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**SALZGITTER  
MANNESMANN  
LINE PIPE**

A Member of the Salzgitter Group

Issue 09 · April 2016

Sustainability

## Reconciling economy, environment and society

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Dear Reader:

This issue of Line Pipe Global focuses on sustainability.

For us at Salzgitter Mannesmann Line Pipe, sustainability is omnipresent and plays a central role in how we think and act. Some may doubt at first glance whether the manufacture of steel products, with all the energy required, can be sustainable at all. It can, for there's hardly another material as variable, versatile and durable as steel. It is the durability,

in particular, which provides for a very good energy balance, despite the energy consumed in steel production. In addition, steel components such as structural tubes or line pipe, are easy to replace and close to 100% recyclable after a long service life.

As we see it, sustainability is also closely linked to responsibility. Responsibility towards society and the environment, but

also towards our customers and employees. As evidenced by our certifications and management systems, our far-sighted HR policies and innovative products, all geared towards durable, economical and user-oriented service properties.

Precisely how we define sustainability and how we reconcile economic, environmental and societal considerations you can find out on the following pages.

**I wish you a stimulating read!**

A handwritten signature in black ink, consisting of a stylized 'J' and 'W'.

Jörn Winkels  
Director Technology and Sales





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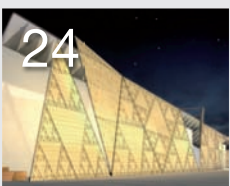
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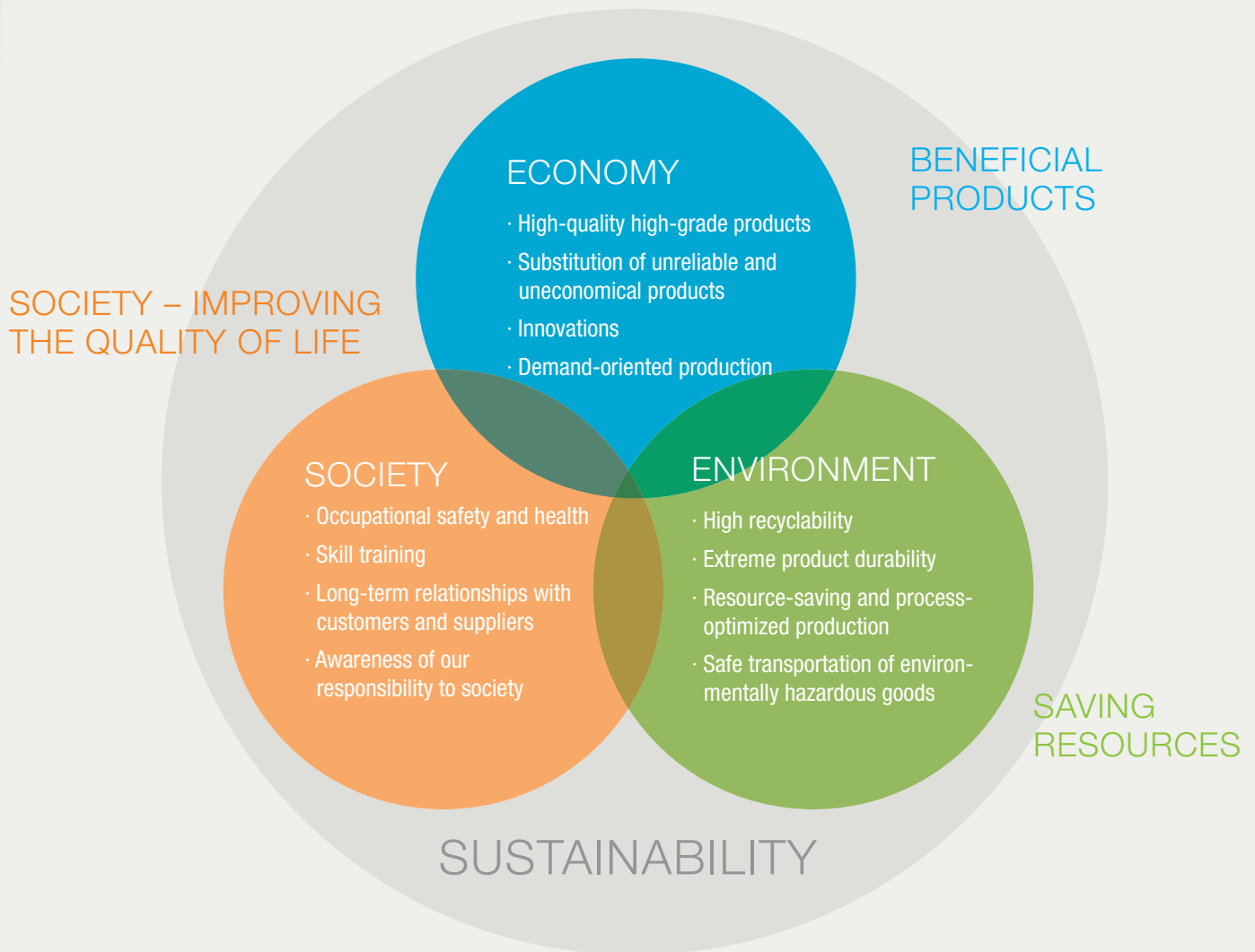


Cover story: Sustainability

## Reconciling economic, environmental and social requirements

The term sustainability is used and interpreted differently in different contexts. Salzgitter Mannesmann Line Pipe has laid down long-term objectives regarding the impact of its activities on the environment, economy and society. In this way, a high degree of compatibility is created between the three areas.





One important goal is to generate value and avoid waste. Which is why sustainability is closely linked to "lean" activities at Salzgitter Mannesmann Line Pipe. "Avoiding waste" means avoiding overproduction, reactive power, quality problems and unnecessary information flows. "Creating value" means that products and services from Salzgitter Mannesmann Line Pipe must work for their intended purpose to the full satisfaction of the customer.

**Environment – conserving resources and ensuring safety**

Steel and steel products are nearly 100 % recyclable. In addition, they have an ex-

tremely long product and service cycle. Hardly another material is as variable, versatile and durable as steel. Accordingly, despite its energy-intensive production, it achieves an excellent energy balance in service. The German steel industry in general, and Salzgitter Mannesmann Line Pipe in particular, have long made great efforts to reduce energy and water consumption in the production and processing of steel. The companies in our supply chain as well as Salzgitter Mannesmann Line Pipe itself, have an efficient environmental management system in place and have

been certified to DIN EN ISO 14001. In addition, our certification to DIN EN ISO 50001 documents our compliance with exacting standards in the field of energy management.





### **Economy – creating beneficial products and services**

Another aspect of sustainability concerns the goods and products we deliver. The name Mannesmann has been synonymous with maximum product quality and reliability in steel tube production for over 100 years. Our present research and development activities perpetuate a tradition of continuous product improvement. This makes our products safer and more economical in

service, and opens up ever-new application possibilities, the focus always being on user benefits and compliance with continuously more challenging customer requirements.

### **Society – improving the quality of life**

The third aspect of sustainability is people. This extends from employees via suppliers right down to society in general. The occupational safety and health of our employees are as important as is a

company culture centered on mutual respect. Our courses in skill training are both a contribution to society and an important element in keeping us fit for the future. All our business relationships are built to last; we advise, accompany and support our customers through all project phases – on-site around the globe.

## Steel tubes and MSH sections facilitate the efficient use of renewables

HFI-welded steel tubes and MSH sections play an important part in the utilization of renewable energies. Products from Salzgitter Mannesmann Line Pipe can be found in nearly all such environments.

### **Wind power**

Offshore wind farms offer a variety of applications for circular, square and rectangular MSH sections from Salzgitter Mannesmann Line Pipe. Besides jacket structures for the foundations of wind turbines and transformer platforms, HFI-welded steel tubes in grade S355 with diameters up to 610 mm and wall thicknesses up to 25.4 mm are used in

peripheral applications such as cable conduits, boat landings and supply platforms.

### **Geothermal energy**

Technology for drilling deep geothermal exploratory and production wells can rely on the HFI-welded line pipe and oilfield tubulars (OCTG) which have already proved themselves for decades

in the oil and gas industry. The ongoing product improvements and innovations in these application areas are now feeding through to the geothermal industry. Similar to district heat systems, the operating temperature of hot pipes from geothermal wells very often goes well beyond 100 °C. This places high demands on the thermal expansion of the pipes.



Salzgitter Mannesmann Line Pipe can draw on decades of experience as a supplier to the leading system pipe manufacturers. We offer a full spectrum of products for the most varied applications, in a wide range of grades and with outside diameters up to 610 mm and wall thicknesses up to 25.4 mm.

#### Hydropower

HFI-welded steel pipe has long been used in various applications in hydro-

electric power plants. Whether sweet or salt water, line pipe or high-pressure piping systems – Salzgitter Mannesmann Line Pipe offers its customers the perfect product for every application, complete with a comprehensive range of coatings and linings.



## Use of sustainable products in classic applications

#### Pipelines – maximum safety for our environment

Due to their exacting quality standard, products from Salzgitter Mannesmann Line Pipe are particularly reliable and provide for the safe and resource-saving transportation of hazardous substances, for example, in pipelines. Even though oil and gas pipelines do not transport renewable energy sources, they replace the need for thousands of haulages by road, rail or water.

#### Steel as a construction material – the epitome of sustainability

Steel tube structures can enclose more space than, for example, concrete ones, for the same amount of energy

consumption. At the same time, steel is always an investment in a valuable raw material. Intelligently used, it is not only easy to assemble, but equally easy to recover when a structure is taken down, and it offers up to 100 % recyclability. In bridge construction projects, for example, the re-use of the recovered steel covers the cost of dismantling and demolition of the old bridge.

And there's another advantage that steel brings with it: components for load-bearing structures can be manufactured with millimeter precision, or they can

be preassembled to complete structures and delivered straight to the construction site just in time. This saves valuable storage space, facilitates logistics and shortens project times – a benefit over other construction methods that shouldn't be underestimated.







*At the end of its life cycle, a product should if possible be fully recyclable. And this is absolutely true of steel.*

*Konrad Thannbichler*

#### Interview Sustainability

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"It's not a question of asking the questions but of delivering the solutions."

**Sustainability affects a wide range of corporate areas and has its special focuses in each. Lutz Rosiepen, Head of Human Resources, Markus Westhoff, Technical Services Siegen, and Konrad Thannbichler, Sales Manager, talk about goals, achievements, and other tasks.**

**What's your personal definition of sustainability in your field of responsibility?**

**Konrad Thannbichler:** Sustainability is the result of durable products. There are steel bridges that are as old as the first railroad. And some mineral oil pipelines have already been

in operation for a century. Solutions using steel pipe and MSH sections, as offered by Salzgitter Mannesmann Line Pipe, are always geared to quality and hence to a long service life. And another thing is important: At the end of its life cycle, a product should if possible be fully recyclable. And

this is absolutely true of steel.

**Markus Westhoff:** We want to be a high-performance and competent supplier for our customers constantly and in the long term. Above and beyond action to ensure occupational safety, we want to actively improve the health of our staff long-term.



Energy and other resources are used as sparingly as possible in production, and we want to continually reduce emissions. And, not least, we constantly check what has already been achieved and seek improvements.

**Lutz Rosiepen:** For me, in the light of demographic change, sustainability in the human resources sector means making skilled personnel available to our company as required at all levels in the long term.

**Where do you see Salzgitter Mannesmann Line Pipe on the way to becoming a sustainable company?**

**M. Westhoff:** Not least as a result of growing environmental awareness in society, which is also found in our sales markets, we extended the existing quality management to DIN EN ISO 9001 in 2002 to include environmental management to DIN EN ISO 14001. In 2005, we added the needs of occupational safety and health protection to the established environmental and quality standards and had them certified to OHSAS 18001. From the application of these systems, we have realized that a structured management system is a key precondition for the ongoing improvement of our products and processes. Since 2012, we have also been operating an energy management system

conforming to DIN EN ISO 50001. We have meanwhile made the transition from reactive correction to proactive foresight. This results in a sustainable caring approach to the people working at the company and to the environment. And our products and corporate processes have a direct impact on the environment.

**L. Rosiepen:** We have a long-term approach to our goals in the human resources sector. We meanwhile have ties with numerous schools and universities and are also active at job fairs. In addition to classical training course, we also offer cooperative study programs. The initial training and subsequent upskilling of our staff is also an important factor. However, we have found that new challenges are constantly arising due to changes in the market situation, which means we have to accept that sustainable human resources planning is a process subject to dynamic change.

**Whether sustainability is possible in the energy-intensive production sectors is doubted and often called into question. How do you respond to such criticism?**

**L. Rosiepen:** By judging sustainability on the relationship between what goes into production and the product's service life. Steel pipe takes a lot of energy

to produce but is also outstanding in terms of its useful life. I can't think of any more sustainable alternative.

**K. Thannbichler:** We shouldn't shy away from international comparisons, as each Chinese steel pipe is produced with higher energy consumption and greater environmental damage than here in Europe. It's therefore senseless in double respects to penalize pipes produced in Europe with high energy taxes when exported to Asia. On top of the high energy input in the production process, there's the additional transportation of the pipes to Europe by ship and the return of steel scrap to China's steel mills.

**M. Westhoff:** There's a widely held view in society that energy-intensive companies benefit from tax subsidies and the ordinary consumer has to pick up the tab. The fact is that the legislator has tied exemption from EEG apportionment to continuing improvement in the energy performance characteristics. However, improvements in energy efficiency are precisely the essence of sustainability in the energy sector. In this respect, we believe on the contrary that the energy-intensive companies that satisfy the legal requirements for exemption from EEG apportionment are the very ones that practice sustainability every day.



*But we must also be in a position to carry out production with realistic energy and resource prices. Sustainability then is no longer a luxury but the motive force for growth.*

*Markus Westhoff*





*The Chinese themselves are currently having to learn that their growth policy hasn't been sustainable.*

*Lutz Rosiepen*

**In view of the international economic conditions, particularly as far as China is concerned, isn't sustainability a luxury that Germany can no longer really afford?**

**L. Rosiepen:** No, on the contrary. The Chinese themselves are currently having to learn that their growth policy hasn't been sustainable. Massive environmental damage and impairments for the population are among the consequences. Efforts in the sustainability sector are indispensable in China and more necessary than ever.

**M. Westhoff:** Salzgitter Mannesmann Line Pipe in particular can benefit from the energy turnaround toward greater sustainability. Some of our R&D activities have long been aligned to sustainability. We offer solutions for the foundation of offshore windparks, to name just one example. But we must also be in a position to carry out production with realistic energy and resource prices. Sustainability then is no longer a luxury but the motive force for growth.

**Government and the State help to shape the general economic conditions. In terms of sustainability, would you prefer more or less intervention?**

**L. Rosiepen:** I'd like the importance

attached by government to the steel industry to reflect the number of people employed in it. This is where government must make greater efforts to eliminate global restrictions on competition.

**K. Thannbichler:** In Germany, concrete is usually given preference over all-steel structures for building and bridge projects. This has had a long tradition and starts with the training of engineers and architects. Steel has a poor lobby here. Standards and codes are overly cautious when it comes to steel. In many public bidding procedures, concrete is still the material of choice and steel constructions aren't even considered. Yet the numerous crumbling concrete bridges dating back to the Sixties and in need of refurbishment ought to have opened the eyes of public clients. Things could be different, for in Britain and the Netherlands, steel enjoys equal status in the building sector. A change of heart in the public sector is long overdue. Over-zealous carbon reduction policy on the local level must not distract attention from the global carbon footprint.

**M. Westhoff:** Or let's take EEG apportionment. In connection with the energy turnaround, Germany's Federal Government is pursuing its goal of raising the share of regenerative energies. This is all well and good, but it ultimately results in the apportionment-

financed subsidization of regenerative energy generation, which has meanwhile become detrimental to electricity price trends and is damaging our international competitiveness. Government must find a mechanism that doesn't burden companies excessively and at the same time provides a sustainable incentive to investment in environmentally beneficial technologies. This general framework must be coordinated across Europe. And it must be immune to global economic upheaval.

Nationally, we're finding increasingly that tasks previously handled by the public authorities have been handed over to industry. The State with its supervisory functions is stepping back and leaving this to private enterprises. This privatization of tasks slows down project handling, wastes resources, and generates considerable costs.

**To what extent does belonging to the Salzgitter Group affect sustainability efforts?**

**M. Westhoff:** Salzgitter AG supports the lively exchange of information between the companies – among other things in the form of cross-company workshops. In today's information society, knowledge can give us a competitive edge. Sustainable companies disseminate their knowledge.

**L. Rosiepen:** The problems facing us, such as those due to demographic



change, were identified and addressed about ten years ago at the Salzgitter Group. Processes and strategies have been set in motion that support us and help to counter the challenges of the future. We're benefiting from this.

**Thannbichler:** By participating in industry associations, the Group is also trying to bring its influence to bear on the initiation and shaping of laws, targets, and business conditions on the European level. We at Salzgitter Mannesmann Line Pipe also benefit from this.

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**Where do you currently see the biggest challenges for Salzgitter Mannesmann Line Pipe in terms of sustainability?**

**L. Rosiepen:** To achieve sustainability in human resources, we have to close ranks with senior management and the various people in executive positions. We

achieve this by developing, coordinating, and modifying the respective strategies in interdepartmental work groups.

**M. Westhoff:** On the basis of the performance indicators in occupational safety and health protection, and in the light of energy and raw material consumption, we regularly analyze key areas by investigating the causes of accident hotspots and excessive consumption levels. From the results, we set goals that are coordinated at management level interdepartmentally and across locations. Experts are awarded responsibility for their implementation. Management control lies in the hands of managers who report to senior management.

**How do you set your objectives and coordinate and implement your activities?**

**L. Rosiepen:** As already mentioned, the steel industry is in the throes of major change. The image of the whole industry as an attractive employer could suffer in the long term. Countering this and persuading young job seekers of the benefits and prospects of a job at

Salzgitter Mannesmann Line Pipe is undoubtedly one of the current main tasks. But I'm very confident that we shall succeed, particularly thanks to our membership of the Salzgitter Group.

**K. Thannbichler:** Our employees in sales have to convince our customers every day that they are getting from us not only a better, but also a more durable product. Unfortunately, this is in some cases only possible with higher costs at the start of the product life cycle. Sustainability, particularly from the economic point of view, only manifests itself after 50 or 100 years. It's therefore all-important to communicate the added benefit that they get from us in the form of better service, such as expertise, personal presence on site, delivery performance, logistical services etc.

**M. Westhoff:** We have to do everything we can to offset rising energy prices in Germany so that we can hold our own internationally. Against this backdrop, we have to exploit our full creativity in actively shaping the energy turnaround. It's not a question of asking the questions but of delivering the solutions.

## The interviewees



**Lutz Rosiepen, Head of Human Resources**

Lutz Rosiepen studied business administration, majoring in HR management and labor law at the University of Siegen. After various positions in human resources departments in SMEs in the metalworking sector, he has been Head of Human Resources at Salzgitter Mannesmann Line Pipe since June 2006.



**Markus Westhoff, Technical Services Siegen**

Markus Westhoff is a graduate engineer (Dipl.-Ing. (FH)), technical business administrator (IHK), IRCA environmental manager und European Energy Manager (IHK). At the Siegen location, he was responsible for the introduction of environmental management in 2002. In addition to his work as environmental, waste, water protection, and fire officer, he is also responsible for the works suggestions scheme and, since 2012, for energy management at the Siegen location.



**Konrad Thannbichler, Sales Manager**

Born in Traunstein in Bavaria, 47-year-old business administrator Konrad Thannbichler has been working at Salzgitter Mannesmann Line Pipe in various sales positions for 12 years. He has recently become responsible for total global sales.



Technology Sustainability in jacket structures for offshore wind energy plants

## Automated node welding, maintenance-free corrosion protection

Besides components such as cable conduits, boatlandings and supply platforms, the main application for HFI-welded steel tubes in offshore wind energy plants is jacket structures. Salzgitter Mannesmann Line Pipe is currently involved in two innovations that can heighten the sustainability of these structures in an economically viable way.

In terms of power generation potential, offshore wind parks are significantly superior to their onshore cousins thanks to the wind speeds constantly prevailing on the high seas. At the same time, the conditions typically encountered during the construction and operation of such

plants place much higher demands on both people and materials. What started at the beginning of the millennium with initial test and research facilities has meantime evolved into an industry of high-tech products. Now that the technically feasible has been identified and ever larger and more

energy-efficient plants have been developed, the focus is on raising the level of economic efficiency.

The measures for increasing productivity and efficiency not only concern the wind turbines themselves, but also the manufacture of their foundation structures.



# 30 % cost reduction thanks to automated node welding



If jacket structures are to remain competitive vis-à-vis monopiles, industrial series production must replace manual fabrication. HFI-welded steel tubes from Salzgitter Mannesmann Line Pipe, which come in mill lengths of up to 18 m, are predestined for this strategy.

On 22 October 2015, the symposium "Offshore systems and components for wind energy towers" took place in Gdansk. Salzgitter Mannesmann Steel Trading Poland brought together some 50 attendees who were informed in detail about the savings potential achievable through the use of standardized tube diameters in conjunction with automated node production by welding robots.

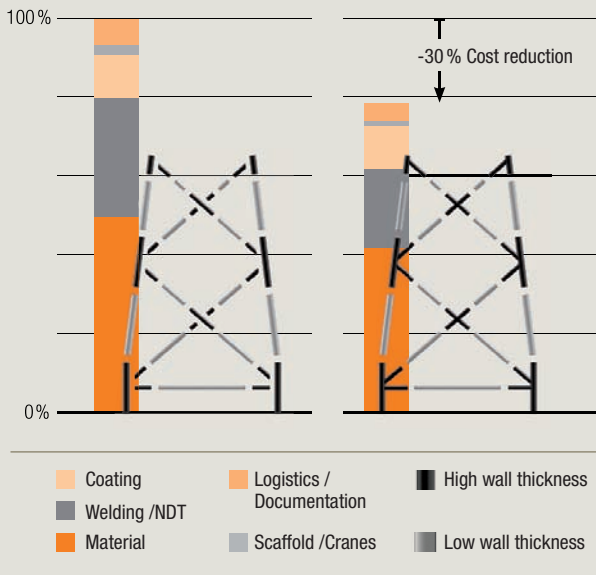
## Polish production plant opens up new possibilities

This was also an occasion to introduce the visitors to the new production plant for foundation structures which Bilfinger Mars Offshore (BMO) runs in Szczecin, Poland, and where automated welding has opened up completely new and much more economical options.

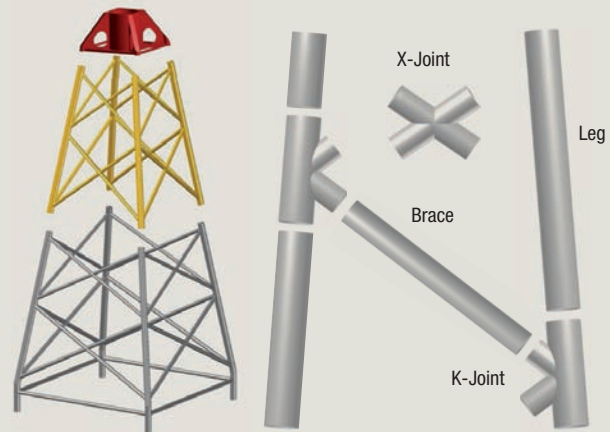
The plant put into operation in 2015 is entirely dedicated to the series

production of offshore foundation structures. A unique facility of this kind in Europe, it features a high degree of automation, state-of-the-art automatic equipment for series welding of nodes, a huge field warehouse and a gantry crane for the final assembly of structures up to 98m in height and 1,400 tons in weight. The crane is also used for loading the structures onto ships.

Cost advantages of 3- and 4-legged series produced jacket structures



The production cost of standardized jackets can be reduced by about 30 % compared to manually assembled structures. The biggest savings potential comes from the material and the weld count.



- Top Section: Flexible – Turbines 5-8 MW
- Middle Section: fixed
- Bottom section: adoption on the ground

In order to achieve a competitive jacket structure, BMO and Salzgitter AG have developed an innovative fabrication design and strategy, based on modular foundation design, standardized components and serial production principle.

[www.magazine.smlp.eu/en/bmo](http://www.magazine.smlp.eu/en/bmo)



Visit our website to watch the Bilfinger video showing the erection of the 120 m tall assembly crane.

Right:  
The premises  
of Bilfinger Mars  
Offshore in Szczecin,  
Poland



### Combination of tubes and production process sets new standards

The tight dimensional tolerances and the availability of tube lengths up to 18m make HFI-welded tubes from Salzgitter Mannesmann Line Pipe the ideal material for the new standard jackets. The enormous tube length means much fewer girth welds are needed within the jacket structure. This, in turn, reduces welding and testing requirements

significantly.

Dr. Stephan Brauser of Salzgitter AG: "Our calculations reveal that, with standardized structures, the production time needed for the nodes can be reduced by about 60%, and overall costs by about 30% compared with manual one-off production."

Additional advantages of automated K- and X-joint welding and prefabrication of the jacket legs are fewer flaws and much easier test documen-

tation. The nodes are made in dimensions of up to 4 x 4 x 4 m and weights of up to 10t. The entire production process as such is designed for jacket heights of up to 85 m, a base size of 27 x 27 m, and weights of up to 1,250 t.

"This means we are setting new standards regarding the cost effectiveness and speed of jacket structure production for offshore wind energy plants," says an upbeat Stephan Brauser.

## Maintenance-free corrosion protection for foundation structures

Besides economical production, corrosion protection also plays a key role when it comes to the sustainability of jacket structures. Salzgitter Mannesmann Line Pipe has been closely involved in the development of a totally new protection strategy based on a polyamide 12 coating.

Offshore wind energy plants work under harsh weather conditions. Wind, waves and UV radiation create punishing loads, and corrosion induced by salt water attacks structural components such as tubes and nodes. The anti-corrosion coatings used until now on offshore foundation structures were not designed for a service life of 20 to 25 years and hence needed considera-

ble maintenance under the described conditions.

"What's more, conventional coatings based on epoxy resins are quite time-consuming, as they have to be applied in several layers, each of which must set and harden," pointed out Hanno Schnars, at the start of the project responsible for the KOWIND project at the Fraunhofer Institute for Wind Energy and Energy System Technology (IWES). KOWIND stands for Korrosionsschutz für Offshore-Windenergieanlagen, which



Left: Fatigue test on a hollow section node: Test set-up on a multi-axial testing machine (span) at the test center for load-bearing structures, Hannover.

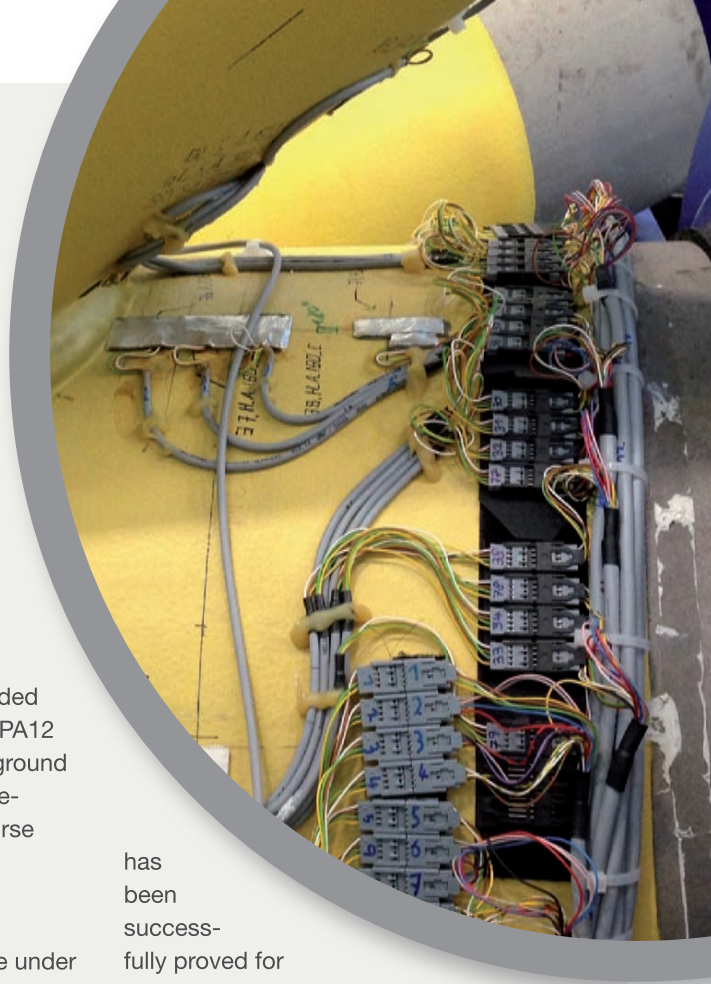
© Photo jan.meier / Fraunhofer IWES, 2015





*The efficiency of the new corrosion protection strategy has been successfully proved for large components as well.*

*Mareike Collmann,  
Fraunhofer Institute for Wind Energy and  
Energy System Technology IWES Northwest*



is German for Corrosion Protection for Offshore Wind Energy Plants. Besides the IWES, partners in the project sponsored by the German Federal Ministry of Education and Research include the chemical companies Evonik and TIB Chemicals, Salzgitter Mannesmann Line Pipe, the engineering firm Prof. Bellmer, the research institute IFINKOR, and the University of Duisburg-Essen.

**Maintenance-free protection for 25 years**

The objective of the project is to coat the tubes and components of offshore foundations with a thermoplastic layer of polyamide 12, in order to ensure maintenance-free corrosion protection for 25 years. Significantly longer intervals between inspections, more economical production of the foundation structures, and substantially lower operating costs due to reduced maintenance requirements also played an important role in the research project.

**Corrosion protection based on polyamide and PUR coatings**

Within four years, the project partners developed a corrosion protection strategy for welds and node structures, which – unlike tubes - cannot be coated using the extrusion technique. Dr. Hans-Jürgen Kocks, who was involved in the project on the side of Salzgitter Mannesmann Line Pipe, explains: "To start with, the component to be coated is shot-blasted to the ap-

plicable specification and provided with a primer that matches the PA12 coating. Subsequently, a cold-ground UV-stable PA12 powder is flame-sprayed onto the primer, of course also to tested specifications."

**Tests on the demonstrator**

For verification of the resistance under dynamic loads, especially in the weld areas, a hollow section node in a double-K configuration was chosen as a test specimen. Scaled approximately 1 : 2.5, it was subjected to robustness and fatigue tests. A tangential brace was subjected to sinusoidal oscillations, which created a real mechanical load that acted not only on the steel structure, but also on the coating. No peeling was observed during the fatigue test. In order to document potential progressive damage to the steel structure, more than 80 strain gauges were applied in the weld area, which is particularly susceptible to fatigue.

**Positive upshot of the project**

"A registered increase – or drop - in strain could have indicated signs of cracking and thus initial damage," is how Mareike Collmann from IWES explained the testing technique. Under the load level defined in the project, there was, however, no abnormality observed in the steel node structure nor in the coating throughout the duration of the test. "So the efficiency of the new corrosion protection strategy

has been successfully proved for large components as well," is Mareike Collmann's positive conclusion.

Thomas Elzenbaumer, Regional Sales Manager Structural Tubes Wind Energy Projects at Salzgitter Mannesmann Line Pipe: "With the new corrosion protection strategy, we are putting a tailored, sustainable innovation at our customers' disposal. Within the framework of KOWIND, it has been possible to define the requirements on an extruded PA12 coating in a detailed mill standard, which is now available to our customers as a technical delivery condition, and that constitutes a contractual basis. At the same time, this standard prepares the ground for the certification of this maintenance-free corrosion protection for offshore jacket structures."





### Project Expansion of Mallorca's gas network

# Reducing energy costs, creating jobs, meeting environmental standards

In 2008, Spain prepared the way for the expansion of the gas network in Mallorca, with three objectives in mind: Firstly, reduce annual energy costs caused by tourism by over 9 million euros; secondly, enhance the stability of the power grid and thus encourage the establishment of new industrial enterprises; and thirdly, implement the environmental protection regulations of the EU.

To enable the expansion of the gas network on the Balearic Islands, Mallorca and Ibiza had to be connected to it via a 320 km natural gas pipeline from the Spanish

mainland through the Mediterranean Sea. Construction work for the "Gasoducte Península-Illes Balears" project was started in 2008 and completed in 2010. Commission-

ing of the new pipeline marked the achievement of the first subgoal: the obsolete coal-fired power plant Central Tèrmica de Sant Joan de Déu in Palma was closed down.





Left: Pipes laid out along the Ma15 near Sa Casa Blanca, in the vicinity of the airport of Palma de Mallorca

Right: The combined-cycle power plant Cas Tresorer in Palma de Mallorca is fired with natural gas. From here, the new pipeline will be extended up to Felanitx.

Bottom: Welding work on the new natural gas pipeline from Palma de Mallorca to Felanitx.

*Besides significant cost savings for the consumers, the expansion will also afford an enormous reduction in CO<sub>2</sub> emissions.*

**Network expansion in several phases**

A further important step was the expansion of the gas network north of Palma de Mallorca between the combined-cycle power plant Son Reus and the gas-fired power plant Es Murterar in Alcúdia in the northeast. For the construction of the 47 km natural-gas pipeline, the Spanish gas supplier contacted Salzgitter Mannesmann Line Pipe in June 2014 with an enquiry concerning a 10-inch pipeline in steel grade X42N.

"Right from the outset, the emphasis was on having the 2,340 tons of pipe in three wall thicknesses from 7.1 to 11.1 mm, delivered on time. It was absolutely essential for the project be started before expiry of the term for subsidies from the EU and from Madrid and Palma de Mallorca," says Paulo Santos, who was responsible for the project at Salzgitter Mannesmann Line Pipe.

**Complex logistics**

To start with, the bare black pipes had to be shipped to the Spanish coating plant Sert in Alegría in Northern Spain, where a flowcoat lining and an HDPE coating were to be applied. However, their transportation from Germany to Alegría was by no means easy and drove the logistics department in Siegen to the brink of despair.

At the Salzgitter Mannesmann Line Pipe representative Ecopipe in Barce-

lona, Alberto Simón and Rafael Vidal were responsible for the project. Alberto Simón: "Weekend and holiday traffic and parking bans in France created chaotic conditions for some of the deliveries to the Sert plant." Rafael Vidal adds: "But despite this, we kept all the deadlines and completed the project successfully for the customer."

Since March 2015, another twelve Mallorcan communities with some 135,000 inhabitants altogether have been linked up to the gas network thanks to the start-up of the pipeline. In addition, new areas have been opened up for industry. According to Redexis Gas, 250 new jobs have been created directly or indirectly.

**Immediate follow-up order**

In April 2015, a new project was tackled with the aim of connecting the communities between Son Malferit and Felanitx in the southeast of Mallorca to the network in the spring of 2016. In this case, Salzgitter Mannesmann Line Pipe supplied 60km of 16- and 12-inch pipes in steel grades X60M and X42N and with wall thicknesses of between 7.1 and 12.7 mm. In all, 4,180 tons had to be kept ready and delivered in two instalments, the first of which arrived at the Sert location in Alegría

by early September and the second in December 2015.

**Target in sight**

With the two pipelines commissioned, the expansion of natural gas supplies in Mallorca is progressing further. By 2018, 630,000 households on the Balearic Islands are to be linked up to the natural gas network. Besides significant cost savings for the consumers, the expansion will also afford an enormous reduction in CO<sub>2</sub> emissions.

Since the power grid is operated independently of the mainland grid, the linked-up power plants ensure a more stable power supply in Mallorca, which is essential if new industrial enterprises are to set up new sites and create new jobs on the island.





At the invitation of NEW Netz, interested representatives of other public utility companies had the chance to see the advantages of the plowing technique for themselves live on site.

Technology Laying a high-pressure gas pipeline using the plowing technique

## Conserving resources, cutting costs

A high-pressure gas pipeline, which conventionally requires time-consuming laying in two phases, has been installed in just four working days by using the plowing technique. This method is easy not only on the environment but also on the purse of NEW Netz GmbH.

NEW Netz GmbH operates the supply grids for electricity, natural gas and drinking water in Mönchengladbach and environs on the Lower Rhine. The grid for gas covers a surface area of 955 km<sup>2</sup> and supplies a population of some 645,000.

In February 2015, it became necessary to re-lay an existing high-pressure gas pipeline in Mönchengla-

dbach between the districts of Hehn and Herdt. Since the pipeline route crosses open terrain without any major slope, NEW Netz became the first energy service provider in the area to choose the plowing technique for laying the new pipeline.

At the start of planning, some 1,700 m of the total distance of 2,400 m was identified as ideal for the technique.

### Steel pipes with a two-layer coating of PE and PA

Salzgitter Mannesmann Line Pipe supplied HFI-welded steel pipes with a diameter of 273 mm and a wall thickness of 5 mm in unit lengths of 12 m. The pipeline in steel grade L245N was dimensioned for a maximum permissible operating pressure of 16 bar and given a 2.7 mm two-



## Plowing technique – benefits and potential

With over 20 years of experience of this special plowing technique IFK in Salzburg, Austria, has been and is considered Europe's technology leader in this sector.

Using the plowing technique, pipes with diameters of DN 40 to DN 600 can be laid down to a depth of 2.5 m in soil classes 2 to 5. Plowing through water bodies at depths of up to 1.5 m is also possible. In addition, IFK produces extensive documentation containing all the pipe-laying parameters.

### Advantages at a glance

- 20 times faster than a digger
- Up to 40 % cheaper than conventional pipe-laying
- Easy on the environment
- Reduction in trenches, excavated soil, soil transportation and damage to the land
- Very little disturbance of local residents



layer polythene coating with an additional 2 mm polyamide wear protection layer. The field coating of the weld area was also adapted to the pulling process and the polyamide coating.

### Laying using the plowing technique

The pipes were laid out along the 1.700m long route and welded into three strings on site. The joint areas were shot-blasted and subsequently field-coated by with HT80 by Kebulin.

Laying with a special-purpose Unimog vehicle and the pipe-laying plow was carried out by the Austrian company IFK, which has amassed over 20 years of experience with this method. The Unimog winched the plow which, in turn, pulled the welded pipe string at a laying depth of up to 2.5 m with millimeter precision along the planned



*With the plowing technique, we've set a new pipe-laying record.*

*Norbert Eber,  
Site Manager NEW Netz*



route and at the laying level. In the same cycle, two empty pipes for glass fiber cables were additionally laid in the furrow drawn by the plow. After plowing and detachment from the plowshare, the ends of the strings were welded to the rest of the pipeline and subjected to extensive testing.

### Pipe-laying record for NEW

NEW Netz Site Manager Norbert Esser: "Normally, the project would have had to be carried out in two phases at the

turns of the year 2014/15 and 2015/16. With the plowing technique, we've set a new pipe-laying record, completing the project in just four working days." Marion Hauschke, Director of Execution Planning and Construction at NEW Netz, is also delighted with the project. "As we didn't need any trucks or diggers, damage to the land that had to be remedied afterwards was reduced to a minimum." Esser's final comment: "After plowing, it almost looked as if we hadn't been there at all."



Left: The pipe-laying plow with a steel rope winch pulled by a special-purpose Unimog vehicle, which is capable of applying a tensile force of up to 250 t.



Technology HFI-welded steel pipe for cryogenic service

## Steel grade X8Ni9 replaces stainless steel in LNG transportation

More than 90 percent of the natural gas produced worldwide is distributed via pipelines. An alternative to this is transportation by sea using LNG carriers. With this mode, the natural gas is liquefied at  $-163\text{ }^{\circ}\text{C}$  and thus reduced to one 600th of its original volume. This places extreme demands on the pipes used for this purpose, which Salzgitter Mannesmann Line Pipe satisfies with the new steel grade X8Ni9.

To minimize energy requirements during transportation, the pipes must be given a close-to-perfect thermal insulation. The "FW-KAMMER PIPE" (Kammer is the German word for chamber) launched by FW-FERN-WÄRME-TECHNIK in 2012 has proved ideal for this application. It is a triple pipe-in-pipe system made up of a fully insulated inner pipe, a chamber pipe and a casing pipe. The chamber is under permanent vacuum, and the inner pipe features a high-grade cold

insulation coating. The first product generation had an inner pipe of stainless steel for LNG transportation at  $-163\text{ }^{\circ}\text{C}$ .

### Improvement approach Economic efficiency

To make the product more economical and attractive, Salzgitter Mannesmann Line Pipe developed a new steel grade for this application together with Salzgitter Mannesmann Flachstahl. Valentina Berger from the

Technical Customer Service (TCS) department of Salzgitter Mannesmann Line Pipe in Siegen: "We have profited from the experience of our sister company, where high-nickel alloys have been produced for years."

The hot wide strip was processed to pipe of the dimensions  $219.1 \times 5.0\text{ mm}$  at Salzgitter Mannesmann Line Pipe in Hamm. The specified product properties were achieved by a custom-optimized quench-and-temper treatment.





Left: Preparing the pipe sections for the construction of the test track

Right: The test track under construction on the premises of FW-FERWÄRME-GmbH



**HFI-welded pipes in grade X8Ni9 steel make our FW-KAMMER-PIPE more economical and more attractive for our customers.**

*Volkwart Harders, Owner of FW-FERNWÄRME-GmbH*

#### **New grade replaces stainless steel**

FW-FERNWÄRME-TECHNIK installed the X8Ni9 pipes as inner pipe in its FW-KAMMER PIPE. For the chamber pipe, material numbers 1.4301/1.4307 were used and for the casing pipe P355NL with a polyethylene corrosion protection coating. The components of FW-KAMMER-PIPE also have different coefficients of thermal expansion, given the different materials and the temperature profile under operating conditions: inner pipe: -196 °C; chamber pipe: -17 °C to +5 °C, and casing pipe: -3 °C to +8 °C.

"If the KAMMER-Pipe were made entirely of 1.4301/1.4307 steel, the pipeline would undergo extreme contraction under operating conditions," explains Project Manager Michael Stille, who was responsible for the test track on the FW FERNWÄRME-TECHNIK premises. "In practice, this would lead to significantly higher costs as we would have to buy compensating elements. The use of dissimilar materials for the pipes has substantially reduced contraction between the chamber pipe and the inner pipe."

The new inner pipes in grade X8Ni9 steel have much higher strength levels than the previously used stainless steel ones. This allows for increased operating pressures despite thinner pipe walls.

#### **Simulation track with 100 measuring points**

For test purposes, FW-FERNWÄRME-TECHNIK laid an almost 50 m long simulation pipeline on its premises. This was filled with liquid nitrogen and cooled to an operating temperature of 196 °C over several weeks. The entire pipeline – chamber, casing, pipe bends, fixing points, bearings and tangent lengths – was fitted with measuring sensors.

Michael Bick, who cooperated in the development of the quench-and-temper treatment at Salzgitter Mannesmann Line Pipe in Hamm, was more than satisfied with the test results: "At 196 °C, the new inner pipes revealed a toughness of over 80 J. The specified level was 40 J. At about 600 MPa, the yield strength was also significantly above the required 490 MPa."

Michael Stiller of FW FERNWÄRME-TECHNIK confirms: "The outcome of the tests is that we can in future substitute HFI-welded pipes in X8Ni9 for the stainless steel pipes previously used on the LNG pipelines. This makes the product more economical and more attractive for our customers."

Yet another good example of how innovative product improvements can lead to more sustainable solutions.



### **What is LNG?**

LNG (liquefied natural gas) is produced by cooling natural gas to a temperature of 163 °C. During this process, it is converted to the liquid state and its volume reduced to about one 600th of its original gaseous state. This means LNG can be transported safely and economically over long distances from remote regions even without a pipeline. Liquefaction or the reverse process – regasification – takes place in LNG terminals. Once the LNG has been pumped to an onshore terminal and returned to its gaseous state, it can be readily fed into a pipeline.



The roughly 3,200-year-old statue of Ramses II will welcome visitors in the foyer of the new museum. The upper floor accessed via a huge staircase offers a breathtaking view of the pyramids of Giza.

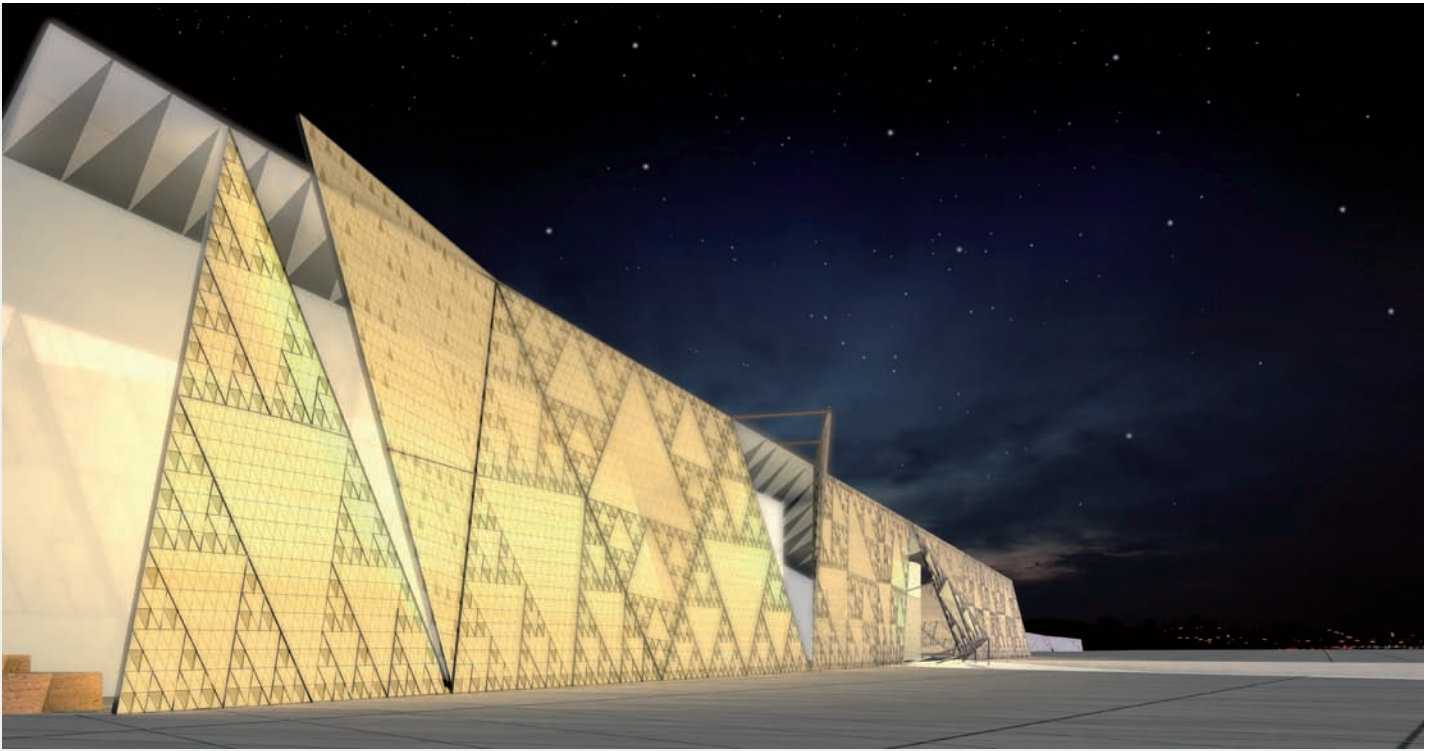


### Project Grand Egyptian Museum, Cairo

# Museum for the third millennium

The Giza pyramid complex ranks among the best-known and oldest preserved building structures of humankind. And, under construction in its immediate proximity is the Grand Egyptian Museum, currently the world's biggest new museum building. Being used in the project are round and square MSH sections from Salzgitter Mannesmann Line Pipe.





The translucent façade of the new museum will be used for spectacular light effects. Image © www.archimation.com

The plainness of the architectural design and the perfection in the execution of the Egyptian pyramids have become iconic of the fascinating Age of the Pharaohs and, over 4,500 years after their construction, have lost nothing of their magical appeal. The still-continuing investigation of the structures, statues, tombs, mummies, sarcophagi and grave goods creates plenty of scope for theories and conjecture and is constantly yielding new findings.

#### **Under the spell of history**

So it is hardly surprising that Ancient Egyptian history has cast its spell on so many people, drawing millions of people from all corners of the globe to Egypt's heritage sites. Among these are not only the pyramids and the Sphinx, but also the Egyptian Museum in Cairo. Even today, it is still the world's biggest museum of Ancient Egyptian art, attracting some 2.5 million visitors per year. Opening in 1902, it provided sufficient space, by the standards of the day, for the numerous finds and exhibits from about 4,000 years of Egyptian cultural history. However, the historic building has not been

spared by the ravages of time and falls short of contemporary standards of exhibition practice and artefact conservation. Even the spectacular treasures from the tomb of King Tutankhamun from the finds of the archaeologist Howard Carter dating from 1922 cannot be presented in context. Only some 1,700 of the estimated 3,500 objects can be exhibited. And yet it is precisely this exhibition surrounding the brief reign of the pharaoh of the 18th dynasty that is one of the biggest crowd-pullers of all. Consequently, there have long been moves to create a contemporary museum commensurate with the extent of the exhibits.

#### **New building outside Cairo**

However, it was clear from the outset that a new building of the envisaged size cannot be accommodated in Cairo's center. So there has been a search for a location with historic ties, and this has been found in the immediate vicinity of the Giza pyramids and not far from the Nil. The foundation stone for the ambitious project was laid by the then President Muhammad Hosni Mubarak. It is hoped that

the new museum will have a charismatic appeal for visitors that does justice to the scale and size of the some 100,000 exhibits, but without upstaging the pyramids and the Sphinx.

#### **Competition of superlatives**

The open architectural competition received a total of 1,557 entries from 82 countries in 2002, making it one of the biggest architectural competitions to date worldwide. In the second stage, 20 entrants were given the opportunity submit additional information. On June 2, 2003, the competition jury chose the elaborated design from architects Heneghan Peng in Ireland as the winning design. Similarly plain and ingenious as the nearby and visible pyramids, this design stands out

The meanwhile 114-year-old Egyptian Museum in Cairo has not been spared by the ravages of time.





with its use of the triangle as its primary design element. Building on this, the design succeeds in converting the 800 m long main façade into a delicate, translucent and openable exterior membrane by using the Sierpinski triangle. As a result, an interior outer space is created within the building that skillfully links the forecourt with the building interior, subjecting the concept of the foyer to a new interpretation.

#### 16,000 visitors per day

The museum will contain about 93,000 m<sup>2</sup> of exhibition space – about a third more than the Louvre in Paris. Up to 16,000 visitors are expected to flock through the exhibitions each day – equal to approximately 5 million per year and thus twice as many as until now. All the same, the new building will be so spacious that a sense of

overcrowding can hardly arise. But it is not only the size and design that stand out, for the project's cost is also setting records. The building will house not only the exhibition space proper, but also storage rooms and archives, a conference center and a children's museum. The restoration workshops alone will account for about 7,000 m<sup>2</sup> of space. Also included are restaurants, cafés and ancillary buildings such as the museum's own power generator and fire department. Not to be overlooked is the extensive landscaping of the roughly 50 ha of park-like grounds. The construction costs are currently put at around 1 billion US dollars.

#### Construction in three stages

The realization of this mega-project has been divided into three stages. The initial preparation of the site got

underway in 2006. The first buildings and infrastructure measures were completed by 2008. Work on the museum itself has been in progress since 2013. A so-called "soft opening" is scheduled for 2018. By then, about a third of the exhibition space will be accessible to the public. But it's early days yet. The Director of the GEM Tarek Tawfik has been quoted with the words: "Sometimes I feel like we're building the fourth pyramid here."

#### The challenge of the façade

The façade is certainly one of the biggest challenges. It consists of MSH sections that frame the light-permeable, large-area stone panels. The façade's ornamental character stems from the subdivision of the 30 m high triangles on the Sierpinski principle. For this, the overall area of the equilateral triangle is divided equally into four smaller triangles. The central triangle remains undivided, while the system of division is applied again to the corner triangles. The triangles thus become progressively smaller, and the large initial pattern is reiterated in the smallest triangles.

The development of a lasting structure and the façade's construction with the delicate stone panels, transport to the construction site, plus assembly



Behind the entrance façade, the museum building is organized in various functional areas such as exhibition area, conference center and children's museum.  
Image © hparc.com



locally certainly rank among the most exacting and difficult processes of the entire project. On completion, spectacular light effects will be achieved both inside and outside due to natural light and artificial illumination.

**Maximum flexibility in terms of procedure, handling and supply**

Responsibility for the design of the 800 m long and up to 30 m high exterior membrane lies with Arup, the internationally renowned firm of engineers with 92 offices in 37 countries. Steel fabrication work is handled by National Steel Fabrication (NSF) based in Cairo, to which Salzgitter Mannesmann Line Pipe, through Vallourec and ThyssenKrupp Mannex, has supplied round and square MSH sections between 114.3 and 406.4 mmm in diameter and with wall thicknesses of 3.6 to 20 mm. "In addition to the higher yield strengths that were required, the most important factor was flexibility in terms of the procedure, handling and deliveries," says Guido Ludwig, who supervised and coordinated the order for Salzgitter Mannesmann Line Pipe. "The timing of the delivery dates for the project was extremely tight for each construction phase. Our deliveries had to be precisely coordinated for further processing at NSF so that the materials needed for the next phase of

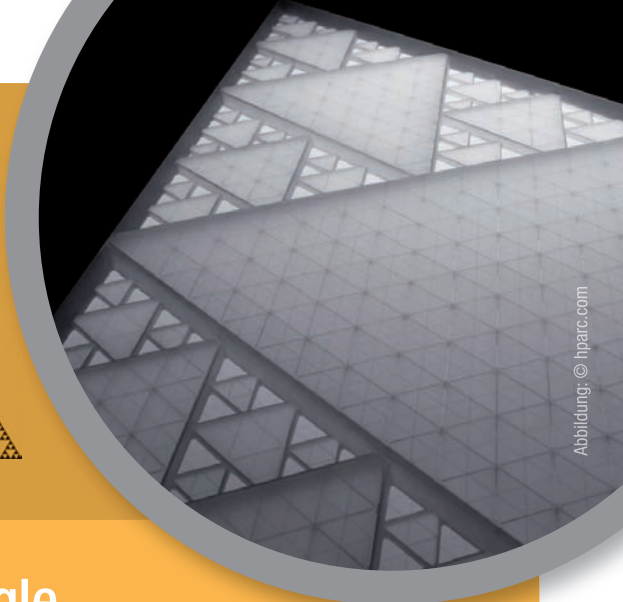
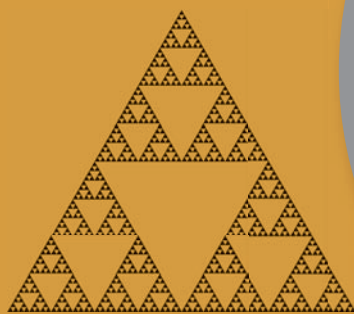


Abbildung: © hparc.com

## Sierpinski triangle

**Main design element of the 800 m long and up to 30 m high façade**

The Sierpinski triangle, a self-similar subset of a triangle, is a pattern described by Polish mathematician Waclaw Sierpinski in 1915. If an equilateral triangle is divided equally into four equilateral triangles whose corner points are located in the middle

of the sides of the original triangle, the subsets in the three corner triangles are scaled copies of the overall pattern without the central triangle. This division into scaled copies can then be repeated over and over again in the corner triangles.

construction were always available," he recalls. Very useful, he feels, was the good communication between those in charge at Salzgitter Mannesmann Line Pipe, Vallourec and ThyssenKrupp Mannex.

Till Burgsmüller, who was responsible for the project on behalf of Vallourec, had to be available to the customer virtually around the clock for the entire duration of the project and of deliveries, even on public holidays and at Christmas.

"The swift and direct communication among all those involved in the project streamlined the process enormously and made the whole thing a success," says Ludwig, adding: "Of course no one can say whether the museum will last as long as the pyramids. Maybe our steel tubes and MSH sections will be dug up by archaeologists in four to five thousand years and give rise to intriguing speculation about the significance of the Sierpinski triangle ..."



The construction project has been divided into three phases. The Conservation Centre and a number of ancillary buildings have already been completed and are now occupied. A so-called "soft opening" for the museum has been scheduled for 2018. By then, roughly a third of the exhibition space will be accessible to the public. Photos © www.gem.gov.eg



**2. Chile** At the end of the world – Markus Ketelhut during the unloading of gas line pipe in Punto Arenas



**3. Germany** Customer event Gas/Oil Line Pipe in Siegen on November 5 to 6, 2015



**1. Canada** Talk »Pipe to Bends« on October 28, 2015 in Calgary



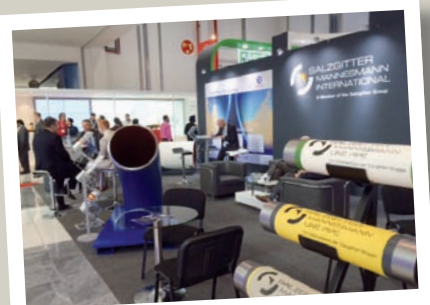
**8. Bolivia** Visiting delegation from YPFB Transporte S.A., Bolivia, in Siegen, February 2016



**7. Italy** Michael Kosfeld and Andrea Jachetti (Sintertec srl) on the construction site for a DN 500 high-pressure gas pipeline near Monte Casino



The pipe-laying contract was awarded by Società Gas Italia (SGI)

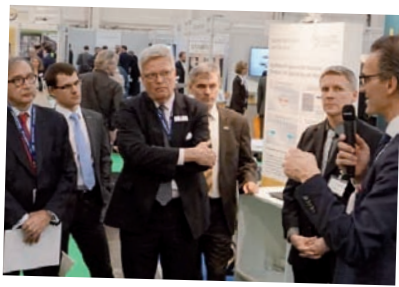


**6. Abu Dhabi** Adipec trade fair, November 9 to 12, 2015



# On the go – from global to local





**3. Germany**  
Visitors at our trade fair stand at E-world energy & water in Essen, from February 16 to 18, 2016



**3. Germany** Visitors at our Sieg plant on March 16, 2016 during the pipeline seminar of TÜV Rheinland



Starting off on a guided tour of the plant with seminar attendees



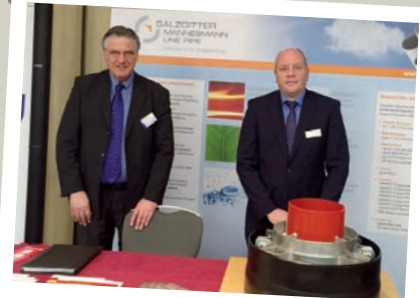
**4. Poland** Technical symposium »Offshore systems and components for wind energy towers« in Gdansk, October 22, 2015



**5. France**  
Olivier Boinot and Vincent Bertolone visiting a construction site for an offshore pipeline in Berre near Marseille



Offshore pipe-laying operations



**5. France** Frank Meyer and Michael Bick at the International LNG Summit in Cannes, March 7 to 8, 2016

**Legal notes**

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