Dear Readers,

Siemens has a new organization with three major sectors – Industry, Energy, and Health-care. This will enable us to focus more specifically on helping expand the leading market and technology positions of global businesses, increasing speed and customer proximity, and boosting competitiveness and cost efficiency. We are concentrating more than ever on providing tailor-made automation concepts that are perfectly aligned to customer requirements and that will increase customer plant productivity. With our integrated solutions, we help our customers save money on operations and optimize their manufacturing. We are also broadening our focus to serve the solar photovoltaic and thermal systems industry for which we provide specific solutions, adapted to the special requirements of the industry (see pages 10 to 15).

Talking about requirements: Requirements coming from the market often make their way into industry-specific standards. Since years Siemens is involved in the activities of standardization committees such as those of SEMI. The article on the following pages provide more details about our commitment there. I hope you enjoy this FabFocus and find the information interesting and valuable!

Burkhard Mueller
Head of Competence Center Semiconductor
Siemens is well known for its involvement in standardization activities – both industry-specific and cross-industry. What relevance do standards and regulations have?

**Artur Lederhofer:** Standards are strategic in global competition because they are the hinge for interoperability, foster technical and economic development, and reflect the recognized state of the art. They may even open the door to new markets. For example, standards that work for the semiconductor industry can be – at least partly – reused for the solar industry because the principal functions – needed to control and supervise production processes – are comparable to a certain extent. And standards are an important interface between manufacturers and customers/consumers, because they are referenced in tenders, contracts, and product specifications.

*Involvement with the standardization committees is voluntary. The meetings are open to all. Therefore, the composition of the individual committees is very heterogeneous...*

**Artur Lederhofer:** ...which is definitely beneficial. From the outset, it is possible to make sure that the regulations do not simply reflect the self-interests of a few companies. By definition, regulations and standards must be neutral and manufacturer-independent, so that all users/manufacturers may comply with them equally.

*What value does a company like Siemens place on the standardization process, or what contribution can it make?*

**Artur Lederhofer:** We are recognized as a global market leader in automation, and, as such, we have numerous references from the semiconductor industry and many other sectors. So we know the automation processes like the back of our hand. And...
through working closely with our customers in the semiconductor industry, we have access to detailed industry knowledge. Together this helps us actively support semiconductor standardization.

How do you judge the importance of industry-specific standards compared with cross-industry standards?

Artur Lederhofer: Collaborating on the definition of cross-industry standards such as those of the ISO or IEC is a must – no question. In addition to general industrial standards, it is key to define standards that are tailored to the respective industry where necessary. The differences between industries are too vital for general industry standards to be equally applicable to all. So we participate actively in industry-specific standardizations – such as those promoted by SEMI.

In the semiconductor industry, we pursue a structured top-down approach. We are active on three levels of standardization work: process control, controller, and fieldbus levels. In the facility field, we support MoFaS, “Models for Data Processing in Facility Systems,” – which provides an object-oriented model to access facility package units from a facility control system. Then we work on standards for the integration of equipment control with the MES (manufacturing execution system) level, for example by use of SECS/GEM or equipment data acquisition (EDA). And the third level involves the integration of individual devices into one machine and the standardization of interfaces. In the safety field, we have made a significant contribution to shaping the corresponding SEMI S2 standard.

The definition of standards is the theoretical side of the coin. But what about the practical implementation?

Artur Lederhofer: Standards and regulations must be easy to understand and implement, otherwise they will not be adopted. First of all, SEMI organizes so-called STEPs (Standards Technical Education Programs), technical programs focused on one or several SEMI international standards. SEMI produces STEPs to communicate information about newly published or revised standards, as well as critical documents under development, that are expected to have a profound impact on industry operations.

Attending a STEP gives you the opportunity to learn more about a critical new standard that impacts your manufacturing site or affects your supplier or customer relationships. It will also teach you how to implement new technical information into your everyday fab operations, which may help you and your company improve your product and processes considerably. The STEPs provide participants with a better understanding of the benefits, and of drawbacks and differences between the various solutions.

What does Siemens offer on the product side?

Artur Lederhofer: On the product side, we offer products such as Profinet (SEMI E54.8) and Profinet (SEMI E54.14) compliant devices and controllers. The software is 100 percent compliant with all relevant SEMI standards. In the safety field, for example, we also have a complete integrated concept conforming to SEMI S2 and the related annex 14. In addition, we provide starter kits for these technologies, enabling OEMs to adopt such technology for their own devices and controllers. We are the world market leader in Profinet technology, with a cross-industry installation of more than 23 million nodes around the globe. Profinet is ramping up as well, with more than 1 million nodes being installed by Siemens.

What are your activities in the solar/photovoltaic field?

Artur Lederhofer: We have recognized the importance of this vigorous and rapidly growing market. Here the situation is such that the requirements for standards have come from the market itself. SEMI has reacted accordingly, and in April 2007 a standards task force was put in action – where we are also represented. However, this community still has some homework to do because there is still no definition of the standards.

Mr. Lederhofer, thank you for speaking with us.
**Key Note**

### Standards in the solar industry

#### Developing standards

The burgeoning solar industry is still learning to use consistent terminology. Standards are being requested to help reduce production costs and meet growing demand.

Analysts predict that manufacturers in the solar/photovoltaic (PV) market will need to reduce production costs by 10 percent per year, as well as ensure a strong ability to grow, in order to cope with the challenges of the market. It is no surprise that the call for general standards has been loud. Last year, representatives of the solar/PV industry started a discussion process with SEMI (Semiconductor Equipment and Materials International) on suitable areas of standardization for production. As one result, a first task force was established, targeting a standard IT equipment interface for the solar industry.

### Similarities and differences

At first glance, several standards for the semiconductor industry seem as if they could be applied to or easily adopted for the solar industry, since the two industries are related. For example, some processes from the semiconductor industry are used in the solar industry. Market operators from the semiconductor field, such as equipment manufacturers and integrators, also appear in the PV field. However, there are also market operators with completely different backgrounds. And there are important differences in production. The throughput of wafers is considerably greater in the PV field. Besides the wafer-based technologies, the thin-film technologies which use glass substrates instead of silicon wafers play an increasing role. The area of these substrates can be up to 5.7 square meters. To complicate matters, production processes used by various PV manufacturers are nowhere near uniform.

The different technologies used in PV manufacturing have major consequences for production. And there is a variety of operating philosophies for PV production. Some manufacturers prefer batch operation, where material is transported from one piece of equipment to the next in carriers and processed there. Other manufacturers favor a consistent in-line approach, in which series of processes are linked into lines through which individual substrates are guided.

The term “equipment” is still not clearly defined in the PV field. It is not yet possible to treat pieces of equipment as black boxes that are assembled by different suppliers. As a consequence, synergy effects between PV and semiconductors can be utilized in the field of standardization for production, although the specifics of PV need to be taken into account.

### Next steps for the PV standards activities

Additional effort must be spent by the PV industry to identify and prioritize further promising areas of standardization. The resulting road map must be implemented by different task forces worldwide. A critical factor for success is the commitment of the PV industry to contribute to this work and to use the standards afterward. Although these activities involve some initial costs, they promise a great return on investment.

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**Table: Comparison of Photovoltaic and Semiconductor Production**

<table>
<thead>
<tr>
<th>Description</th>
<th>Photovoltaic</th>
<th>Semiconductor</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of process steps</td>
<td>&gt;10</td>
<td>&gt;800</td>
</tr>
<tr>
<td>Throughput in a typical factory (Wafer/day) (PV: 50 MWp/a)</td>
<td>&gt;40,000</td>
<td>&gt;2,000</td>
</tr>
<tr>
<td>Value of raw wafer (in euros)</td>
<td>2–3</td>
<td>100–250</td>
</tr>
<tr>
<td>Value of product (in euros) (cell vs. processed wafer)</td>
<td>Slightly more than raw wafer</td>
<td>4,000–10,000</td>
</tr>
<tr>
<td>Cycle time Hours/day</td>
<td></td>
<td>1–3 months</td>
</tr>
</tbody>
</table>

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New and improved cell phone features with each passing year, frequent upgrades to computers and gaming systems, electrical appliances so inexpensive that people choose to replace them rather than fix them, consumers have come to expect electronics to get progressively better while staying affordable. To gain customers in tough times, manufacturers must keep functionality high and prices low. But production costs sometimes go up.

At the heart of electronics is the integrated circuit (IC) chip. The cost of packaging, or mounting and interconnecting the devices on the IC chip, has risen, due to increased functionality and performance, from 10 percent of the production cost to 28 to 30 percent. In addition, manufacturers must be able to switch between the different types of thin films required for advanced packaging applications, such as under bump metallization (UBM), redistributed layers (RDL), back side metallization (BSM), barrier and seed for through silicon vias (TSV), and so on. If the systems don’t offer the full applications capability or take a long time to switch between thin-film applications, the capital costs increase with the dedication of a set of tools for every film. To help manufacturers compete, OEMs (original equipment manufacturers) must offer manufacturing tools with advanced processing capabilities thanks to adaptable mechanical designs and flexible control systems.

Flexible and high-performance tool

To meet this demand, Tango Systems offers a high-performance tool that can be reconfigured in one shift instead of weeks or months as in the past. A multichamber and modular system can continue production while one of the modules is undergoing maintenance or inspection. Tango’s Axcela 300/200/150 PVD (physical vapor deposition) system is a high-volume manufacturing tool that enables advanced IC packaging. Manufacturers traditionally buy dedicated tools for different packaging methods.

Siemens technology allows an IC chip fab tool to be reconfigured quickly and cheaply, reducing manufacturing costs.

- Tango Systems, USA
Tango’s patented multitarget, multiwafer chamber architecture, however, can produce a variety of packaging methods, such as UBM. Tango’s PVD system offers cost savings and therefore a higher return on investment (ROI).

Simatic makes it possible

The high ROI and flexibility of Tango’s AXCEL A system is made possible by a Simatic S7-317F safety controller connected to Simatic ET 200S distributed I/O system using Profisafe. The integrated safety solution allows one control system for process and safety control, saving hardware, wiring, implantation, diagnostic, and maintenance costs.

With PLC control of the safety I/O system, one chamber’s safety circuit can be disabled for maintenance or removal while the tool continues to run processes in other chambers. This functionality is crucial to support Tango’s multitarget, multiwafer chamber architecture. Only a Profibus bus connection to the distributed I/O and an Industrial Ethernet connection for integrating the devices with serial communication is needed to control the connections to the process chambers. In contrast, a hardwired control system requires complicated keyed bypass systems and more wiring terminations between the load locks and process chambers. The fieldbus solution costs less, increases flexibility, and decreases the time needed to swap a chamber.

Integrated safety features

Tango uses the Siemens 317F integrated safety I/O to monitor the magnetic switches on the chamber lids and covers. There are about four switches on each chamber. The fail-safe logic also controls 5 to 10 leak sensors and three flow switches to monitor the coolant system.

Tango’s PVD system uses argon and oxygen, which are not dangerous, and the safety logic is not used for controlling or monitoring vacuum valves or a gas box. Therefore, to save money, the Siemens logic used for Tango is not safety I/O. However, the logic and output relay are still safety-rated. The Safety Integrated solution offers a single control system for all needs, lowering packaging costs for Tango and its customers.

Key Points

- Tango Systems’ AXCEL A system/fab tool can be easily adapted for different packaging needs, which lowers manufacturing costs and helps offset rising packaging costs
- Siemens technology supports this multifunctionality, since all devices such as pumps, robots, gauges, load locks, motion controllers, power supplies, and other devices are not hardwired, but controlled through a PLC, Profibus, and Industrial Ethernet
- Siemens PLC control of the safety I/O system also allows part of the machine to run while other parts are undergoing inspection and maintenance.

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CRP Automationstechnik AG and Odevis AG, Germany

Double Separator

At Siltronic in Freiberg, two systems separate, clean, and dry 300-millimeter wafers and place them in coded batches for further production. All movements and actions are controlled by a Simatic S7-300 with T-CPU.
The manufacture of 300-millimeter wafers at Siltronic in Freiberg in eastern Germany requires that silicon ingots up to 400 millimeters in length be manufactured under clean-room conditions, sliced into wafers, and placed in cassettes in a water bath. For the subsequent intermediate step before the epitaxy, CRP Automationstechnik AG, based in Ampfing, Germany, and Odevis AG, of Burghausen, Germany, first developed one prototype plant followed by two production plants that separate the wafers (which stick to each other after slicing) and clean, dry, and store them in defined batches.

**Single-controller solution**

The entire separation process – several production steps, each of which requires precise positioning and motion control – is controlled by a Simatic 317T2 DP with a technology CPU. “We decided on the purely Simatic solution because the 317T2 DP already offers all the required functionality for this task, making additional functional modules or positioning controllers in the drives superfluous,” explains Helmut Huber, automation engineer and program developer at Odevis. “A comparable solution, for instance via the drives, would have involved considerably more intense bus traffic and, almost certainly, longer cycle times for the entire process. Aside from this, the programming expense would also have been considerably greater.”

All five axes of a separator are moved via Simodrive 611U drives, and the actuators and sensors are linked to the controller via distributed switch boxes with ET200 peripherals and Profibus. The control of the paternoster unit was implemented in the technology CPU, and magazine and data management were also transferred to the technology CPU. Overall, around 450 I/O signals are processed.

With the fast technology CPU, everything runs on one device, and the user-required overall lead time of 17 seconds from coarse cleaning trolley to batches was easily achieved. The hardware costs of the possible options (controller or drive-based) are roughly equal.

**Distributed concept for operation and monitoring**

A Simatic OP 170B operating panel has been installed on the clean-room side for the delivery of the coarse cleaning trolleys. On the other side, in the system itself, a Simatic Mobile Panel 170 is in use for setup and troubleshooting. The portable device can be operated at three terminal boxes and connected at any point in the plant using a 10-meter connection cable. The operator panels are connected via the combined DP/MPI interface of the technology CPU.

In addition, a Simatic Panel PC 670 with Simatic WinCC has been installed on the front of the machine. Its main tasks are the handling and transfer of all product data to the downstream systems. The data use collected via transponder at the coarse cleaning trolleys, as well as the batches from beginning to end of the process, and transferred via the technology can be assigned to its batch at any time.

**One controller for technology and motion control**

The Simatic 317T2 DP integrates technology and motion control functions in the form of functional modules conforming to PLCopen. This enables technological tasks such as gear synchronism, cam profiles, movement to a positive stop, pressure mark corrections via measuring sensors, path- or time-dependent cam switching, and closed-loop positioning to be implemented without additional hardware and thus more cost-effectively. The functional modules are certified in accordance with PLCopen and are called from the user program. In addition to the usual standard FUP (Function Plan), KOP (Contact Plan), and AWL (Instruction Set) languages, engineering tools such as SCL, S7Graph, or CFC can also be used for programming. The uniform architecture simplifies both engineering and project management.

The ability to program the solution universally in Step 7 offers several advantages, explains Huber: “The programming is familiar, there is no need to learn any special motion control language, and the new and, in my opinion, excellent functional modules can be used immediately. Working with virtual axes simplifies the introduction because it is also possible to work without drives connected.”

Odevis AG, an international systems vendor for industrial applications in the fields of automation and IT, primarily uses automation technology from Siemens, as the comprehensive product range facilitates universal solutions tailored to each other. Design engineer Walter Kokott from CRP values the 3-D data models made available by the manufacturer because it is possible to determine, at the push of a button, whether or not a component will fit in a particular location. “CRP plans, designs, and manufactures complex specialist machinery for users in a wide range of industries as well as products for aviation and aerospace. We welcome anything that gives us a head start,” says Kokott.

**The uniform architecture simplifies both engineering and project management.**

Helmut Huber, automation engineer and program developer at Odevis

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Siemens offers dedicated applications with products, systems, and solutions for the solar industry.

The first Siemens contribution to the technology still used by the solar industry today dates back to the 1950s, when Siemens produced ultrapure monocrystalline silicon using zonal heating. That innovation was followed by the invention of the Siemens reactor, a thermal decomposition furnace for the production of polycrystalline silicon. Both technologies are now widely used in the solar photovoltaic industry. Today, Siemens is a key player in equipping photovoltaic and solar thermal power production with total automation, power distribution, water, and information technology (IT) solutions. Following a successful approach already undertaken in related industries such as semiconductors and glass, Siemens now offers an industry-specific portfolio tailored to solar power production and infrastructure.

Facilitating solar photovoltaic production

Special low-iron glass sheets form the mounting for the finished solar cell modules and serve as the substrate for thin-film application. Special cast and float glass are increasingly produced in dedicated lines that have a flexible design for both cell and thin-film applications. Siemens offers enhanced technical solutions for the integrated automation of all production levels — from raw material to the finished product and from field automation to production and process management. With an integrated approach,
Siemens is creating complete solutions for process and field automation, for energy supply, and for all IT levels.

Another major component is polycrystalline silicon (polysilicon). Siemens understands the particular requirements of the polysilicon production process that uses the Siemens reactor. The portfolio for polysilicon production includes all the electrical and automation equipment for deposition reactors – from medium-voltage switchgear to type-tested and certified bus-bar systems to the process control system – tailored to the individual requirements of the chemical vapor deposition (CVD) process. Siemens also offers resin-encapsulated dry-type transformers and integrates third-party power control into a total power solution.

Out of the raw polysilicon material, multi- or polycrystalline wafers are produced. This process is time consuming and produces a great deal of waste silicon – aspects that can be improved with dedicated concepts from Siemens for machines and turnkey wafer lines. Special drive technology, complete equipment automation, line integration, and IT applications such as manufacturing execution systems (MES) from Siemens allow leading productivity and global support.

Wafers are the starting point to produce photovoltaic cells that will later be assembled and connected into solar panels. As an alternative to cell and panel technology, thin-film technology deposits semiconductor materials on glass panels directly, creating the photovoltaic effect. This avoids extensive use of silicon but at lower efficiency. Controlling tight process windows, tracking quality data, and process steering are the success factors for these technologies.

With its set of solutions using Safety Integrated technology, Siemens is able to effectively support reliable and safe operation in the production lines. Moreover, the modular and integrated Totally Integrated Automation approach enables a flexible production concept that can fit various panel sizes and types and provide track-and-trace capability, data acquisition functions, and a high degree of automation in the production lines for cell, panel, and thin-film units.

**Feeding sunlight to the grid**

Today, most solar-generated direct current (DC) power is converted to alternating current (AC) power and then fed into the public grid. For this purpose, Siemens offers the highly efficient Sinvert PV inverters, which are adapted to various grid conditions in order to ensure that maximum power is delivered to the grid under all specified conditions.

For turnkey projects, Siemens can provide all the equipment – from tracking solutions, boxes, inverters, medium-voltage switchgear, and transformers to complete container solutions – and the corresponding services for installation, commissioning, and maintenance.

**Serving solar thermal systems**

Solar thermal units focus the sun’s light into receiver tubes to heat up a heat-transfer medium, which then drives a steam turbine. In this process, precise focusing of the light while tracking the sun is critical. Additionally, systems must withstand outdoor conditions and be able to cover wide distances in the field as well as guarantee a wide range of operation for the turbines. For these tasks, Siemens offers a distributed, decentralized control and automation system that includes drives for tracking combined with lightning protection. This solution is capable of integrating field operation, maintenance, process control, and power station control into one complete system.

**A reliable production environment**

All the process steps for producing solar photovoltaic systems and receiver tubes for solar thermal systems need extensive facility infrastructure, including building technology, energy supply, and the supply of gases and water, as well as medium- to low-class clean rooms.

Siemens Water Technologies delivers ultrapure water systems for the manufacturing process, as well as wastewater ion exchange (WWIX) and capital solutions to comply with effluent guidelines governing the heavy metals in the waste stream.

For power supply, Siemens offers a complete solution portfolio – equipment and control for cogeneration plants and high-, medium-, and low-voltage packages, including energy distribution to tools. Scaleable, fabwide integrated control solutions including instrumentation, engineering, installation, and building automation, as well as IT services from MES to enterprise resource planning (ERP) complete the Siemens portfolio.

**Experience and readiness for growth**

A long history in the semiconductor field, pioneering development in the solar field, and an understanding of the solar industry make Siemens a partner with which solar power producers can grow and face future needs. With Siemens’ integrated set of industry-specific solutions, the solar industry can benefit from increased availability, higher energy yields, and improved overall performance – paving the way for a sunny future.
Hamburg-based Conergy AG is Europe’s leading solar enterprise and also a leading international supplier in the field of solar systems integration. On its Frankfurt (Oder) premises, the company turned a former chip fab into one of the world’s most advanced solar power plants. The plant began operating in the summer of 2007 and will reach its full capacity in 2009. The target is a production capacity of 250 megawatts per year.

**Tight timeline**

The equipment for the new plant had to be delivered and installed in a challenging setting. First, the solutions for integrating the various systems in the facility were quite complex from a technical point of view. And second, the project had to be completed within a very tight time frame: just seven months from order to completion. This also included the integration of multiple units via interfaces of considerable complexity. However, this task proved only a small challenge for the project team of M+W Zander, Siemens, and Conergy’s technical project leads.

M+W Zander contracted Siemens to deliver the automation technology for the entire process infrastructure. This package also included process cooling units, air-conditioning systems, vacuum systems, systems for heating and distributing hot water, and chemical supply. Siemens was able to convincingly demonstrate its industry expertise during this project.

Moreover, the integrated Simatic technology, which is based on proven industry standards, offers several benefits for such an application. The Simatic S7 controller family covers a set of components that are

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**Conergy AG, Germany**

Sunny side up

Conergy’s new solar plant in Frankfurt (Oder) serves as a benchmark for the solar industry by integrating all production steps – from wafer to finished photovoltaic module – into a seamless concept.

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A “single roof” facility

The Conergy solar power plant in Frankfurt (Oder) incorporates a fully integrated wafer, cell, and module production plant. During the initial construction of this, the world’s only fully integrated facility for the mass production of wafers, cells, and modules, Conergy invested around 250 million euros. This state-of-the-art facility supports highly efficient mass production of photovoltaic systems and will help Conergy maintain its competitive edge. By exploiting synergies through the close integration of production and R&D activities, Conergy is also pursuing ambitious goals for innovation – for example, raising the efficiency of monocrystalline solar modules to more than 17 percent.

Aligning internal production design with production units decreases distances for transport, and the high degree of automation in the facility helps reduce breakage in handling the sensitive cells. The machinery that is employed offers options for further improvements in operational efficiency and silicon consumption. Currently, production uses cells with a thickness of 200 micrometers, but plans aim at reducing the cell thickness to 160 micrometers and even lower.
well accepted in the market and meet the different requirements in the various plant units. The integrated communication concept (Profibus for process-level communication and Industrial Ethernet as the backbone) enables easy integration of the controllers in the process units, such as cooling systems, vacuum pumps, and chemical cabinets.

The Simatic PCS 7 process control system in a redundant configuration handles all higher-level control tasks. It controls plant operation, handles alarms, and manages all data analysis and archiving. A dedicated process bus system in a fiber-optic ring configuration was installed for fast communication between the automation systems and the servers for the operator stations. This ring is equipped with active Scalance components. The process level is connected to the control system via Profibus. Several Modbus devices are also connected via a Modbus/DP link module. The enterprise resource planning (ERP) system, the office applications, an alarm system with a radio server, and a system for paging functionality are linked to the control system via standard interfaces.

Another part of the electrical installation, the switchgear systems for medium and low voltage, are also integrated into the control system via Profibus. Consequently, Conergy can benefit from comprehensive power monitoring and excellent system visibility from all the operator stations of the control systems. The same principle was also applied in the units for chemical supply and water treatment, where all operational conditions can be monitored both locally on operator terminals and in the central control room.

**Integrated solution**

This integrated and uniform system for engineering, process visualization, and operation is an absolute first for the photovoltaic industry. Effective and straightforward engineering is supported by an easy-to-use tool set, and a uniform software library based on the semiconductor library of the Simatic PCS 7 Version 7 process control system enables uniform and integrated engineering. Operator symbols are the same on every operator station, so all user screens have the same look and feel, an aspect that also significantly facilitates staff training. A solution that was implemented especially for the solar manufacturing plant in Frankfurt (Oder) is the PCS 7 CAS central archive server, which delivers long-term archiving capability for all relevant system messages and measured values.

**Photovoltaics enjoys a sunny outlook**

Looking back on the project, all parties are extremely satisfied with the results and the team performance. The systems in the plant are currently being fine-tuned. With analysts predicting continuing growth in photovoltaics, Conergy expects future expansions of the facility over the next few years – and this might also mean that the proven collaboration with M+W Zander and Siemens will be continued as well.

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As energy demand and energy prices rise dramatically, so has the search for energy production from renewable sources. Awareness of the need to reduce CO₂ emissions has only added to the mandate for renewable energy. Experts predict that demand for polycrystalline silicon (polysilicon), used in the production of solar cells, will rise significantly in the coming years.

Implementing customized solutions

Totally Integrated Automation (TIA) and Totally Integrated Power (TIP) offer numerous benefits: a high degree of standardization shortens the period of time until commissioning, simplifies maintenance, and reduces expenses. To advance these developments, Siemens collaborates with plant manufacturers, mechanical engineers, and systems integrators. In close cooperation with the customers, Siemens designs custom solutions to make production processes more transparent and reproducible and to enable verifiable documentation of quality standards.

Subprocesses harmonized

Supported by the Simatic PCS 7 process control system, all subprocesses are harmonized and monitored. Up-to-date asset management, which not only references the core process but also manages performance and equipment, allows customers to see the

With the rapidly growing demand for solar power and the demand for increased productivity in solar as well as in semiconductor production, the need for a wide, scalable range of sizes is also increasing. Accordingly, control systems are requested in varying sizes as well. There is also a call to integrate control systems and associated devices, regardless of size or design. Based on proven and established components, the Simatic PCS 7 distributed control system (DCS) offers a solution by including libraries that support task implementation, integration of machines, and even the merging of DCS and Supervisory Control and Data Acquisition (SCADA) worlds. PCS 7 allows the number of interfaces to be reduced by using integrated automation components from a single vendor. This concept integrates all subsystem packages and their varied components into a common database, which allows system changes during runtime. Especially for solar applications, control solutions must be able to incorporate a small controller as well as a complex process control system. They must be able to merge a centralized control system with a distributed one. The solution must integrate a variety of devices into a universal and uniform whole, regardless of system size. The use of field-proven libraries is an absolute must in this case. It reduces engineering time, generates a uniform system layout, and guarantees safe operation. Therefore, Siemens has developed a semiconductor library usable with PCS 7 that enables the operation and control of all devices such as motors, valves, and PID (proportional-integral-derivative) controllers. This library can also be used for any solar application. The library enables universal reporting, and offers interfaces for central reporting, and acknowledgment. It also allows the data concentrator to be omitted, and in most cases can connect the S7-300 directly to the OS, creating continuity from the PCS 7 to the S7-300 level. An operator panel on a machine can thereby be fully integrated into the system. Different scenarios are conceivable. Package units such as chemicals, cooling, and power supply can be directly integrated or integrated via the Simatic PCS 7, via a data concentrator, or via a central controller if the package units have no controller of their own. Whatever the approach, the semiconductor library will always provide a standardized and universal solution.
entire “utilization history” of every single investment. Preventive maintenance can also be managed in order to avoid failures. Since Simatic PCS 7 is equipped with a comprehensive industry-specific library of function blocks, it serves as the key system of the polysilicon production process.

Solutions for communication and CVD reactors

Simatic PCS 7 enables unlimited data exchange on all levels and guarantees central plantwide engineering. The Profibus fieldbus system provides integrated data communication from the field level to the ERP (enterprise resource planning) level, at a high degree of standardization. Siemens’ portfolio also includes complete electrical equipment for CVD reactors. This includes medium-voltage switchgear for the full range of 6 to 24 kilovolts, as well as type-tested and certified busbar systems for the low- and medium-voltage range of 200 to 2,000 volts. These can all be tailored to the individual requirements of the production process. Siemens also offers resin-encapsulated dry-type transformers and integrates thyristor control into production facilities.

Siemens’ semiconductor library allows reduced engineering time while providing scalability, machine integration, and effective task implementation.
On March 3, 2008, Siemens Water Technologies announced the acquisition of Chemitreat Group. This expands Siemens’ expertise in water and wastewater treatment and services into Southeast Asia, namely Singapore, Thailand, Malaysia, the Philippines, and China.

Chemitreat offers comprehensive process solutions for water and wastewater treatment and fluid management concerns. These solutions include consulting, design and manufacture, installation, and complementary services such as operation/maintenance contracts, lab analysis, consumables, and resin regeneration for portable ion exchange units.

Creation of a powerful team

Chemitreat has a proud history of providing solutions in the food, beverage, municipal, oil, gas, pharmaceutical, power, electronics, and semiconductor markets, among others. Its activities complement those of Siemens Water Technologies in this important region of the world.

This expanded Siemens Water Technologies reach provides a larger established solution base for global customers in the solar, semiconductor, and electronics industries. This customer base continues to receive the best equipment and service offerings for ultrapure water treatment, wastewater treatment, hydrofluoric acid (HF) treatment, acid waste neutralization (pH), slurry waste treatment, and wastewater reclaim treatment, which includes heavy-metal waste reclaim, reverse osmosis (RO) reject reclaim, and rinse bath water reclaim.

Putting the team into action: wastewater treatment on a global scale

Finding a global solution for multinational companies has become an integral part of success in the semiconductor industry today. The ability to offer cost-effective local solutions, backed by global
process know-how and experience, is essential to providing customers peace of mind when it comes to wastewater treatment technology.

Expanding industrially to serve customers worldwide, as well as reducing manufacturing costs, is required for corporate survival, as much as the environment is essential to life on Earth. And protecting the global environment is the responsibility of every good corporate citizen, whether it be the customer or the supplier.

One multinational company found the answer in patented slurry copper waste treatment equipment from Siemens Water Technologies. Siemens has provided global wastewater copper treatment solutions for the world’s largest microchip manufacturers in a number of regions, including the United States, Europe, Israel, and now China.

Conventional waste treatment is always an option, but considering the environmental impact, it is not always the best course of action. Siemens Water Technologies provides a simple solution of activated carbon and ion exchange for effectively removing copper and other metals from the customer’s manufacturing process.

The patented process has eliminated the need for a variety of chemicals and the need to remove hazardous solid wastes from the facility. The resin can then be regenerated in situ or collected and returned to a centralized facility for processing. The metals are removed from the resin and processed for recovery. The resin is then returned to the customer’s facility.

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Chemitreat – providing “firsts” to the region

- First Southeast Asian water treatment engineering company to be awarded ISO 9001 certification
- First Southeast Asian company to have a Class 1000 R&D laboratory dedicated to water and wastewater analysis
- First Southeast Asian company to construct an ultrapure water treatment system for a wafer fabrication plant
- World’s first EDI (electrodeionization) system in a wafer fabrication plant
- First Southeast Asian company to use ion exchange resin for deionization
- First and largest ion exchange column regeneration facility in Southeast Asia
- First Southeast Asian company to offer a mobile containerized RO/EDI system

Chemitreat offers the following systems, services, and products:

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According to a market research study by SEMI that was published in January 2008, South Korea has emerged as the leader in the manufacture of consumer electronic products. Brands such as LG and Samsung dominate the market, from the latest trendy portable MP3 players to sleek mobile phones. Samsung and Hynix have invested heavily in fabs for producing large-capacity memory devices. LCD and plasma high-definition televisions (HDTVs) and computer monitors have made inroads into the homes of many consumers.

Bright prospects for automation

To advance in the marketplace, Korean companies continue to increase investments in electronic products, including sizable investments in new fabs. Currently, eight 300-millimeter semiconductor volume fab lines are in production, mainly manufacturing Flash and/or DRAM memory. Nine more 300-millimeter fabs are scheduled to go into production in the next six years.

While the market situation both for in semiconductors and flat panel displays, always depends on whether or not the investments of related industries are going ahead – according to the sales fluctuations in the device market, investments in the LCD field that were temporally delayed will be resumed soon. And as the market situation for memory recovers again, investments are being expected in the field of semiconductors as well.

However, companies – not only in Korea, but there especially – must brace themselves for intensified competition. Wafer size is increasing, and every device manufacturer is making efforts to secure the competitiveness of its technology. As a result, the demand for automation has increased steadily and the derived markets have enlarged accordingly. However, improvements in production automation are demanded regardless of the market situation, since
automation helps cut costs. Another feature typical of the Korean market is that many fabs have a long history of semiconductor development and have now become dated. Consequently, modernizing and upgrading these plants will be an important issue for the Korean electronics industry and its suppliers.

**Successful introduction of new technologies**

Fostered by positive responses from the market, Siemens has been able to strengthen its position in Korea. For example, Siemens recently introduced its Machine Vision systems into flat-panel display manufacturing. This images-processing system aids inspection because of its rapid installation, reliability, and stable maintenance, and customers have responded favorably to this new technology.

**Comprehensive portfolio**

Siemens offers a comprehensive portfolio for the semiconductor industry that is based on the proven TIA (Totally Integrated Automation) and TIP (Totally Integrated Power) concepts, which can service almost all electric system facilities. These solutions can be used in a variety of applications, including semiconductor and FPD (flat panel display) fields, integrated automation, fab automation, and integrated power solutions. Korean domestic companies frequently build heterogeneous systems with various components from different sources, and frequently suffer from problems caused by this heterogeneity.

By implementing integrated solutions, such as TIA and TIP, companies can benefit from having more flexible, reliable, and totally integrated solutions that help maximize productivity with minimum risk. TIA and TIP solutions from Siemens can facilitate rapid engineering, reducing the cost of implementation and maintenance. In addition, they can allow a more rapid response to a change in the manufacturing process when a facility is scheduled to be replaced.

**Customized solutions available**

Siemens is looking for a real partnership with its customers, collaborating through seamless communication. Based on its long history in the semiconductor industry and its broad portfolio of modular and integrated solutions, Siemens is capable of developing, suggesting, and providing customer-oriented, customized solutions. And finally, Siemens supports its customers in Korea and worldwide through constant innovation and improvement – not only of Siemens’ own products and solutions, but also through the company’s involvement in industry standards and integration the initiatives. Siemens is actively participating in discussions about the technology standards for the next generation – making greater efforts than any other automation company to develop products using these new technologies.

MoonKi Cho and HeeJin Shin of Siemens Korea are supporting their customers in the Korean semiconductor industry with innovative solutions

**Market trends**

- Analysts expect the 2007 semiconductor equipment market in South Korea to grow 5.2% year over year, from $7.0 billion to $7.4 billion.
- Fab activity in Korea is expected to continue its growth spurt. In 2007, South Korea’s fab capacity was about 2.6 million wafers per month (wpm); this will increase to 2.8 million wpm in 2008.

Source: SEMI
Power distribution

Record-time project

In only eight months – almost half the time usually required under today’s world market conditions – Siemens installed the complete power supply for the commissioning phase of a semiconductor factory in China.

The semiconductor fab is located in Chongqing, a large city at the confluence of the Yangtze and Jialing rivers. Siemens delivered and successfully commissioned the complete power supply system for the first production line of dynamic memory chips for industry applications. Siemens acted as a one-stop supplier on a turnkey basis. The package comprised all power distribution systems, from high voltage to low voltage, including process automation systems. Siemens received the order, which is China’s largest new semiconductor project, from its client L&K, which is based in China and Taiwan.

A first for China

The Asia-Pacific region has quickly become one of the world’s largest production locations for semiconductors. “For the first time ever in the Chinese semiconductor business, an integrated device manufacturer (IDM) awarded a turnkey order of this type to a single supplier – namely to Siemens. In record time, Siemens provided L&K with a single-source, process-optimized power supply solution geared to the special requirements of semiconductor manufacturing,” says Udo Niehage, head of Siemens Power Transmission.

The IDM performs every step of the chip-making process and designs, manufactures, and sells integrated circuit (IC) products for highly specialized applications. Three different power distribution networks (for standard, emergency, and uninterrupted power supply) guarantee a high level of network quality and the availability of reliable power around the clock. An electrical power outage of even less than four milliseconds in the area of the clean room would result in a production stoppage and thus considerable losses.

The order comprised the planning, delivery, installation, and start-up of the entire power supply. In addition to the process automation system and motor control centers, Siemens also delivered gas-insulated high-voltage switchgear (110 kV), eleven gas-insulated medium-voltage switchgear units (20 kV and 6 kV), two power transformers, 60 cast-resin distribution transformers, a low-voltage busbar system, and more than 20 low-voltage distribution centers to ensure safe and reliable manufacturing conditions.

Expertise yields multiple benefits

“Siemens’ cutting-edge energy supply and automation technology, technical expertise, in-depth experience, and international project management capabilities enabled the timely commissioning of this plant,” said Paul Chuang, chief operating officer of L&K Taiwan. “With the reliable power supply, Siemens offered the most suitable and economical solution to increase the efficiency and productivity of our factory,” states Sam Chiu, who is responsible for all the electrical systems on the operator side.
Today Siemens has a large international team providing solutions and services worldwide, contributing to the shortest possible delivery times with a new approach to requirements engineering, based on a high level of partnership, cooperation built on trust, and transparency in software development. This article reports on a semiconductor customer whose collaboration with Siemens in the field of MES is well established. The MES solution covers all the production phases: front end, back end, and raw material production – epitaxy. The whole system consists of a kernel based on standard product, supplemented by many modules tailored to the customer’s needs. The MES includes interfaces to the automation and enterprise resource planning (ERP) levels.

Introduction of new technologies

The rapid introduction of new technologies within the semiconductor industry requires that manufacturing execution go hand in hand with the implementation of new production equipment. The effectiveness and flexibility of the production line steering are the keys to the whole software development process. The speed of new requirements implementation, together with the quality of the solution and robust service-oriented architecture (SOA), applicable in all production sites worldwide, has a crucial impact on production effectiveness and costs.

The demand for shortest possible delivery times requires a new way of requirement engineering, based on mutual cooperation, high level of partnership, trusty cooperation and complete transparency of the software development processes. The traditional “analyze – design – develop (eventually surprise)” method does not reflect the current needs of fab automation and must be replaced by more agile approaches.

Requirements workflow reengineered

The new requirements engineering system ensures that every single requirement is first sufficiently defined by all involved persons on all levels. The completeness of the definition is managed by the requirements workflow, which ensures that none of the required roles can be skipped. The loops for requirement refinement, implemented in the workflow, prevent underspecified requirements.

After acceptance, the requirements can be transferred in the detail development tasks and then included in the respective project planning, configuration management, development, and testing systems. All these systems are integrated in the Microsoft.NET environment. The platform enables fully transparent continuous tracking, controlling, and online reporting of all open issues to all involved parties.

Effective requirements engineering; the process and domain know-how of the development team; professional services covering the complete software development lifecycle; robust, scalable architecture; and high flexibility – these are the attributes of the Siemens IT Solutions and Services solution, which is what brings manufacturing execution to the fingertips of the customer.

Key facts: MES

Manufacturing execution systems (MES) in general address three execution levels:
- Business planning and logistics
- Process control
- Manufacturing operations

Integration of manufacturing execution system and requirements management

Fab automation

Siemens IT Solutions and Services has a long tradition in manufacturing execution systems (MES) for semiconductor industries.
Microelectronic Technology Center, Germany

Process gas control

Ulm University recently modernized the control system for the process gas supply in a research and pilot plant with Simatic S7 technology.

The pilot and research plant for semiconductor technology at Ulm University is used in research and development projects in the fields of semiconductors, optoelectronics, and micro-electro-mechanical systems (MEMS). The process gases – including hazardous and explosive gases – are supplied from 20 gas cabinets in a clean room. Until recently, a Simatic S5 controller was used for the central automatic monitoring and control of the gas supply. As this technology was no longer up to date, the gas-supply control system, its central and distributed units, and the entire gas alarm system needed to be modernized. The new system needed to be capable of ensuring the existing safety level, which required safe handling of hazardous and explosive gases. Moreover, usability was an important criterion for the new solution, as the staff in the research plant changes frequently and often consists of young university graduates. Consequently, easy and intuitive operation of the plant was important.

Modular and flexible

MPA Regele GmbH was awarded the contract for this project. The company is based in Landsberg/Lech in the south of Germany and is a member of the Siemens Solution Partner program. Together with Ulm University, Regele implemented an integrated control solution with Simatic components and Safety Integrated. The automation components, which were previously directly linked, are now connected via fieldbus.

"After the modernization, the plant is now in a state where it can be expanded. We also benefit from a higher level of usability in terms of operation and alarming, a structured program description, and the option of remote access via Internet," says Jürgen Mähnß from the Microelectronic Technology Center at Ulm University. "Another benefit was that we had to shut down the plant for only a very short time for commissioning, as the program had been tested with simulation tools prior to the implementation."

Highest safety levels

The new solution is based on a modular design and industry standards, so it offers maximum flexibility and can be easily adapted to new requirements. One modification that is already planned is to use Profibus to connect 64 sensors for monitoring gas concentrations in the plant as well. These sensors are currently connected via direct wiring.

Technology at a glance

- Simatic S7-400 with fail-safe S7-416F CPU
- Fail-safe Simatic ET 200M remote I/O system
- Profisafe communication via Profibus
- SIL 3 / cat. 4 safety level
- Simatic WinCC SCADA system with Web navigator for central operation
- Local operation via 20 Simatic TP270 touchpanels

Gas monitoring system: overview screen with sensors in the building

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Training session on Profibus and Profinet
A day of training

The PTO and PROFI Interface Center are holding one-day training classes throughout North America for the sixth consecutive year. There are 24 cities on the initial schedule. Classes center on Profibus, Profibus in the process industry, and Profinet. Attendees of each class receive a certificate for 5.5 professional development hours (PDH).

The Profinet one-day training in Silicon Valley drew a good crowd, with almost 70 attendees from various companies. These trainings are highly interactive, and attendees ask a lot of questions, such as, “When should I use Profinet or Profibus?” or “Can I use unshielded Ethernet cable?” This year’s emphasis in the seminars, besides the basic technology and Ethernet in general, is on advanced topics such as wireless, safety and security.

Industrial Ethernet growth is predicted to be over 50 percent per year. By attending the free one-day Profinet training class, industry professionals obtain valuable information on how they can benefit from this technology. Seminar topics include fieldbus technology and application, an Industrial Ethernet basics review, and in-depth information on Profinet, as well as application stories and live demonstrations.

In addition to the one-day training class that will briefly review Ethernet basics, attendees can also view archived Ethernet basics webinars prior to attending to build a knowledge base on Industrial Ethernet basics, network architecture (basic and advanced), and Industrial Wireless networking.

Each attendee will receive a printed book of the presentations and a resource CD containing the presentations, brochures, technical literature, installation guidelines, and much more.

The next class will be held in Atlanta, Georgia, on July 16.

More details at: www.us.profinet.com

Fairs & Events
Meet us at...

Semicon West
(in collocation with Intersolar North America)
July 15–17, 2008
Moscone Center, San Francisco, California, USA
South Hall, #715
www.semi.org/semiconwest

PVSEC Valencia
September 1–4, 2008
Feria Valencia, Valencia, Spain
www.photovoltaic-conference.com
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