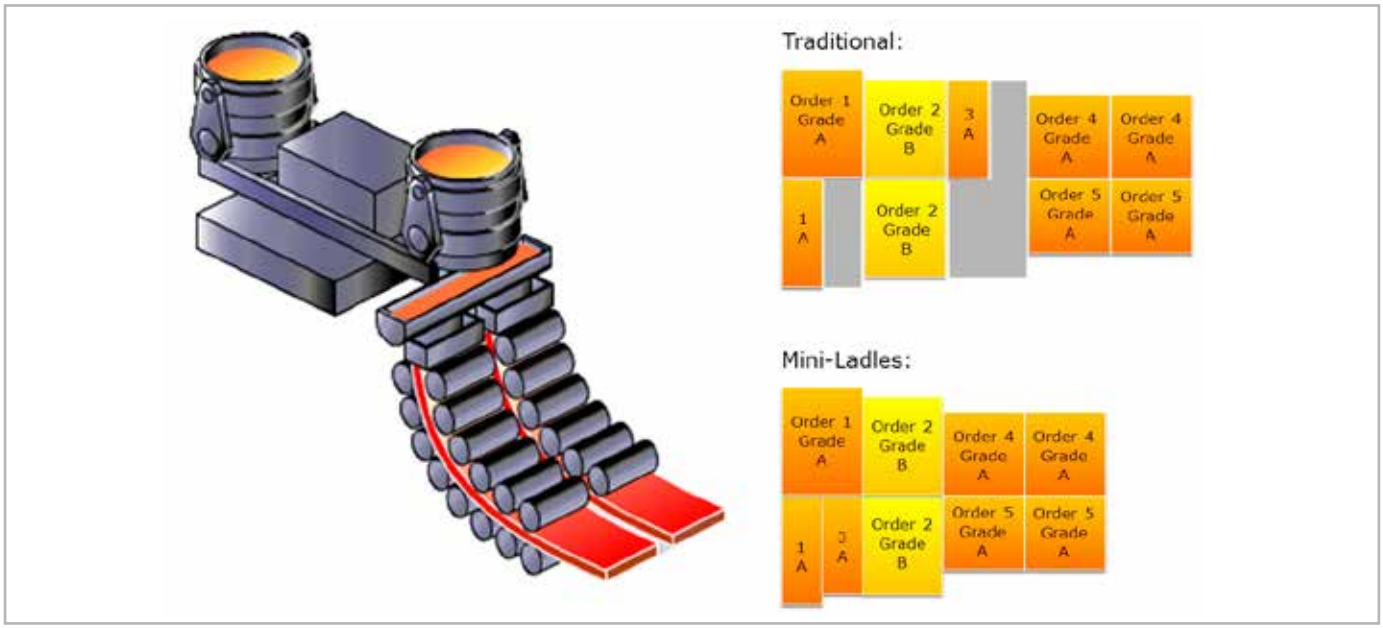
Traditional approach

PSI has been providing solutions for the automated planning of continuous casting plants for more than 20 years. PSI*metals* normally arranges production orders for slabs within a casting sequence (Tundish) as a continuous succession of ladles that fill the sequence. The optimisation algorithms from PSI*metals* optimally combine the orders for the steel products and slab widths to be supplied in respect of the changes in grade and grade-dependencies, as well as the change in width.

PSI*metals* traditionally selects the casting orders and the grades and widths to be cast, and first automatically forms casting sequences from them in the form of ladle sequences with associated slab orders for all casting systems. Each ladle contains only orders of equal width. Secondly, a pattern is created which breaks the continuously cast section down into finished slabs. In this step, slab orders can be rescheduled manually, taking into account resulting ladle transfer problems, when deadlines, priorities or order quantities require. This approach of planning one width per ladle is always satisfactory if customers tend to order large quantities of the same width, making the formation of long production sequences possible. However, if an order book contains many smaller production quantities, the manual planning increases disproportionately.



Dual continuous casting plant: Symmetric solutions (left) and asymmetric solutions (right) with the same (top) and different (bottom) products.



Result of automatic planning with the traditional approach (small order quantities and different widths are not combined) (top), and the planning result of the mini-ladle algorithm (orders 1 and 3 are automatically scheduled in a ladle and stored material is not produced) (bottom).

Planning results compared

In the following example, an order book contains only slab orders of the same grade and in the same quantity, but with different slab widths. If these orders are produced at a dual continuous casting plant, the classic algorithm produces two planning results: symmetric and asymmetric. The asymmetric solution is more efficient because it involves just one change in width (1:3). If orders of a different grade of steel are added, the classic algorithm again generates a symmetric and an asymmetric solution. Here, too, the asymmetric solution enables fewer changes of width (2:5).

The planning result of the traditional approach becomes unsatisfactory if smaller order quantities are to be produced. Since only one width per ladle is possible, smaller orders of the same grade but a different width cannot be combined automatically by the algorithm.

The missing quantity per ladle is filled by unallocated material (grey areas in the image). A useful combination of orders 1 and 3 can only be achieved by manual rescheduling, which increases the planning time. If the planning result is adopted without change, this leads directly to higher stocks of unallocated material.

Mini-ladle algorithm: Multiple widths per ladle

The new algorithm in PSI*metals* now makes it possible to subdivide a ladle into partial quantities and plan them. With these "mini ladles", small quantities of orders with different widths can be scheduled automatically in one ladle. In the example shown, orders 1 and 3 are now automatically combined in a ladle by PSI*metals*. It is not necessary to fill the orders with stored material, which will reduce the overall quantity by one ladle.

Results in practice

For many years, ArcelorMittal Spain has used PSI*metals* for automatic caster scheduling. However, order situations with smaller production volumes could not be automatically scheduled to the company's satisfaction, as too much manual adjustment was required. Initial experiences with the new "mini-ladle algorithm" show that it delivers very good automatic planning results for small order quantities. ArcelorMittal Spain was therefore able to reduce the planning time for a casting sequence from half an hour to just five minutes. By taking into account the change of width within a ladle for the entire algorithm, the quality of the automatically generated planning results for caster scheduling in PSI*metals* was increased substantially.

PSI will be speaking on this topic on 25 June at 4.10 p.m. at the 8th European Continuous Casting Conference (ECCC) in Graz, Austria, where it will also be exhibiting.

▶*Your contact*

Annett Pöhl
Marketing Manager
PSI Metals GmbH, Berlin
Phone: +49 30 2801-1820
apoehl@psi.de
www.psimetals.de

Event: New types of human–machine interfaces for controlling Industry 4.0 processes

Interaction concepts of the future at the Hanover Fair 2014

Berlin-based PSIPENTA Software Systems GmbH presented new interaction concepts as part of the digital factory at the Hannover Messe 2014 trade fair. Participants in the Industry 4.0 visitors' tour organised by the trade fair received exclusive insights into the applications and technologies live on-site.

The term Industry 4.0 is understood by software manufacturers as referring not only to horizontal and vertical integration, as well as engineering through to automation, but above all to support for users in the form of new, user-orientated operating concepts for software, moving away from the mouse and keyboard.

Multi-touch operation

For example, companies presented touch screens that will be familiar from smart phones, tablet PCs or laptops, on which the user can freely arrange their working windows and, if required, move, maximise, minimise or zoom in or out by touch.

Contactless control of a SCADA system

In a further demonstration, Microsoft Kinect—familiar from the games industry—was used to navigate through a visualised production line using gesture commands alone, for example to view a production station or an individual welding robot without being present on site.

Control of a SCADA system using EEG (electroencephalogram)

In the most spectacular demonstration of the show, visitors were able to experience moving through visualised machinery, actuating individual machines and accessing parameters with a single-channel electroencephalogram headset —using the power of thought. This was just one of the possibilities for interacting with systems without additional mouse or keyboard devices.

With the concepts presented, PSIPENTA is looking to develop even more user-friendly interfaces for its own products in the future, such as ERP, MES, APS or just-in-sequence systems, moving towards a modern world.

▶*Your contact*

Beate Wesenigk
Marketing Manager
PSIPENTA Software Systems GmbH, Berlin
Phone: +49 30 2801-2127
bwesenigk@psipenta.de
www.psipenta.de

News: "industrie 4.0 magazin"—the journal for integrated production processes

The trade magazine for the fourth industrial revolution

The fourth industrial revolution is the hot topic of German industry. As an experienced German software company, PSIPENTA Software Systems GmbH already offers its customers integrated solution concepts and, together with leading partners in the fields of science, research and industry, is researching future implementation strategies.

In the first edition of "industrie 4.0 magazin", PSIPENTA provides information on upcoming changes and challenges for production and manufacturing, as well as existing and upcoming solution concepts.
In the editorial, Prof. Stich, Managing Director of FIR e.V., explains what requirements smart factories impose on the ERP systems of the future.

The journal focuses on the new PSI solution architecture. With the Java-based architecture, PSI AG offers a powerful platform which, with a modern user interface and numerous productivity enhancements, provides the customer with the perfect technological basis for future production processes.

Read the magazine online:
www.psipenta.de/industrie-40/

CONTENTS

News: Stabilisation in Energy Management segment

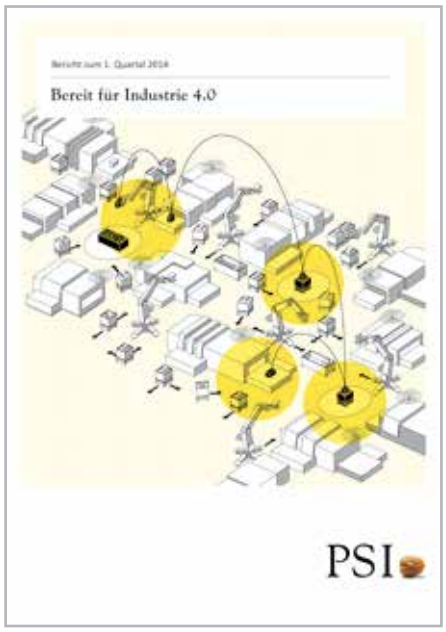
PSI with Improved Cash Flow and Stable Results in First Quarter

The PSI Group attained 10 % lower sales of 40.1 million Euros in the first quarter of 2014. The EBIT in the first quarter was, at 2.1 million Euros, so that the EBIT margin improved from 4.6 % to 5.1 %.

Due to the poorer financial result, the group net result was, at 1.2 million Euros, 26 % below the level of the previous year. In the previous year, the financial result also included the profit from the sale of shares in the Moscow sales joint venture PSI Energo. The volume of new orders, which was marked by a number of major international orders in the previous years quarter, decreased to 56 million Euros, the order book volume on 3 March 2014 was, at 129 million Euros, 11 % below the value for the previous year.

Energy Management (gas, oil, electricity, heat) attained 3 % higher sales of 15.3 million Euros in the first quarter. The segment's EBIT doubled compared to the previous year to 0.8 million Euros. The electrical energy business was able to improve its result following increased product investment in the previous year, as could the energy trading business. The gas and oil business displayed fewer major international contracts, but overall could confirm the good developments of the previous years.

Sales in Production Management (raw materials, industry, logistics) were, at 18.9 million Euros in the first three months, 18 % below the figure for the previous year. The EBIT decreased by 20 % to 1.0 million Euros. The metals industry and automotive businesses had shifts of licensing orders to the second quarter; logistics received important acceptances for the new transportation management software. In the metals industry, the business has increasingly shifted from the Russian to the North American market.



In Infrastructure Management (transportation and security), sales decreased as a reduction of the systems business by 12 % to 6.6 million Euros. The segment's EBIT dropped to 0.6 million Euros. Business in Poland developed especially well, while the sales in Southeast Asia decreased as a result of the drop in the systems business.

The number of employees in the group increased to 1,704 as of 31 March 2014 due to the expansion of capacity in the export markets. Cash flow from operating activities, which at –0.1 million Euros had been negative at the end of 2013, recovered to 4.2 million Euros and was therefore significantly above the figure for the last year. Liquidity decreased to 24.4 million Euros.

PSI expects important decisions to be made in the coming quarters about license contracts as well as follow-up orders in the fields of automotive and logistics. The PSI solution for smart distribution grids has passed the IT security acceptance test at the beginning of the year.

Please, find the complete report on the first Quarter and the 2013 Annual Report online:
www.psi.de/en/psi-investor-relations/financial-reporting/

Financial Calender

31/07/2014	Report on the 1st Six Months of 2014
22–24/09/2014	Berenberg/Goldman Sachs German Corporate Conference, Munich, Germany
30/10/2014	Report on the 3rd Quarter of 2014
24–26/11/2014	German Equity Forum 2014, Frankfurt, Germany

▶*Your contact*

Karsten Pierschke
Head of IR and Corporate Communication
PSI AG, Berlin
Phone: +49 30 2801-2727
kpierschke@psi.de
www.psi.de

R&D: Research Projects for the Fourth Industrial Revolution

EUMONIS—Operation and Maintenance of Renewable Energy Systems

Flexibility and a high degree of automation are the competitive advantages of a high-salary country like Germany. In order to secure them, PSI AG pursues research together with excellence clusters in German engineering and leading universities. Five projects are considered cornerstones for the fourth industrial revolution. In the current issue we present EUMONIS—Operation and Maintenance of Renewable Energy Systems.

Over the entire plant life cycle, the EUMONIS project addresses the operation and maintenance of renewable energy plants, such as wind, solar or bio-energy plants.
To do this, integrated software systems must be created in the areas of energy park operations planning and service management, facilitating the communication between all elements involved in the life cycle of these plants via a central platform.

As part of EUMONIS, PSI is therefore researching the development of monitoring and control systems (MDC, SCADA) to support advanced business models of component suppliers, plant manufacturers, energy park operators, network operators and external service providers.

▶*Your contact*

Beate Wesenigk
Marketing Manager
PSIPENTA Software Systems GmbH, Berlin
Phone: +49 30 2801-2127
bwesenigk@psipenta.de
www.psipenta.de

EVENT CALENDAR
www.psi.de/en/events

03/06/–05/06/2014	VDA Roadshow	Wolfsburg and Ingolstadt, Germany	PSIPENTA | Participant
03/06/–05/06/2014	Aachener ERP-Tage	Aachen, Germany	PSIPENTA | Stand MS03
23/06/–26/06/2014	8th European Continuous Casting Conference	Graz, Austria	PSI Metals | Stand 01
09/07/–09/07/2014	IPA International	Stuttgart, Germany	PSIPENTA | User Conference
09/07/–11/07/2014	Aluminium China 2014	Shanghai, China	PSI Metals | Stand 1C12
23/09/–26/09/2014	InnoTrans 2014	Berlin, Germany	PSIPENTA| Hall 2/1, Stand 309
07/10/–09/10/2014	Aluminium 2014	Düsseldorf, Germany	PSI Metals | Exhibitor
08/10/–10/10/2014	IT & Business	Stuttgart, Germany	PSIPENTA | Exhibitor

PSI Aktiengesellschaft für Produkte und Systeme der Informationstechnologie

Dircksenstraße 42–44
10178 Berlin (Mitte)
Germany
Phone: +49 30 2801-0
Fax: +49 30 2801-1000
www.psi.de
info@psi.de

PSI