

# **i**NDUSTRIAL PLANTS

May 2018

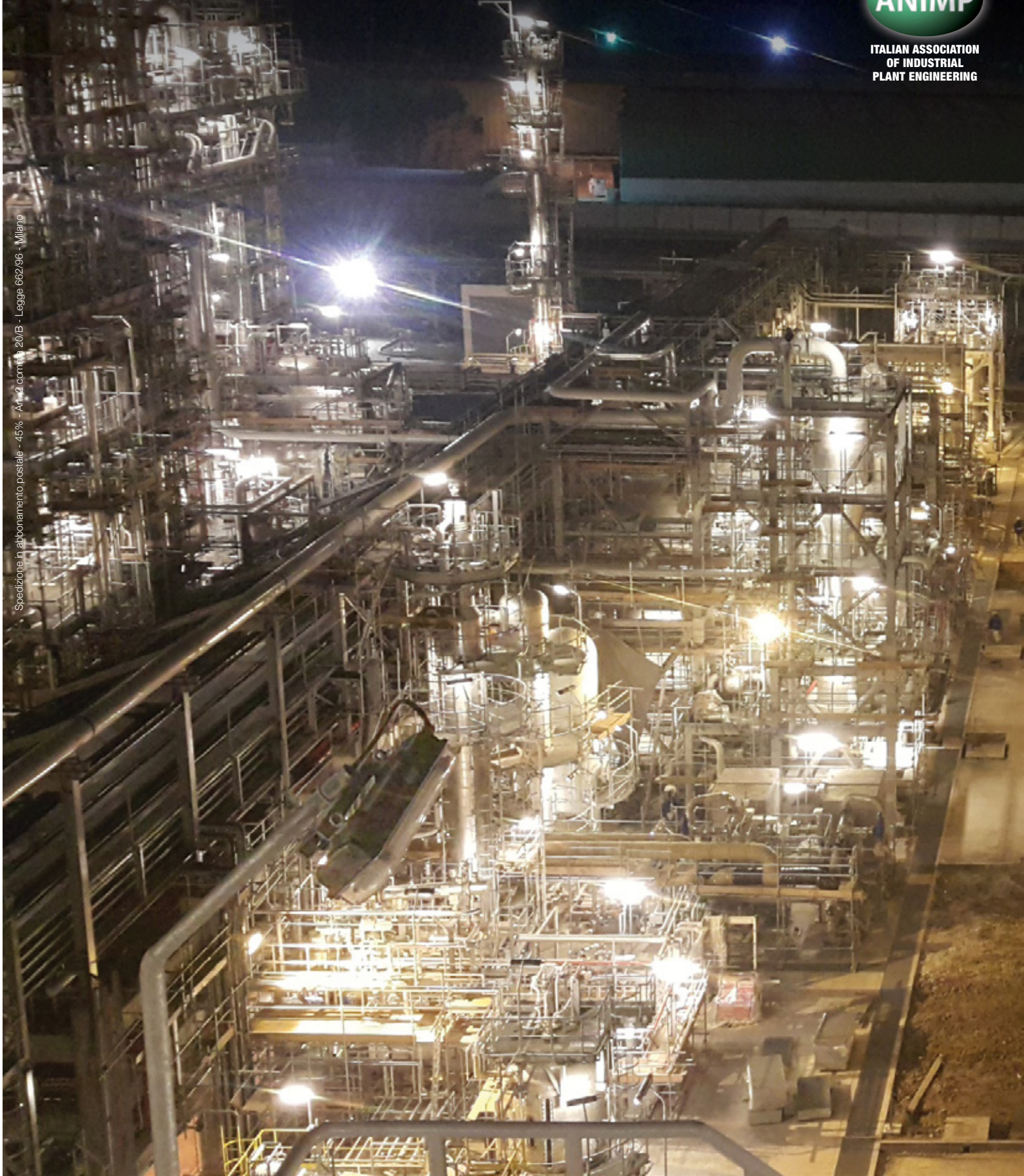
ITALIAN ENGINEERING, CONTRACTING AND PLANT COMPONENTS SUPPLIERS



ITALIAN ASSOCIATION  
OF INDUSTRIAL  
PLANT ENGINEERING

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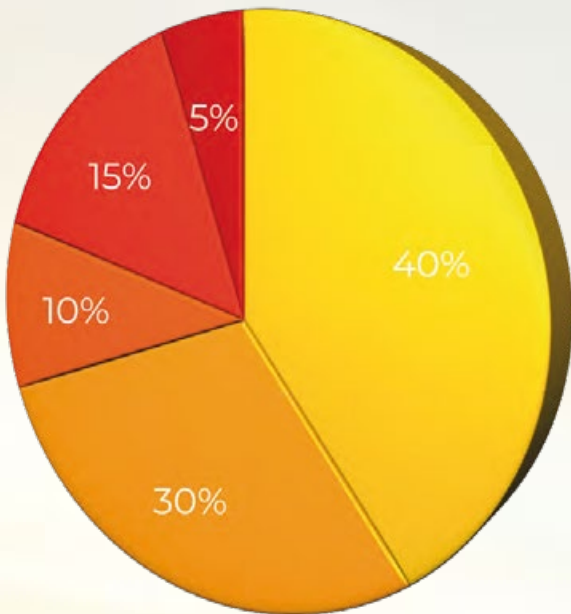


# XYLEM

The Application of Risk Quality Management  
during Construction

***Your Project, Our People.***

***“We go above and beyond the clients’ expectations.”***



- Cons. Infrastructure
- Cons. Oil&Gas
- Commissioning
- Other
- Maintenance

### **Geographic location**

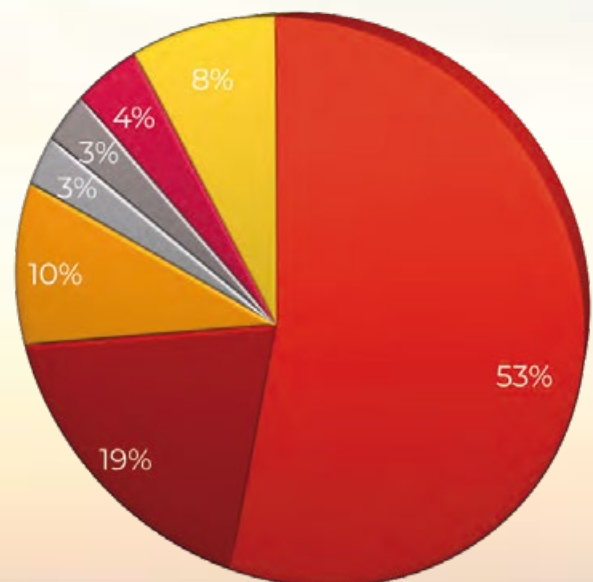
Beside the Mediterranean area, where the company started its activity, the area of operation has been constantly expanded, thanks to cooperation agreements and acquisitions. Nowadays Xylem can render its services everywhere in the World.

The operations have been executed in the following geographical areas:

### **Current Operations**

Initially established as a Quality and Inspections Consultancy company in the sector of Oil&Gas, Xylem acquired over the years further experience and competence to meet the specific skilled needs of the complete industrial market. This additional experience lead the company to expand the range of services.

Process, Power, Pipeline and Mill contractors are the core of Xylem business.



- GCC
- Africa
- EU
- Form. U.S.S.R
- South America
- Far East
- U.S.A.

## Plant Experience

- Pipeline Construction
- Process Plants
- Power Generation (Gas, Hydro, Steam)
- Civil - Road - Rail Construction
- Mill Plants
- TurboMachinery

## Main Skills

- Supply Chain Management
- Execution & Supervision of Installation
- Pre-commissioning
- Commissioning
- Start-up
- Operation and Maintenance
- Project Management
- Quality Management
- Document Control
- Construction Management
- Warrenties Management
- Shipping Coordination
- Root Cause Analisys
- Crisis & Risk Management
- Worldwide QC Inspection Coordination



# XYLEM

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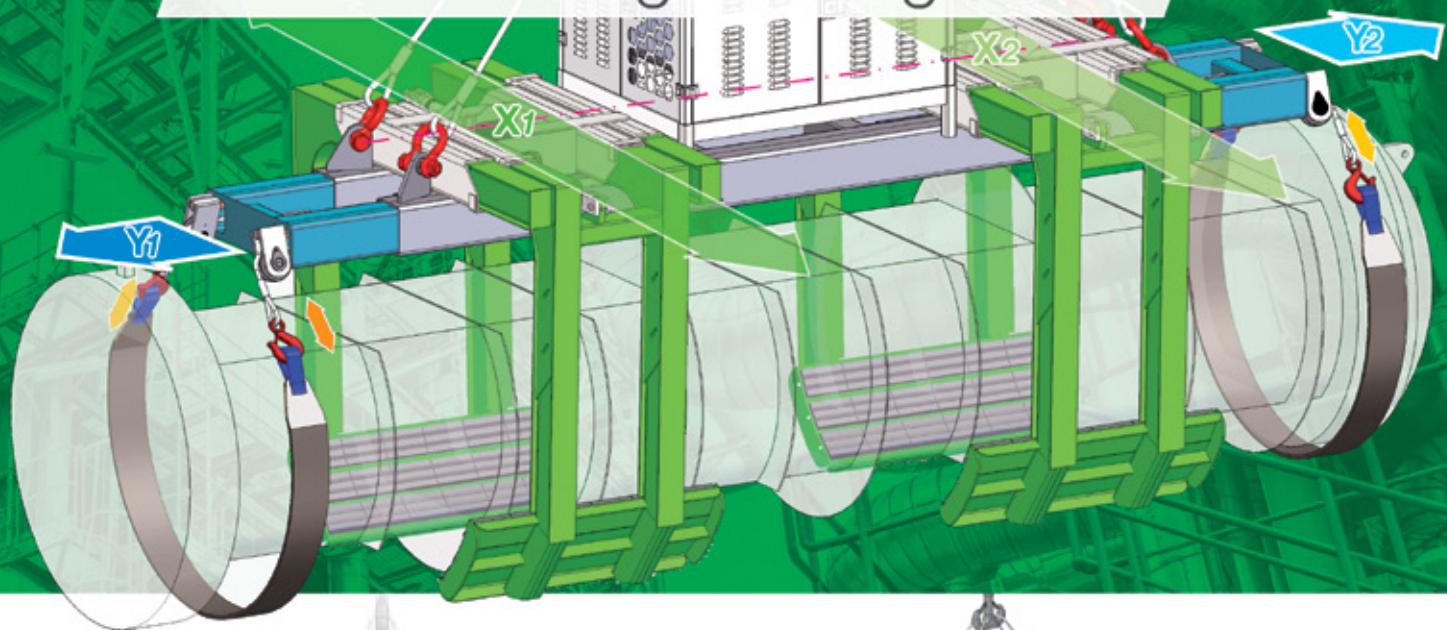
Patent pending

# BundleTutor 1500

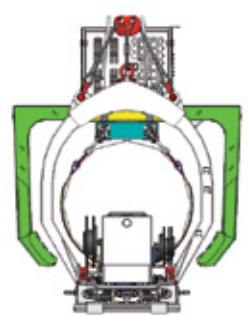
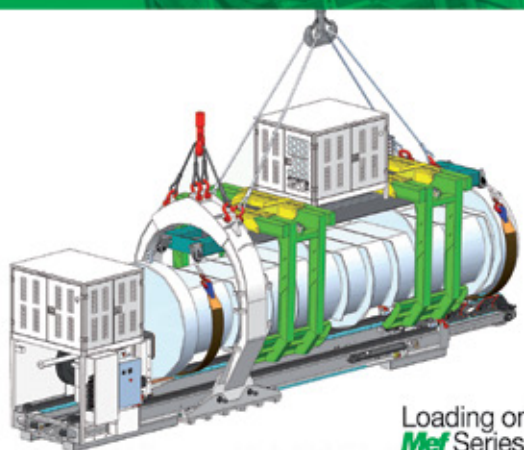
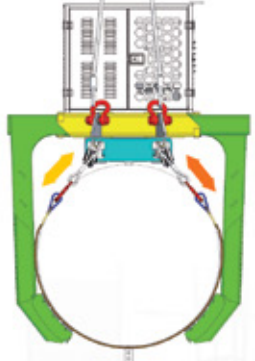
Multi grab quick lifting machine for protecting the tube bundle during handling



giovaredi



**Ex** ATEX certification on request



Loading onto and unloading from **Mef** Series tube bundle pullers

Maus Italia can also offer:

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- Tube bundle hydro-jet cleaners
- Tube bundle saw machines
- TIG orbital welding equipment
- Internal single tube cutters
- Tube extractors
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- Tube expanders



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26010 BAGNOLO CREMASCO (CR)  
ITALIA

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2015 ÷ 2018

updated in May 2018

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**WEG ITALIA SRL** – CINISELLO BALSAMO (MI)  
**WEIDMULLER SRL** – CINISELLO BALSAMO (MI)  
**WEIR GABBIONETA SRL** – NOVA MILANESE (MI)  
**WEIR MINERALS ITALY** – CERNUSCO S/NAVIGLIO (MI)  
**WOLONG EMEA SRL** – MILANO  
**XYLEM SRL** – S.AMBROGIO DI TORINO (TO)

*Square shaped beam LED floodlights collection*

# PURE LIGHT







Thanks to the “square shaped beam” optics, the explosion-protected floodlight SLED series of Cortem Group ensures a uniform illumination over large spaces, both indoors and outdoors. Characterized by high light output with a white light and a colour rendering index greater than 70, they are able to replace the sodium vapour or metal halide floodlights, ensuring the quality of the light, energy saving and visual comfort.



**SLED-600**  
30.800 lm

**SLED-400**  
20.750 lm

**SLED-250**  
13.050 lm

-  **II 2GD Ex de IIB+H2 method of protection for environments with the presence of hydrogen**
-  **High luminous efficiency**
-  **Energy saving**
-  **Optimization of plant engineering and maintenance costs**
-  **Cool White LED, color temperature 6.500 K**
-  **Long Term Performance**

Zone of installation 1, 2, 21, 22 | ATEX/IECEX/TR CU certificates  
Class temperature T5 (100°C) T6 (85°C) | Degree of protection IP66  
Power supply 100-277 Vac ±10% and 120-277 Vac ±10%

## Enhanced offering from the Italian Engineering and Contracting Industry



**Claudio Andrea Gemme**  
ANIMP President

I am pleased to introduce also this year *Industrial Plants*, ANIMP's yearly publication for international audiences, which highlights a selection of our industry's recently completed projects or of those currently under execution, both in international and domestic markets.

Indeed, promoting growth, development, innovation and international cooperation are the main goals of ANIMP, the Italian Association of Industrial Plant Engineering Companies, which includes Engineering and General Contractors, plant component manufacturers, service suppliers as well as universities, with the main focus on designing and building large industrial plants in every corner of the world. Today, ANIMP has over 500 members and for more than 45 years we have strived to develop a world-class supply chain, competitive globally in any industrial plant market.

Following the market contraction in 2014, a direct consequence of the oil price collapse, our industry has restructured extensively, significantly cut costs and improved the efficiency of the overall supply chain and of the project delivery process, in order to return to profitability and growth in today's 'New Normal' market reality. This was done by leveraging on the traditional and well-known resilience and fle-

xibility of our industrial system and related supply chains, and particularly on our companies' expertise in project management in complex environments and generally under difficult conditions. The success of these turnaround programs is witnessed by the recent surge of new big orders for mega-projects in key pivotal markets, onshore and offshore.

**Recent awards of pivotal mega-projects witness the success of the turnaround and cost-cutting programs of Italian industrial players**

But, at the same time, our industry has also embraced new trends, particularly in the energy markets, where we see numerous 'transitions' under way: our companies have scored significant new achievements in advanced projects aimed at producing energy from renewable energy sources on a very large scale, e.g. in Egypt or in the North Sea, respectively for power production plants from large photovoltaic or wind-offshore installations. In the domestic market, efforts are under way to build new solar power plants positioned on old, decommissioned industrial sites; to produce

ever cleaner fuels in bio-refineries etc. At the same time, in order to enhance the competitiveness of our industrial system and to offer a broader range of services, in recent years we have seen an enhanced role of Sace Simest, the financing arm of CDP (Cassa Depositi e Prestiti), the national promotional institution that has supported the Italian economy since 1850 as the financier of public investment, supporter of international cooperation and catalyst for the country's infrastructure growth. Sace Simest offers a wide range of financial and insurance products and services to support the Italian businesses, e.g. the assessment, assumption and management of risks associated with operating in foreign markets, as well as the acquisition of stakes in the share capital of companies abroad.

Last year has seen a significant increase in Sace Simest's budgets and activities: opening

A significant increase in Sace Simest budgets, financing and credit insurance activities enables Italian Companies, large and small, to be fully competitive on the global scene with a more complete product/service offering

of new credit or guarantee lines, agreements with key industrial and financial players, creation of mechanisms etc., whereby also smaller Italian suppliers can take advantage of these services in order to broaden their product/service offerings.

In this way, the overall Italian industrial system can offer a larger and fully competitive portfolio of services for international markets.

All in all, we continue to look at the future with renewed optimism. We

also continue to be grateful to the Italian industry for their strong and continuing support of ANIMP. We confirm our commitment to provide to our Associates an ever improving range of services and to represent effectively the Italian supply-chain of the Engineering and Contracting Industry in all global contexts.

**Claudio Andrea Gemme**

## Claudio Andrea Gemme

Born in Genoa, he graduated in Economics and International Policies. He is Chairman and Chief Executive Officer of Fincantieri SI (Integrated Systems), Member of the Board of Directors Isotta Fraschini Motori spa. ANIMP President, member of the Board of Fincantieri Marine Systems North America. From November 2016 he is Director of Systems & Components Division of Fincantieri leading three Business Units (Accommodation & Entertainment, Electric & Electronic Systems) In Confindustria is a member of the Advisory Board, Chairman of the Industry and Environment Technical Group, member of the Committee for the implementation of the reform and definition of aggregation protocols (Commission Pesenti). He is invited to the General Council of Confindustria and he was member of the Technical Group of Industrial Relations, the Group Technical Internationalization and Foreign Investors, the Group Technical Infrastructure, Logistics and Mobility, Technical Organization Group and Technical Thematic Energy Group. In Confindustria was a member of the Special Project Expo 2015.

He is President of the Strategic Committee of the Great Milan Center. He is in a Board of Director of the Gaslini Onlus Association and Member of the ISPI Board of Directors

He was President and founder of the association "Angels for Children".

He was Chief Executive Officer of Isotta Fraschini Motori spa.

He was member of the Executive Committee of Confindustria Genova - Genova Smart City Project.

He was President of ANIE Federation, member of the Italian-Serbian Business Council and member of the Board of Directors of the Bicocca University of Milan.

In December 2015 he was awarded the Great Prize Spires Milan to him recognized as a businessman who has distinguished himself for having enhanced the economic environment, scientific, social and cultural development in the Milan area.

During his professional career he has held various managerial positions. He started in Finmeccanica group in 1973 where he assumed duties before within the Procurement Department, then in the Project Management of Ansaldo S.p.A. (A subsidiary of Finmeccanica).

Since 1987 he manages the litigation between industry and government after the closing of the nuclear power plants as consequence of the national referendum result.

In 2000, with the privatization of the Ansaldo group industrial branch, he was managing the privatization process of Ansaldo Sistemi Industriali SpA and subsequently, when the shareholder High Voltage Engineering Corporation USA was in crisis in 2005 bringing the company close to bankruptcy, was essential his contribution, together with his team of managers, in transition to the new property and for the restoration of the company.

He is an expert in energy and energy efficiency, covering a number of positions in major organizations and industry associations at national and European level. He was vice president and CEO of Nidec ASI SpA, CEO of Nidec ASI Japan Corporation, managing director of Nidec ASI GmbH Germany, Chairman of Conseil de Surveillance Nidec ASI s.a. France, President of Nidec ASI.Vei Russia, member of the Board of Directors of Nidec ASI RO Romania Srl, President of Arsenal Consortium (electrical installations for the arsenal of Taranto Navy).

Since 2002 he is a Knight of Italian Republic



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# Maire Tecnimont Group's Petrochemicals Milestones in Azerbaijan

The Italian company is supporting the industrial development of Azerbaijan with two strategic polyolefins projects, the first of their kind in the Country, enabling the growth of the domestic hydrocarbon downstream sector

**Niccoló Heilpern** – Branch Manager Baku, KT-Kinetics Technology (Maire Tecnimont Group)



## The projects

SOCAR Polymer is a company aimed at the development of the petrochemical industry of Azerbaijan, founded by the Country's Government on July 16<sup>th</sup> 2013.

SOCAR Polymer's production facilities, consisting of a polypropylene (PP) and a high-density polyethylene (HDPE) plants, are under construction within the territory of the Sumgayit Chemical Industrial Park (SCIP), located about 30 km north of Baku, the capital and largest city of Azerbaijan.

Created in 2011, SCIP was set up to stimulate growth in high-tech industrial fields in Azerbaijan. Its main goal is to be an accelerator of economic development of Azerbaijan by increasing competitiveness in comparison with other regional countries. SCIP supports innovative industrial initiatives through extensive tax exemptions and provides full infrastructure support and single point approach to permitting matters.

**SOCAR Polymer's polypropylene (PP) and high-density polyethylene (HDPE) plants will be the first of their kind in Azerbaijan, enabling the growth of the domestic petrochemical industry, thus making the Country a regional player in exporting plastic materials**

SOCAR Polymer's PP and HDPE plants will be the first of their kind in Azerbaijan, enabling the growth of the

domestic petrochemical industry through the development of the plastics market, thus making Azerbaijan a regional player in exporting plastic materials. SOCAR Polymer implemented the first project in Azerbaijan based on the non-recourse project financing principles, without a guarantee from the parent company. The implementation of the SOCAR Polymer project is expected to create a multiplication effect in many important sectors of Azerbaijan's economy.

### Client

SOCAR Polymer is a company incorporated under the Azerbaijan Legislation as Limited Liabilities Company. It is part of SOCAR, and its additional main stakeholders are Pasha Holding, Azersun Holding and Gilan Holding. It aims at implementing the new petrochemical industry in Azerbaijan and making Azerbaijan a regional player in petrochemicals production.

### Licensors

LyondellBasell, the world leader and largest producer of polypropylene and advance polyolefin's product for the HDPE plant, while Inspec Ethylene Oxide Specialties (Ineos) one of the top ten chemicals manufacturing companies as measured by sales revenue, was chosen for the PP plant.

*Night overview of the petrochemical complex in Sumgayit, Azerbaijan.*



Detail of the PP unit – dry end

### Project Management Consultant (PMC)

Fluor B.V. has been awarded as Project Management Consultant of SOCAR Polymer and it implemented an Integrated Project Management Team (IPMT) to jointly follow the execution and

the development of the project in each of its phases.

### Key National Agencies Involved

- National Regulatory Bodies (primarily, Ministry of Emergency Situations);
- National Design Institute (mainly Institute Azerinshaatlayihe and GosGorTexNadzor);
- Construction Contractors, including the main construction contractor and the national subcontractors.

### EPC Contractors

#### Tecnimont SpA (Maire Tecnimont Group)

Tecnimont SpA has been awarded the Engineering & Procurement (EP) contracts for both PP and HDPE

## Historical glance and oil heritage in Azerbaijan

The cultural link between Azerbaijan and oil comes from the history.

Azerbaijan's oil was repeatedly described in the works of medieval scholars and travelers, but at the time oil was only used as a household fuel and for medicinal and military purposes. Azerbaijan oil resources were already mentioned a couple of centuries earlier than the furniture below by the famous traveler Marco Polo, indicating the use of the oil in Azerbaijan for treatment purposes and to export it to adjacent countries

An inscription on a stone recently found in an oil well in Balakhany tells that the well was drilled by foreman Mr.

Allahyar Mammad Nuroghlu in 1594.

A turning point in oil production was reached in the 19th century, specifically in 1847 when the first oil wells were drilled in Bibiheybat and then Balakhany by means of State of the Art technology.

Azerbaijan was the world leader in oil production in early XX century and the production of oil strongly supported the victory of the Soviet Union in World War II and made oil an extremely important factor in the national economy. Azerbaijan was also the world's first offshore oil producer. On November 7, 1949 Azerbaijan and the Caspian Sea became known all over the world with the discovery of the Neft Dashlari ("Oil Rocks") field 40 km offshore and 90 km from Baku.

On September 20<sup>th</sup>, 1994, the famous "Contract of the Century" was signed by several oil companies from eight Countries. The Contract boosted the confidence of the international business community in Azerbaijan and encouraged oil companies to invest in the Country.



Azerbaijan, a former Soviet republic, was founded in 1991. It has a population of almost 10 millions. The capital is Baku. Azerbaijan has vast oil and gas fields.



In the small but highly valued museum "Poldi Pezzoli" in Milano there is a piece of furniture dated around 16<sup>th</sup> century with several drawers, all ivory engraved. One of them represents the Caspian see: no mentioning of Azerbaijan but a clear indication of Noah's Arch located very close to the current position of Azerbaijan.

plants. The main activities can be summarized as:

- engineering works / services for the whole petrochemical complex;
- procurement activities (namely pre-ordering, ordering and post-ordering) for all equipment, bulk materials, E&I and others related to the complex.

### **KT-Kinetics Technology SpA (Maire Tecnimont Group)**

KT-Kinetics Technology SpA has been awarded the Engineering, Procurement and Construction (EPC) contracts for both PP and HDPE plants. The main activities include:

- the localization of the whole design through the utilization of a National Design Institute;
- permitting activities for Engineering & Construction;
- domestic market procurement of project materials in addition to domestic services necessary to support and develop the Branch Office and Site office;
- Field Engineering team was implemented in order to properly support construction team;
- Construction, pre-Commissioning and Commissioning execution for both PP and HDPE plants through a main subcontractor for all disciplines.

## **Operating Centers**

Maire Tecnimont Group (MET) adopted a multicenter strategy to execute the activities related to both the PP and HDPE plants. Such strategy is coordinated and led by the Project Director coupled with the wise use of the I&CT tools among the Group. This

approach aims at optimizing the operations of the project and providing services which exceed Client's expectations. Detailed below are the main operating centers.

## **Tecnimont Private Limited - TCMPL (Maire Tecnimont Group)**

The detailed engineering was executed by the fully owned subsidiary Tecnimont Private Limited (TCMPL, formerly known as TICB) with the headquarters in Mumbai in Western India. A team of skilled and experienced engineers was involved in the comprehensive design engineering phase and Project / Cost Control discipline.

All procurement services were executed in TCMPL by a dedicated and focused Procurement Team led by the VP Procurement of TCMPL. The full integration of Procurement Dept. and Engineering Dept. during the first phase of the project was a milestone in the project, allowing an optimization of the whole schedule to reach Client's expectations in terms of time schedule and operation implementation.

### **KT-Kinetics Technology SpA (KT SpA) and KT-Kinetics Technology SpA Azerbaijan Branch Office (KTAZE)**

In order to increase Client's satisfaction, raise project localization rate and better focus the efforts, KT-Kinetics Technology SpA, as Onshore EPC Contractor, set up the KT-Kinetics Technology SpA Azerbaijan Branch Office. The Branch has its registered offices in Baku. All the local construction subcontract(s) were handled



*Detail of the PP unit - wet*

Seq.	Description	PP	HDPE
1	Concrete Foundations[m <sup>3</sup> ]	23,350	9,400
2	Cast in situ RC & buildings (m <sup>3</sup> )	11,900	10,000
3	Steel structure (ton)	5,000	4,000
4	Equipment (n.)	500	400
5	Piping prefabrication (dia)	73,600	59,000
6	Piping erection (dia)	149,000	66,000
7	Electrical cables (m)	466,000	321,000
8	Instruments main cable laying (m)	363,500	355,000
9	Instruments installation (n.)	5,000	3,000

*Table 1 – The most significant key parameters of the polypropylene (PP) and high-density polyethylene (HDPE) plants*

and managed by this location. In addition to that also all activities related to Administration, Finance and Control, Human Resources, Procurement, Local Engineering and interface with Local Design Institute and Logistics were fully coordinated and implemented.

## Maire Tecnimont Group's commitment

Through its hub KTAZE, the Group applied a strong effort to scout Azerbaijani market to find reliable and sustainable domestic market suppliers / subcontractors which can become part of the Group's global supply chain.

The localization of activities, the synergies with the national market and the implementation of long-lasting relationship with national suppliers and subcontractors was part of an effective locally-focused procurement strategy sponsored by Maire Tecnimont's top management.

In order to underline the interest of Maire Tecnimont Group in Azerbaijan national market, in 2016 Maire Tecnimont participated in a workshop sponsored by

*Warehouse for the HDPE unit*



SOCAR and Ministry of Economy of Azerbaijan to share the main criteria to choose domestic supplier / subcontractor and to identify the main objects of the procurement strategy in Azerbaijan.

KTAZE qualified almost #200 domestic companies in all necessary fields to be used in the development of the project at any possible steps. The qualification is for the entire Supply Chain since the Group – being a global licensor and EPC contractor – is always interested in having reliable and available suppliers for its investments worldwide.

**Maire Tecnimont Group adopted a multicenter strategy to execute the activities related to both the PP and HDPE plants, under the coordination of the Project Director: an approach aimed at optimizing all the operations and providing services which exceeded Client's expectations”**

### Complexity of the project

The project aims at producing PP and HDPE to be then packed and sold in-the-country and exported in the area. The most significant key parameters of the projects are summarized in **table 1**.

SOCAR Polymer carried out all the site preparation in 2015 and the site was handed over to the EPC Contractors in the same year.

### Challenges, but also opportunities

Since the beginning, the execution of these two plants in Azerbaijan seemed to be challenging, due to several different conditions which affected the normal scheme of the implementation of a project of this kind. Naturally, challenges always bring opportunities and MET has been able to leverage them to strengthen its position in the Country and in the relevant market.

The main challenges were the implementation of a relatively big project in a Country where no investments of this type were performed in the last forty years, and ensuring on a fast track basis the coordination with Azerbaijani authorities for permitting matters and technical standards to be utilized in the design phase of the project. Furthermore, since activities were carried out in several operating centers located in different areas of the world and thus different time zones, the development of a concrete and effective time management strategy was required to have the project team working in complete coordination, leveraging I&CT tools and efficient integration of the teams.

Moreover, notwithstanding the fact that initially domestic vendors were not ready to satisfy the

expectations of an international EPC contractor, MET – through its hub KTAZE – invested efforts in driving the strategic national suppliers to fulfill its needs project-wise and to become more effective in providing materials/services with the quality requested. In addition, managing a main subcontractor which was responsible of all construction and commissioning phases of the project implementation was naturally one of the most important aspects, together with the necessity to find domestically available skilled and technically prepared resources, as blue and white collars are still in the learning curve to master how to deal with international contractors. In this respect, all national resources involved in the projects were successfully managed, educated and mentored in terms of safety issues.

## The execution

Since the inception of project activities, engineering was implemented in order to deliver the necessary documentation to obtain all the permits, without which site construction activities would not have started.

The preparation of the document “Issued for Permitting” has been coordinated with a National Design Institute in which a dedicated team of specialist was deployed. The decision to deploy such team and to assign an Interface Manager fully dedicated to the administration of local technical authorities were among the success factors in the arrangement of the permitting, allowing a coordinated and structured information flow decreasing significantly the timing of the permit issuance. All permitting documentation duly signed by all necessary national regulatory bodies were obtained on-time and in-line with project and Client expectation. As a matter of fact, construction sequences, timely availability of permits and materials are jointly of great importance to implement a project of this type

In this scenario, the Group managed to provide feasible look-ahead work-fronts for the construction subcontractor which were also supported by the concrete utilization of 3D model tools.

The utilization of another Group tool such as Marian allowed a full control over the in-coming material at the warehouse, thus introducing a level of insurance of the implementation of different work-fronts, which was vital during the first phase of the construction project.

### Sophisticated Coordination with Client and PMC

A sophisticated day-by-day coordination with the Client was developed with Client and its PMC in order to achieve the following targets:

- full transparency and reliability in project

management;

- full sharing of project milestones and achievements;
- implementation of Sponsor Committee to provide guidelines to project teams in a coordinated and proactive way;
- ensuring a fast-track decision-making process to provide clear vision and communication to ensure that goals, decisions and actions are consistent with the benefits of the project and fully achieved.

This new approach and this new vision of project development was implemented with the involvement of the Client organization, in order to ensure its complete satisfaction.



### Procurement strategy

The Group made an effective procurement campaign based on MET global supply chain. In particular, the early placement of the purchase orders related to the long lead items, like loop reactors and extruders enabled to have the main and most complex items at site at an early stage of the project.

In addition, the leverage on the domestic market, which optimized time efficiency and minimized lead time, allowed to have part of the bulk materials ready to be erected at the early stage of the project.

Finally, the extensive session of Factory Acceptance Test for equipment in vendor premises, coupled with a reliable and sustainable supply chain, allowed to have materials available at construction site in line with time expectations.

### Subcontracting strategy

The first subcontract awarded in Azerbaijan was for the additional soil investigation to a national company to prepare the additional soil report to drive the correct implementation of civil engineering.

The construction works were implemented by a sole

Overview of the PP unit - utilities

main subcontractor which, then, subcontracted part of its activities and construction materials supply to local vendors. Once again, the local market was one of the success factors in the implementation of this project in Azerbaijan.

### **HSE performance**

Safety, environment and the health of the labour force building the plant were of paramount importance for the Group, as well as for the Client and the PMC. The main subcontractor and all its subcontractors were requested to observe the most stringent international standards enforced by Maire Tecnimont.

In addition, KTAZE site team undertook a number of new engaging initiatives in this respect such as a Training Center where the main hazards are shown, as well as weekly HSE (Health Safety Environment) management walk-down with Client and PMC representatives and a monthly incentive scheme for HSE as "Safe worker of the month".

Moreover, a permanent training center was established by the subcontractor where all employees, including vendors and workers, were specifically trained to be able to safely cope with the tasks they were called for. Recognition of intermediate safety achievement was distributed to all employees present at site as sign of appreciation of their attitude versus safety on site.

As of today, the project has exceeded 12.0 mil worked man-hours without LTI (Lost-Time Injuries) a track record achievement in Azerbaijan.

### **Lesson Learnt approach**

HDPE project has been awarded six month into the PP project. MET leveraged on this fact and through

dedicated Lesson Learnt session(s) was able to optimize the activities for HDPE and to avoid redundancy in engineering. This wise approach allowed for a smoother implementation of engineering activities and a more coordinated sequence of site activities to achieve intermediate milestones of the project.

## **Conclusions**

The finalization of PP and HDPE plants is scheduled to take place in 2018, fully in line with Client's expectations. The results achieved as of today are based on a full commitment of the Group in the Country and specifically on the two projects to lean the decision-making process and to provide unique guidelines for the basis of a correct implementation of the project. In addition, the cultural sensitivity and the careful management of local environment, both of which are a trademark of MET's along its story of successful project implementation, were essential for the successful completion of the project.

The unique harmonization of national and international resources blended with correct and wise management allowed to leverage interaction between cultures to bring the best outcome, both for the client Socar Polymer, and Maire Tecnimont Group.

In a recently published book, *The Silk Roads* by Peter Frankopan, Heydar Aliyev airport in Baku is shown as example of Azerbaijan's rapid economic growth with far reaching outlook on all national aspects, therefore Maire Tecnimont Group is proud of being part of this industrial development program, setting standards in the region and world-wide.



## **Niccoló Heilpern**

Niccoló graduated in Chemical Engineering at Politecnico di Milano in 2003 and he received his MBA at the International University of Monaco in 2007.

He is working in KT-Kinetics Technology SpA since 2016 as Branch Manager in Azerbaijan, seconded in Baku, with full responsibility of representing the company in all facets of business in Azerbaijan and

Central Asia Countries.

Prior to joining KT, he was Business Manager for Iveco Defence Vehicles (2012-2015) and before General Proposal Manager in Danieli & C. Officine Meccaniche SpA (2010-2012). He started his career in Foster Wheeler Italiana in 2004.

# More Power, More Future: the New Generation of Gas Turbines is born

The GT36 is the most powerful engine built by Ansaldo Energia today and the top machine in Europe by power. The turbine generates 538 MW of power (ISO conditions) in the 50 Hz and 760 MW in a combined cycle with an efficiency of 62.6%. The GT36 has been developed to deliver high efficiency combined with great operating flexibility, allowing it to deliver power according to the changing needs of the grid, compensating for and supporting intermittent electricity generation from renewable sources. With the ongoing support of Ansaldo Energia's Chinese partner, Shanghai Electric Group, the first GT36 maxi gas turbines will be installed in two power generation plants in the Shanghai area.

Ansaldo Energia Marketing New Units Department

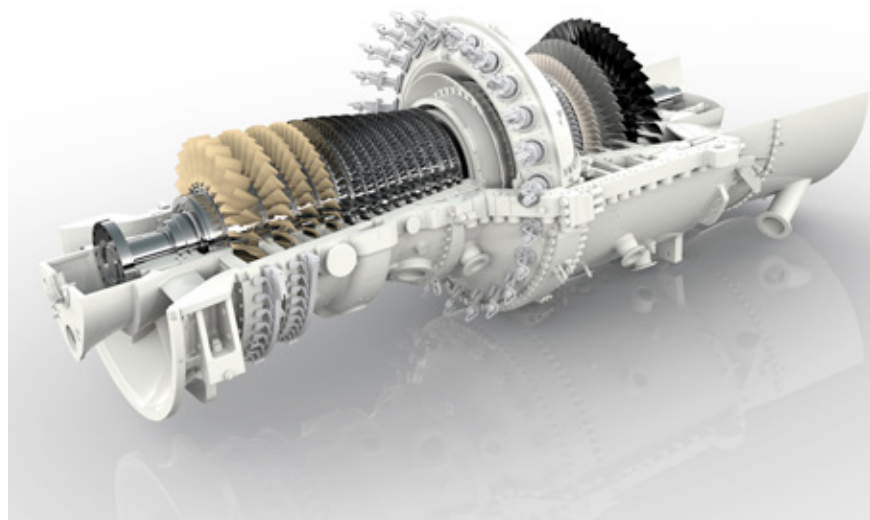
**A**t precisely 5:11 pm, on May 27, 2016, the first GT36 was fired for the first time in Birr, Switzerland, in an event that represents a turning point for the evolution of gas turbines. It was clear from the start that the new GT36 was destined for remarkable things and, in fact, it made its debut delivering industry leading performance combined with best-in-class reliability and availability. The first firing of the unit was the culmination of a six-year development program and the dedication of a worldwide team, renewing the tradition of innovation that is a product of Ansaldo Energia's OEM gas turbine design excellence, which has always been one of the company's key points of strength.

The full potential of the GT36 was plain to see right from the outset, boasting innovation at every level: architecture and operating range, main component design and optimization for maintenance, while using proven and tested solutions for maximum product reliability.

According to Patrik Meier, R&D Program Manager GT36:

Our expectations were very high and there was a sense of great excitement in the air. It was rather like waiting for a baby to be born. And this is one of the reasons why we decided to give the first GT36 a real name.

This had always been a talking point in the team and it was already a tradition for our former Alstom colleagues,



so in the end we decided to follow suite. We called it Irene Sofia. A double name, because there were two key phases in the GT36 program, first design and manufacturing, and second erection and commissioning. Irene Sofia pays tribute to the children of two team members, but there's more to it than that.

It is also a way to establish a more intimate bond with our project and make it feel more alive. It is a symbolic choice to express the passion, love and devotion we have shown towards it over all these years.

Now we all have another birthday to celebrate, May 27!

*The GT36 is the most powerful engine built by Ansaldo Energia today. Nicknamed "Mont Blanc", because it is the top machine in Europe by power, the turbine generates 538 MW of power (ISO conditions) in the 50 Hz version presented today and 760 MW in a combined cycle with an efficiency of 62.6%*

The extraordinary promise shown by the turbine in the design phase was fully borne out by its first steps in the real world. The heart of the GT36, the unique can combustor system with sequential combustion, generates unrivalled turndown and best-in-class emissions.

## The origins of the future

The challenge thrown down by the market is clear: to provide more efficient and more flexible solutions at competitive cost to satisfy the energy market requirements of today and the future. And the effort to do so involved a dedicated team of top professionals and more direct contributions from the end customer than in any other previous design and development experience.

Specific requirements, market trends and the product's competitiveness were all inputs to the development program and form part of the GT36's "genetic code". Together, they have contributed to the definition of a machine with unique characteristics, both in terms of its operating flexibility and efficiency, even at partial

load, and also of its ease of maintenance.

But the GT36 is much more than a new feather in the cap of Ansaldo Energia's product catalogue. It also makes an important contribution to more environmentally friendly thermal power generation and is the ideal combination with renewables.

To meet all requirements of such challenging product specification, a joint effort was necessary. An interdisciplinary team was built, putting together the expertise from all departments and from all over the company.

## Proven power

Irene Sofia took her first steps, safely and in full control, and passed her childhood in the new built open cycle validation power plant in Birr, Switzerland. She reached her maturity in April 2017 with the successful completion of the validation process.

On the first GT36 unit at the Birr Test Power Plant in Switzerland. No teething problems occurred: the new baby performances and behavior made the family very proud of her!

**Presentation of the first GT36-S5 model gas turbine produced at Ansaldo Energia's Genoa production facility in February 2018 at the presence of the most important national and local authorities**



*The first GT36-S5 model Gas Turbine produced at Ansaldo Energia's Genoa production facility was presented to an audience including Italian Defence Minister Roberta Pinotti, Mayor of Genoa Marco Bucci and Edoardo Rixi, Liguria Regional Administration Economic Development Councillor. Also in attendance was the Archbishop of Genoa, Cardinal Angelo Bagnasco.*

*Ansaldo Energia was represented by Giuseppe Zampini, while the shareholder CDP Equity was represented by Managing Director Guido Rivolta.*

The test power plant is a full scale simple cycle power station that can be used for the operation and validation of the fully instrumented engine under real power plant conditions, because the power is dispatched to the Swiss power grid.

The test program included stress testing of the two stages in the sequential combustion system, part and full load mapping, transient operation and performance testing. The validation engine is equipped with more than 3,000 measurement points, including a telemetry system which transfers more than 500 measurements from the rotating parts. In the end, the tests fully confirmed our expectations.

High performance and low emissions over the entire load range confirm all the objectives of the development program and the wide operation window of this engine. The GT36's combustion system had already been tested, starting in 2013, as a single component in a combustor test rig, at full size and under full mass flow, at the DLR (the German Aerospace Center) in Cologne.

The test results reported for the GT36-S6 (the 60 Hz version) confirmed power output above 369 MW at

42.3% efficiency. In a combined cycle, this corresponds to performance about 520 MW at 62.3% net efficiency in ISO conditions. The scaled up 50 Hz version, the GT36-S5, achieves 760 MW at 62.6% efficiency.

## The family, what a team

On November 2, 2015, Ansaldo Energia announced the closing of its acquisition from General Electric of Alstom's advanced heavy-duty gas turbine business and its subsidiary company Power System Manufacturing. It represented a turning point in a lengthy process, with commercial and political implications. The deal between General Electric and Ansaldo Energia included the latest ratings of the GT26 and GT36 heavy duty gas turbines, but most importantly, more than 400 Alstom R&D Center employees in Baden, Switzerland.

And so, the family grew in size, gaining new talents and new professional skills, and with them a set of commitments and prospects allowing the company to look ahead with great optimism and even more confidence to the challenges of the future.



The operation offered Ansaldo Energia the opportunity to start producing the new generation of H-class turbines immediately, optimizing design and development time.

Ansaldo Energia took over intellectual property rights for the GT26 and GT36, existing upgrades and pipeline technology for future upgrades, and with service agreements for 34 GT26 turbines already installed.

Together with its sister GT26, the GT36 joins its new Ansaldo Energia GT family.

The family grows significantly, now including top products at upper end of F-class and new H-class.

Together with its well-known and family members AE64.3A (small F-class), AE94.2 (E-class) and AE94.3A (F-class) Ansaldo has a full-fledge portfolio (in 50 Hz) and different models specialized for different market segments:

- more and better fit to special market requirements;
- from small to very large size;
- from best fit for open cycle to combined cycle;
- from cost-optimized to performance-optimized.

## The new production site on the sea

Ansaldo Energia prepared a warm welcome for its new family members GT36 (and also GT26): it invested over 65 million euros to create the conditions to bring the production of machines based on former Alstom technology to Italy, involving adaptation work on the existing facilities and the construction of the new industrial shed in Cornigliano (Genoa), which was officially opened in June 2017. The Cornigliano site provides a new accommodation directly on the sea shore. From the new site, which has direct access to the sea and a dedicated dock, the new generation GT36 turbines will set sail to international markets.

It is an important investment that satisfies the need to

finalize the production of the turbines near the loading platform, ready to set off on their adventurous journey into the future, because transportation from the factory by road is impossible.

The individual components manufactured and preassembled in the Genoa-Campi factory are transferred to the new facility, which covers a total surface area of 10 thousand square meters, where the production cycle is completed with the final assembly of the new GT36 turbines.

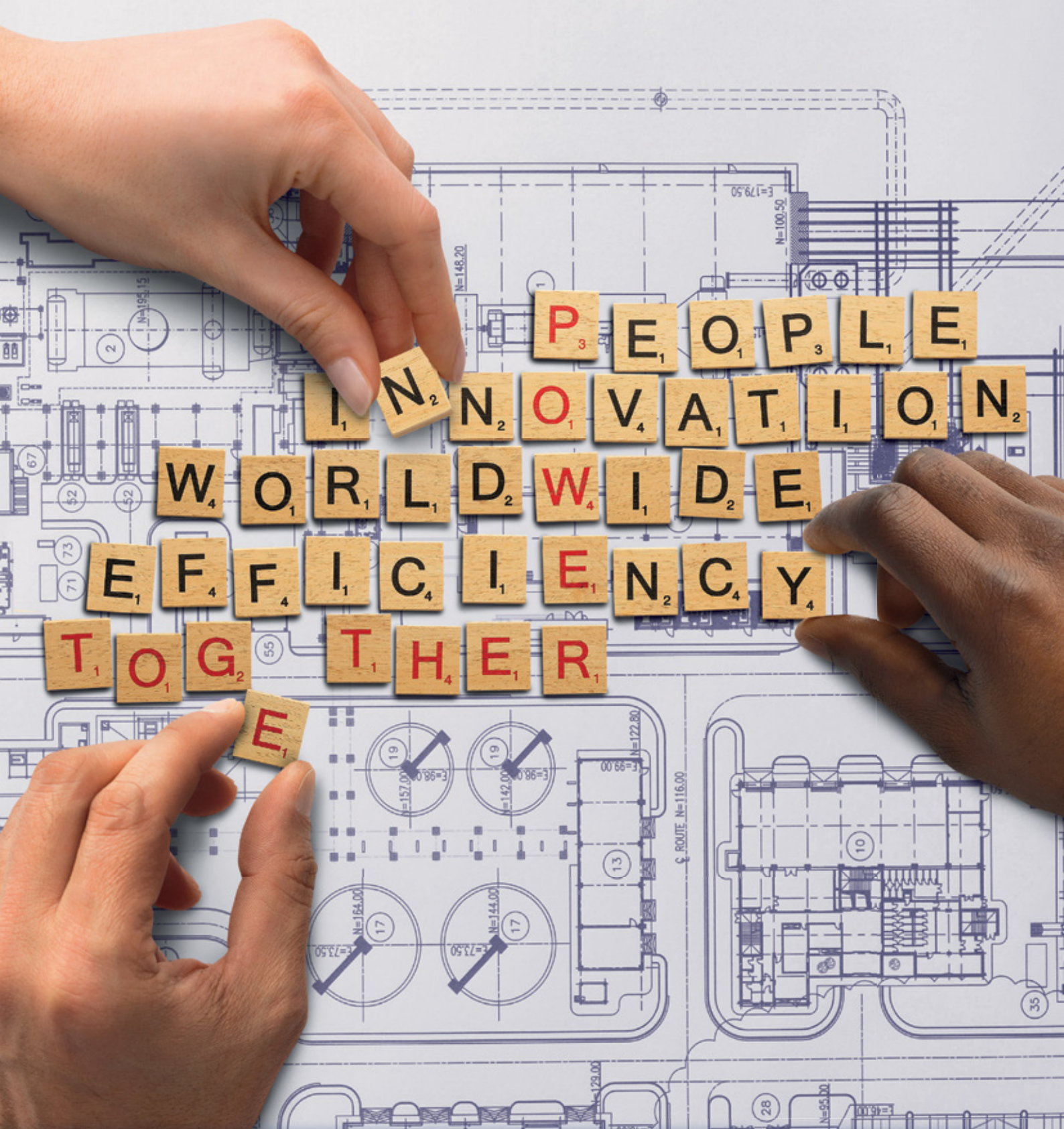
To make all this possible, the welding area has been extended, with the installation of equipment that can weld rotors up to 200 tonnes in weight and 14 meters in length.

There is no doubt that this new facility represents a point of arrival in a production process of vital strategic importance, but it is also, and more importantly, an launchpad that puts Ansaldo Energia in the ideal position to tackle the challenges it faces on international markets in the future.

In February 2018, finally, the first GT36-S5 model gas turbine produced at Ansaldo Energia's Genoa production facility was presented at the presence of the most important national and local authorities.

The GT36 is the most powerful engine built by Ansaldo Energia today. Nicknamed "Mont Blanc", because it is the top machine in Europe by power, the turbine generates 538 MW of power (ISO conditions) in the 50 Hz version presented today and 760 MW in a combined cycle with an efficiency of 62.6%.

The GT36 has been developed to deliver high efficiency combined with great operating flexibility, allowing it to deliver power according to the changing needs of the grid, compensating for and supporting intermittent electricity generation from renewable sources. With the ongoing support of Ansaldo Energia's Chinese partner, Shanghai Electric Group, the first GT36 maxi gas turbines will be installed in two power generation plants in the Shanghai area.



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# A Revamping Project Inside One of the Biggest Refineries in Europe

The leading Italian fired heater EPC company Vergaengineering SpA successfully completed a complex revamping project inside one of the biggest refineries in Europe.

One and half years of engineering, procurement and fabrication activities ended with a double-phase site job: the first phase aimed at the modularization of the items to be installed; the second phase was the execution during the course of a one-month long plant shut-down, when Vergaengineering installed the new modularized items in place of the ones to be revamped.

Among the difficulties: unconventional modularization for optimizing the installation in a very tight time schedule; simultaneous operations and heavy liftings both in day and night shifts; site works performed within the context of the entire refinery revamping, managed through the latest schedule control techniques and with the highest safety requirements.

Italian leading fired heater EPC company Vergaengineering SpA successfully faced a complex retrofit revamping project during a major turnaround, tackling it through modular construction solutions. The job developed in the context of the revamping of one of the biggest refinery in Europe. Vergaengineering scope was the management, engineering, procurement, fabrication, transportation and site activities for the following 3 combined projects to be performed in parallel:

- I) the revamping of two cylindrical 20 m high radiant sections of a visbreaker heater unit (**figure 1**);
- II) the revamping of a vacuum heater convection section with replacement of 20 m long tubes;
- III) the whole replacement of an air pre-heating

system, complete of heat exchanger, insulated and refractory ducts, fan, variable speed driver and machine monitoring system (**figure 2**).

Abraham Lincoln said: «Give me six hours to chop down a tree and I will spend the first four sharpening the axe». This sentence is particularly true for this project, in which Vergaengineering spent one and half year preparing the demolition and revamping site job during a less-than-one-month turnaround.

The major challenges related to engineering, planning and coordination. In fact, in order to stick to strict time / safety / quality / cost requirements, a winning combination of dedicated commitment in organization and innovative creativity in design was put in place.

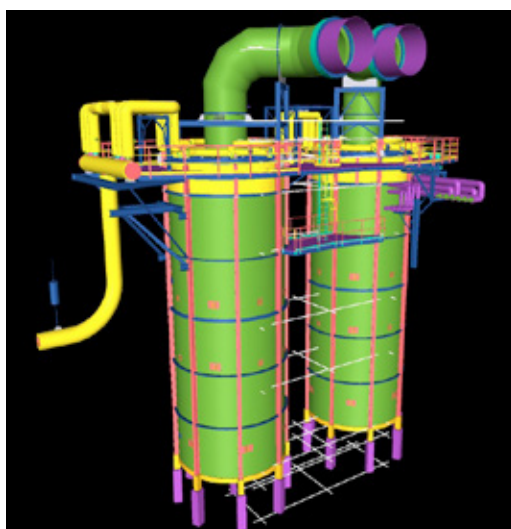


Fig. 1 - 3D design of radiant modules complete of all structures, ducts, equipment, instrumentation and piping

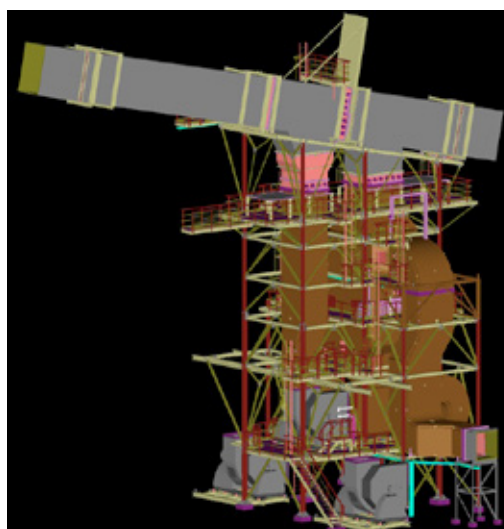


Fig. 2 - 3D design of APH (Air Pre-Heating) system, complete of all structures, ducts, equipment, instrumentation and piping

## Engineering phase

Since the bid phase, long before the certainty of performing the job, Vergaengineering trooped a dedicated design task force with the mission of seeking the best technical solutions for minimizing realization risks, time and costs.

The tough requirements were faced through many solutions, among which modularization had the leading role to bring decisive turning point in success.

Below the 3 parallel projects are described in details.

- I) The radiant sections revamping required many activities, but the big challenge was to completely replace the connected six-passes coils in less-than-one-month turnaround. Difficulty-level was additionally increased, as the coils diameter had to change, with the consequent variation of mechanical interfaces between the coils and the structures.

An uncommon solution solved the puzzle: since the coils in the vertical heaters were supported in the top part of the radiant sections, the quickest way to operate the replacement was to entirely replace the top parts of the radiant shells with the entire new coils hanged on them (**figure 3**).

- II) The 20 m long convection section to be revamped could not be executed with the same approach of radiant sections, as the coil could not be entirely assembled before installation. This brought to a

high-risk schedule, as there is also no possibility to perform other parallel activities on a convection section (such as steelwork welding, supports modification or refractory works) while the coil is in course of replacement.

Moreover, the 20 m tubes, even if of big diameter, are very flexible and generally lead to high installation time, which had to be added to the time required for all the site welds needed, with consequent post weld heat treatment, hardness check, x-rays, magnetic and hydrostatic tests.

In order to solve the matter, Vergaengineering used a specifically designed device to save time for such kind of jobs: a bundle puller, which allowed a quicker-than-usual installation of the coil one hairpin at the time.

- III) The highest-impact part of the project, with reference to weight and dimensions, was the entire replacement of the visbreaker unit pre-heating system: an old ~250 tons structure to be demolished and a new ~250 tons structure (with different internal design to increase the plant efficiency) to be erected at its place, always in the less-than-one-month time window.

Moreover, this replacement had to be performed in the most crowded point of Vergaengineering operation place: just between the radiant sections and the convection section to be revamped.

Of course, modularization was an essential expedient to cope with space and time requirements. Consequently, the entire preheating system was designed in several big modules to be erected one after the other in a few days, being the less-than-one-month of turnaround almost entirely stolen by the demolition of the old system. The biggest new module had ~100 tons weight.

Last but not least engineering act: in order to properly check all interfaces and prevent any clash issue during fabrication and erection, the whole project was completely 3D designed (figures 1 and 2 show 3D models for radiant modules of visbreaker and air pre-heating system).

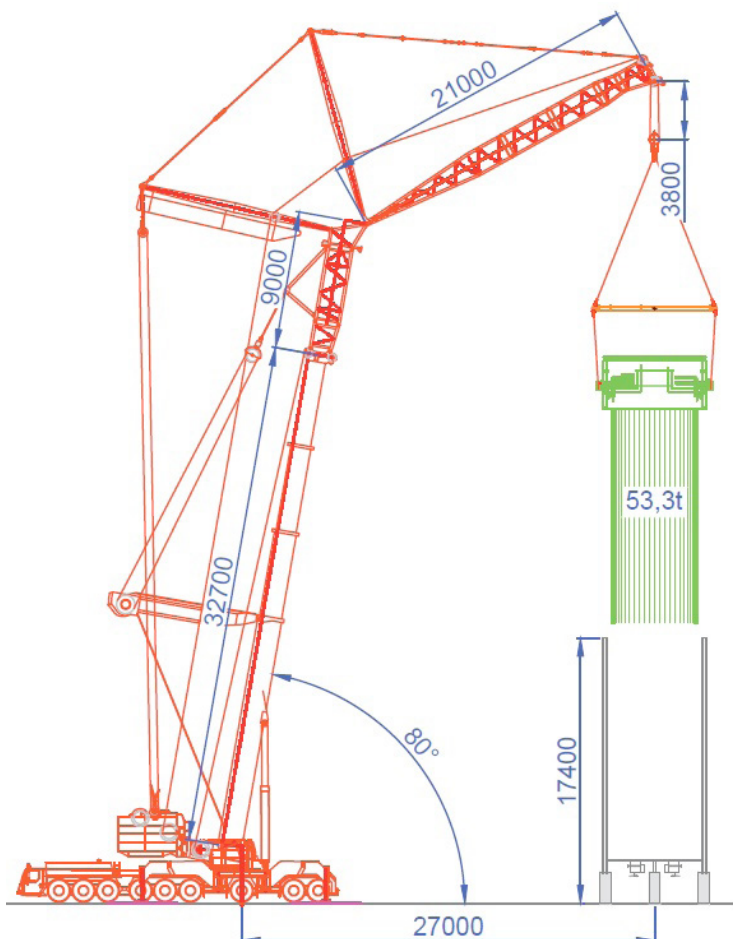
## Planning phase

Since the context of a big revamping needed the management of site works to be defined in detail several months before turnaround, planning and engineering development was strictly linked.

As a matter of fact, planning widely influenced engineering, since the essential constraints were the site yard space and mostly the less-than-one-month turnaround.

A level-4 project schedule was developed almost one year before the turnaround, and it was then used as an

*Fig. 3 - Insertion inside the old radiant section of the completely modularized coil hanged on its top part (arch)*





*Fig. 4 - Modularized radiant coils hanged on top part (arch) inside their temporary frame structures*

input to a specific turnaround planning software tool, able to manage in detail all thousands of single site activities, concerning all fields: fabrication, lifting, scaffolding, quality inspections etc.

Vergaengineering was directly involved in the use of such highly specialized software tool, during both the planning phase and the site works phase for the consequent updates during step-by-step erection completion.

## Procurement, fabrication and transportation phase

Fabrication phase was partially overlapped to engineering and planning phase. Fabrication also had some back-inputs on engineering, and consequently on planning, which allowed further improvement of the design.

The main challenge related to fabrication was the coordination of the workshops spread throughout Europe (mainly: Italy, Romania, Finland, Poland, Belgium and Netherlands) to allow the fabricated items arrive at site yard at proper time. In fact, both delay and advance were to be avoided, as the restricted site layout needed to be timely fed, to achieve schedule construction without space obstruction.

## First site phase: pre-turnaround

Vergaengineering site jobs started five months before turnaround. In fact the prefabricated modules were so big and heavy, which could not travel across the continent. Consequently, these were fabricated in



*Fig. 5 - The biggest module (still uncompleted) during site prefabrication in the pre-turnaround phase*

smaller pieces to be assembled in field. In details:

- I) the new coils for radiant sections were thus completely assembled inside two frame structures, which were appositely erected in a laydown area within the refinery (**figure 4**). The site was so windy, that the tall frame structures had to be constructed with high structural standards, and also a temporary foundation was required for the circumstance;
- II) the convection coil replacement did not require particular activities during pre-turnaround site activities, as the new prefabricated coil sectors were already tested at workshop;
- III) the highest effort was for the construction of the big air pre heater modules. These items were assembled in a laydown area very close to the plant to be revamped, in order to minimize the crane operation range due for lifting of modules in final position.

The modules contained all structures, platforms, ladders, tubing, piping and equipment. Moreover, to optimize the scaffolding effort, some parts of scaffolding were left in place once the modules were finished: this allowed to avoid the re-installation of scaffolds needed for the last mechanical and paint adjustments of assembled system after its final positioning.

A further challenge arose from modules weight. Since a temporary foundation had to be avoided, Vergaengineering designed a temporary flooring structure, which properly distributed the modules weight on the ground. This flooring structure was anchored to removable concrete panels through hundreds of bolts (**figure 5**).



Fig. 6 - Self Propelled Modular Transporter (SPMT)

## Second site phase: turnaround

In order to achieve the schedule, Vergaengineering turnaround site jobs were performed on day-and-night shifts, with no difference in the activities performed (i.e. also critical activities as heavy lifting were indifferently carried on during day and night). In details:

- I) at the big rendezvous with turnaround, the new coils for radiant sections were moved with a Self Propelled Modular Transporter (figure 6) to their final destination (figure 7). This transportation



Fig. 7 - One modularized coil hanged on top part (arch), lifted from its frame structure to final destination



Fig. 8 - One uncovered old radiant module

was particularly critical because of very high center of gravity of such items. The old radiant modules to be revamped were suitably uncovered for the occasion (figure 8), in order to receive the new coils from the top.

This way to operate allowed many activities to be anticipated during the pre-turnaround site works phase. Of course, this anticipation was paid with a higher risk of failing the interfaces between the new coil and the old shell. In order to lower such risk, Vergaengineering performed detailed surveys of existing heaters during engineering phase, and contrived many little design expedients to prevent related issues;

- II) even if the revamping of the 20 m convection coil could seem a quite standard job, its performance during a big turnaround makes it a challenging job. In fact, the bundle puller itself with the related cranes was a cumbersome presence in a crowded yard such as a refinery during complete revamping with simultaneous operations. The issues were solved with a combination of wise site management and proper layout design, studied step-by-step during the engineering phase;
- III) although the prefabricated modules for air pre heater replacement were assembled very close to their final destination, a 750 tons crane was needed to lift them.

The impact cost of such big crane was however fully compensate by modular construction, which lead to great advantages from many points of views: worksite safety, quality and above all schedule efficiency. This last point was particularly critical not only for the general turnaround schedule constraint, but also for needed time flexibility. As a matter of fact, the weather has huge impact on site activities, and the saving of time given by modularization is of fundamental importance.

As for the radiant sections revamping, also for air pre-heater replacement one of the highest challenges was to fit the interfaces with the existing battery limits: the existing ducts and above all the existing foundation. Again, surveys of existing structures during

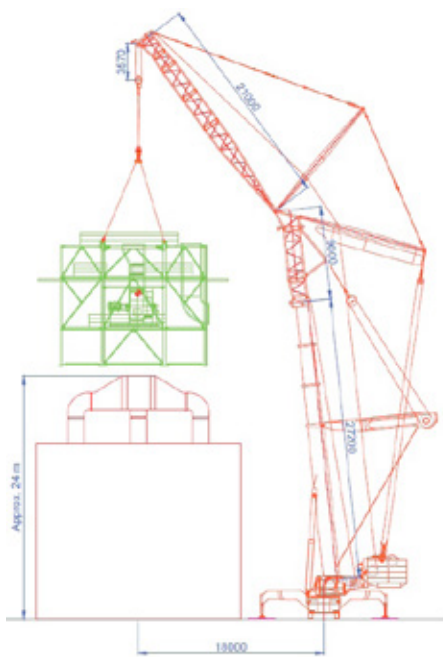


Fig. 9 - Layout and pictures of the lifting of two modules, including the biggest one (~100 tons)

engineering phase were of primary importance to installation success and consequently for complying with turnaround schedule.

## Conclusions

The path that led Vergaengineering to win such challenge essentially passed through proper preparation: i.e. accurate survey, smart design and high construction quality. The job also coped with the highest safety requirements, with a strong focus on

achieving zero hazardous events.

Of course modular fabrication, which was the biggest key to success, required high level of engineering, planning and specialized labor force; nevertheless facts say that the global time saving revenue was enough to compensate such bigger cost.

This successful project had a particular sweet flavor for Vergaengineering SpA, as it increased its leading role in fired heater solutions, by consolidating its know-how, especially on revamping and modularization jobs.



## Roberto Canesi

Roberto is a Senior Project Engineer at Vergaengineering SpA, where he also served as Deputy Construction Manager. He holds a BS in Chemical Engineering from

the Politecnico di Milano and a MS in Nuclearing Engineering from the same University.



## Ettore Garzoglio

Ettore is Managing Director at Vergaengineering SpA. He holds a MS in Business Engineering from the Politecnico di Milano and has over 25 years of experience in the Fired Heaters Industry. Member of

AICHE (American Institute of Chemical Engineers) and API (American Petroleum Institute). He acted as Sponsor of this project.



# The Multipurpose Development of VESTA Technology From Coal to Low Carbon Renewable Applications

Several studies proved that Substitute Natural Gas (SNG) is an excellent energy carrier to be directly introduced into existing natural gas networks. In 2006, Foster Wheeler (now Wood) developed a simple methanation process, called VESTA, using catalyst provided by our partner in the technology, Clariant. In this article a summary of the technology as well as an overview of the state of development will be presented for the various available applications including coal gasification and renewable process schemes.

Valentina Depetri, Guido Collodi, Luca Mancuso, Fabio Ruggeri – Wood

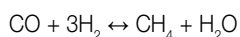
The increasing demand for natural gas and the consequent high prices in the recent past has led both scientific and industrial research to investigate possible alternative pathways that account for more abundant resources to supply end users demand. In this field, many industries developed unconventional methods of natural gas production [1]. The Substitute Natural Gas (SNG) production coming from different sources with a suitable methanation process is considered as one of the most flexible approaches to decarbonise the applications of residential heating (including cooking), cogeneration, and transportation systems by using compressed SNG [2, 3, 4].

The potentialities of SNG are expected to play a key role in the energy sector due to the easy connection of production plants to existing natural gas network and the availability of mature technologies for commercial application. When based on biomass, this process can help to reduce dependency on fossil fuels and help meet environmental targets. Furthermore, the SNG produced can be combusted in any conventional gas turbine to produce low carbon energy and it can be transported and distributed using the existing grids and infrastructure. SNG produced from renewable sources like biomass or biogas is called Green-SNG or Bio-SNG.

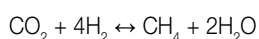
VESTA catalytic methanation to produce SNG can provide an efficient, robust, and viable system, which can play a significant role in this trend to reduce the carbon impact in sectors that traditionally stand on natural gas without losing the possibilities to achieve the sufficient offer to end user needs.

## VESTA Methanation Process

The methanation process occurs with the conversion of the carbon oxides, mainly carbon monoxide, and hydrogen into methane, in line with the following equilibrium reaction:



Carbon dioxide can also be converted to methane according to:



High methane yields are thermodynamically favoured by low temperatures and high pressures. Both these methanation reactions are strongly exothermic, hence the methanation processes are characterised by a large amount of heat released, and so the main issues to be faced during the design of a methanation process is the control of the reactors' temperature by means of an

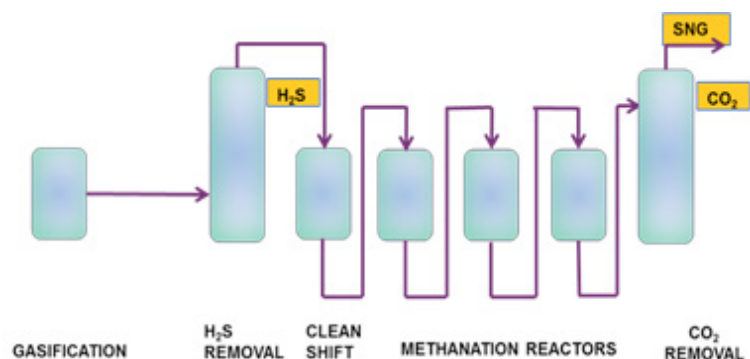
efficient heat transfer system [5] and the optimal recovery of the reaction heat [6].

In conventional SNG processes, the risk of runaway of the methanation reaction is very high, while in the VESTA process such risk is avoided due to the presence of  $\text{CO}_2$  and water, which act as temperature dampers. In contrast to other available technologies,  $\text{CO}_2$  removal in the VESTA process is performed downstream of the methanation reactors rather before the methanation section, and there is no need of product recycle compressors (that, in standard process schemes, typically recycles about 90% of the first reactor effluent).

This strategy of avoiding the recycle of reaction gases reduces the high installation, operating, and maintenance costs associated with the recycle compressor. Moreover, the  $\text{CO}_2$  recovered downstream of the methanation section could have a higher purity than that recovered from the syngas upstream, can be liquefied, and may be used for other industrial purposes. With reference to the optimal recovery of reaction heat, in VESTA technology the heat recovered by the cooling of the reaction is exploited for the production of steam [7]. For the sake of clarity, **figure 1** shows schematically the concept of the once through VESTA process.

## Coal-to-SNG: the Pilot Plant

In many areas of the world, like China, in-house natural gas resources are not present in sufficient quantity to meet domestic demand, while, on the contrary, plentiful and more distributed coal reserves are available. The conversion of coal to SNG by coal gasification and subsequent methanation of the produced syngas provides an alternative energy option in these countries. To this end, in 2013 Foster Wheeler signed a cooperation agreement with Clariant International, the catalyst



*Fig. 1 - The concept of VESTA process. The main sections can be adapted to Customers' need. The main sections reported in this block flow diagram are in order: gasification, sulphur removal, methanation block, and  $\text{CO}_2$  removal.  $\text{CO}_2$  and water in syngas control the exothermic heat of reaction with no need of product recycle*

Fig. 2 - VESTA pilot plant in Nanjing, China, and pilot plant methanation reactors



tests the plant operation, as well as the catalyst performance, has been perfectly in line with the expected data. The VESTA pilot plant and reactors are shown in **figure 2**.

VESTA technology is based only on well-proven equipment, i.e. fixed bed reactors and shell and tube heat exchangers, and the catalyst, which is a nickel-based catalyst, has already been extensively tested by Clariant, which has significant experience with the production of many commercial nickel-based catalysts. The chemistry of this catalyst has been optimised to meet the high quality standards demanded by the new application. The methanation catalyst used in the VESTA process proven in Nanjing is a newly developed catalyst and exclusively available for the Wood/Clariant VESTA cooperation and its Customers [8].

Plants based on VESTA technology allow the production, in a single train, of 2 billion Nm<sup>3</sup>/year of SNG, which is the standard commercial size plant for the Chinese market.

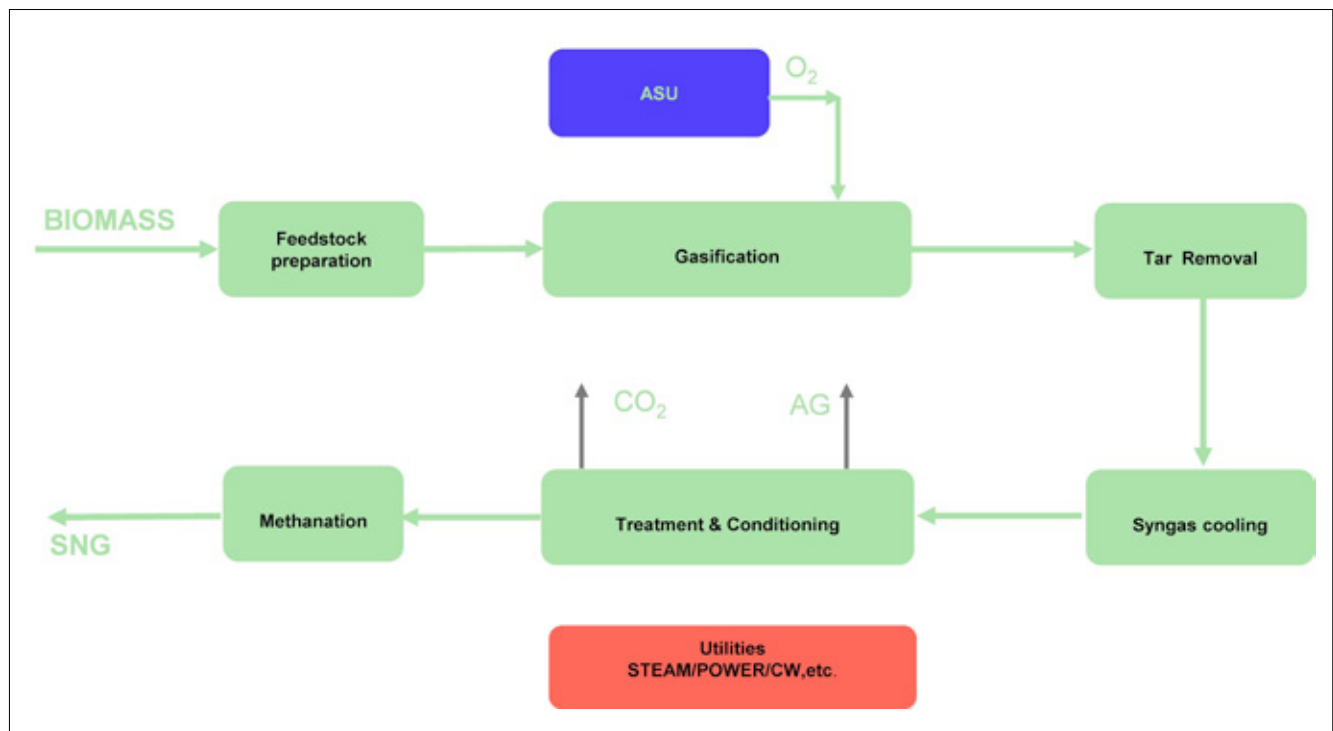
supplier, and Wison Engineering to build a pilot plant in China demonstrating the VESTA SNG technology [7]. The pilot plant, erected in Nanjing, is designed for a production capacity of 100 Nm<sup>3</sup>/h of SNG and includes all the reactors and control system in order to completely reproduce the features of an industrial plant. Two test campaigns were successfully carried out in 2014 and 2015/2016 to demonstrate a continuous operation at 100% SNG production achieving the Chinese natural gas grid specification, and to test different operating parameters. In all the

### Biomass-to-SNG

The ever-increasing demand for alternative fuels, also boosted by local and European regulations, has added value to the multipurpose and multiscale applicability of VESTA technology in the low carbon economy. The renewable Green-SNG production can help in reducing the carbon impact of systems like residential heating and also transportation by using compressed SNG, which is a clean and low carbon alternative to conventional natural gas and can be transported and distributed using the same grid infrastructure.

As well as in all methanation processes, syngas (mainly

Fig. 3 - Biomass Gasification to SNG block flow diagram

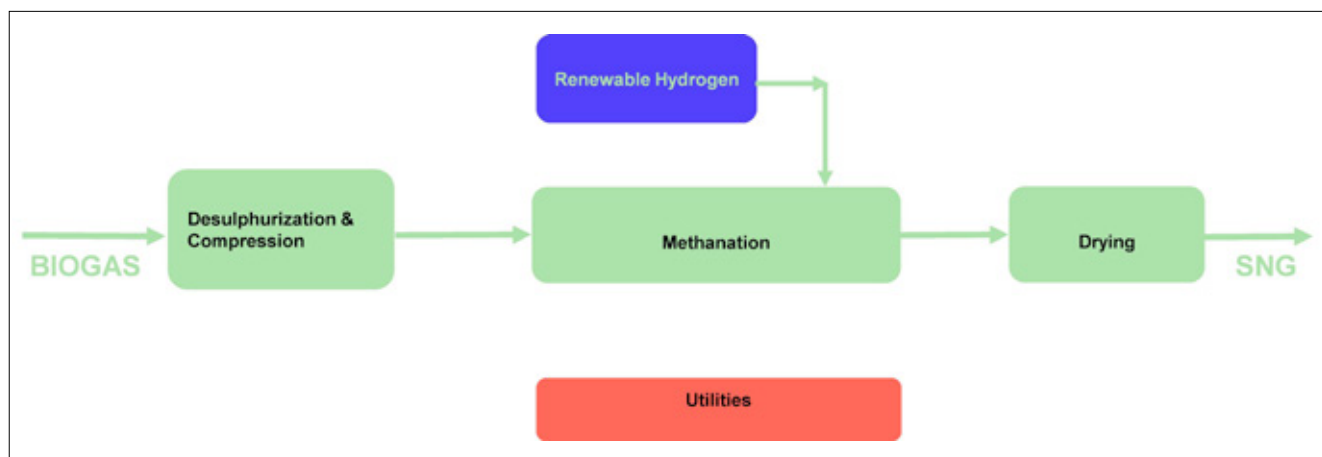


**Table 1 - Performance Data of Bio-SNG production from biomass gasification.** Efficiency is defined as the ratio of produced SNG thermal power and inlet biomass thermal power. The SNG production costs is based on the following assumptions: biomass cost of 22 €/ton, full equity, I.R.R. 8%

Item	Value	Unit
Feedstock flowrate	130	t/h
Inlet thermal power	315-330	MWh
Outlet SNG flowrate	21,000	Nm <sup>3</sup> /h
Efficiency	up to 67	%
Total Investment Cost (TIC)	340-370	M€
SNG production cost	13.0	\$/MMBtu

**Table 2 - Performance Data of Bio-SNG production from biogas upgrading**

Item	Value	Unit
Feedstock flowrate	0.5	t/h
Inlet biogas thermal power	3	MWh
Inlet renewable hydrogen	550	Nm <sup>3</sup> /h
Electrical power required for renewable hydrogen production	2.3	MW
Outlet SNG flowrate	455	Nm <sup>3</sup> /h
Electrical power to SNG efficiency	61	%



composed of CO and H<sub>2</sub>) can contain also H<sub>2</sub>O, CO<sub>2</sub>, CH<sub>4</sub> and N<sub>2</sub> together with organic and inorganic contaminants and must be purified before the methanation process, in order to avoid the irreversible deactivation of the downstream catalyst [9]. All the required technologies for the polishing steps and the subsequent methanation are by now ready on the market and Wood has all the capabilities to manage all the process blocks at full industrial scale. For instance, tar can be removed through specific processes downstream of the gasifier, such as water scrubbing, oil scrubbing, thermal cracking, and catalytic cracking. Organic contaminants (e.g. tar), inorganic contaminants (e.g. H<sub>2</sub>S, NH<sub>3</sub>) and particulate matter can be removed through either physical or chemical absorption. Particular attention has to be paid in conditioning the syngas for SNG production from biomass gasification due to the variety of compositions hidden behind the term “biomass”. SNG can be produced from biomass by using different plant configurations, which depend

on the selected gasification technology with an impact on the downstream syngas conditioning and cleaning steps [10]. A typical conceptual scheme of a biomass gasification to SNG is reported in **figure 3**.

Today, more than ever, the biobased sector is seeing the interest and investment of the main EU members. Considering these current incentives, the biomass gasification followed by a suitable polishing step and the clean gas methanation is a viable and economically attractive solution to produce Bio-SNG and Wood is actively working in this market. **Table 1** provides the technical and economical assessment of an industrial scale biomass gasification and SNG plant, using woody materials as feedstock.

The main input data are relevant to the woody material feedstock and the outlet thermal power of produced SNG of approximately 200 MWh, which correspond to a product flowrate of 21,000 Nm<sup>3</sup>/h. The final clean-up is based on catalytic reforming

**Fig. 4 - Biogas upgrading to SNG block flow diagram**

for tar removal and physical solvent washing of H<sub>2</sub>S, followed by VESTA clean syngas methanation and chemical solvent washing for the CO<sub>2</sub> removal. The Biomass-to-SNG Demonstration Project follows on from the existing pilot plant, and focuses on the commercial innovation necessary to enable the construction of commercial plants now that the necessary technical research has been completed. The UK's Department for Transport, as part of a programme to develop and commercialise technologies required to decarbonise the transport sector, and National Grid Gas Distribution, who own and operate a large part of the UK's gas distribution network, funded the 4.5 MWth demonstration plant of the Biomass-to-SNG process.

The overall process will use Advanced Plasma Power's Gasplasma® technology to convert biomass to syngas followed by Wood's VESTA SNG technology to convert syngas to SNG. Wood's scope inside the Biomass-to-SNG Demonstration Project consists of a Basic Engineering Design followed by Engineering Procurement & Fabrication of Wood's VESTA SNG technology including the following sections:

- final gas clean-up;
- clean syngas methanation;
- CO<sub>2</sub> removal system;
- SNG drying.

The construction activities are ongoing as per the planned schedule and will result in a fully operational commercial demonstrator in 2018 which will enable the first full scale commercial plants to commence operation in 2020, which is in line with the Carbon Plan targets.

## Biogas Upgrading

Biogas upgrading pathways to produce Bio-SNG deals with the integrated SNG production from biogas and renewable hydrogen. Likewise the Biomass-to-SNG process scheme, the syngas conditioning and cleaning steps can vary depending upon feed gas composition. **Figure 4** shows the block flow diagram of biogas upgrading and SNG production from purified biogas and renewable hydrogen coming from electrolytic cell, which includes the following sections:

- biogas clean-up (deep desulphurisation, dehalogenation) and compression;
- clean syngas methanation;
- CO<sub>2</sub> removal system;
- SNG drying.

**Table 2** collects a case study relevant to a small scale unit that involves biogas upgrading and Bio-SNG production with VESTA catalytic methanation.



## Valentina Depetri

Valentina is Process Engineer in the Process Technology & Consulting group of Wood (formerly Amec Foster Wheeler), with a Master Degree in Chemical Engineering from Politecnico di Milano.

After joining Wood in 2016, Valentina had the opportunity to cover the process design of hydrogen and SNG units

for national and international Customers. While maturing her professional skills in the world of process simulation, design and execution, Valentina is coauthoring several papers relevant to the SNG technology.



## Guido Collodi

Guido Collodi is Process Director, Chemicals, in the Milan office of Wood (formerly Amec Foster Wheeler) with responsibilities in fertilisers, syngas derivatives, hydrogen, petrochemicals and SNG technologies.

Before joining Wood (formerly Amec Foster Wheeler) in 2006, Guido spent his career in the process department of Snamprogetti (now Saipem), entrusted with inorganic chemical plants such as hydrogen, ammonia, methanol

and syngas. He then became Technology Leader with process responsibility in major IGCC and Gas to Liquids projects.

Guido Collodi has published several papers on IGCC, gasification, hydrogen and flue gas treatment and gained his degree in Chemical Engineering from University of Pisa, Italy, in 1979.

The plant configuration deals with 3 MWh of biogas and 550 Nm<sup>3</sup>/h of hydrogen as feedstocks and the outlet thermal power of produced SNG of 4.4 MWh. The renewable hydrogen generation involves electrolyzes. The final clean-up is mainly based on either biological or chemical desulphurisation, followed by VESTA clean syngas methanation.

According to the results the biogas upgrading associated with the VESTA process is feasible and provides an efficient, robust, and viable system to produce Bio-SNG that can be delivered, transported, and distributed using the natural gas existing grid and infrastructures.

## Conclusions

VESTA technology was developed in 2006 to be an alternative method of natural gas production in countries where plentiful and more evenly distributed coal reserves are available. In the meantime, many communities pushed the transition to a low carbon economy. The valorisation of biomass like wastes and residues is expected to play a key role in the energy sector, moving from clean energy generation to include chemicals and fuels production. This is why Wood's VESTA technology with its multifaceted potentialities has been adapted to the market needs of different countries (across Europe and Asia) by

gaining references in terms of Basic Design Packages development and commercial demonstration of the technology.

A number of advantages has been envisaged in VESTA technology starting from its demonstration in the pilot plant in Nanjing and continuing the design development to renewable pathways of natural gas production. The plant has a very simple process scheme that facilitates excellent performance both in terms of SNG product and exported steam. VESTA features the absence of the recycle compressor and the possibility to use low alloy steel, for all the reactors, instead of high alloy steel or refractory walls.

Other advantages lie in the full flexibility to balance both capital and operative expenditures and to adapt to any source of syngas on different scales. The thermal integration is designed and optimised in order to meet the customer's requirements: the production of medium or high pressure (saturated or superheated) steam and low pressure steam at the same time, if possible and of interest. The process is made unique by the characteristic that is intrinsically safe, because runaway reactions cannot occur. All these features make the VESTA process a very attractive option for the market and Wood is active in its commercialisation.



## Luca Mancuso

Luca Mancuso is Director in the Milan office of Wood (formerly Amec Foster Wheeler). With a first-class degree in Chemical Engineering, Luca joined Wood (formerly Amec Foster Wheeler) in 2000 and he is now Director in the Process Technology & Consulting service line of the Company. In the past years, Luca had the opportunity to develop a deep experience in the design of fossil-based power and chemical generation plants, following feasibility

studies, basic design and detailed engineering phases of several projects worldwide. In the field of CCS, he has successfully worked for a large number of renowned international companies and organisations. The acquisition of this expertise allowed Luca to publish several papers and to present them at international conferences on Gasification Technologies and Greenhouse Gas Control techniques.



## Fabio Ruggeri

A graduate in Chemical Engineering, Fabio Ruggeri has been at Wood (formerly Amec Foster Wheeler) since 2006, holding at present the position of Technology Business Development Manager.

Fabio has an extensive experience in the process design of refinery and chemical units. He is also author of several papers featured and/or presented at national

and international magazines and events.

Fabio is the leader of the Hydrogen Technology Group in charge of continuously improving our proprietary hydrogen technology. Fabio is also involved in the development and the marketing of our VESTA technology, a novel technology for the production of SNG from both coal and biomass.

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## The Multipurpose Development of VESTA Technology

In recent years, industry and scientific research has gained interest in investigating and developing new methods of natural gas production by exploiting alternative and more abundant resources, without losing the possibility to achieve end user demand and needs. The conversion of syngas coming from coal or renewable biomass gasification and biogas upgrading with a suitable methanation process scheme, which treats the produced syngas, provides an alternative energy option for end demand, including residential heating, and associated applications like cooking and transportation.

Several studies proved that Substitute Natural Gas (SNG) is an excellent energy carrier to be directly introduced into existing natural gas networks. In 2006, Foster Wheeler (now Wood) developed a simple methanation process, called VESTA, using catalyst provided by our partner in the technology, Clariant. A number of technical and economical assessments of SNG production by means of VESTA technology were performed, also by means of a pilot plant erected in Nanjing, China. Moreover, the commercial feasibility of the VESTA process integrated with a waste plasma gasification will be established within the mid of 2018 by means of a Biomass-to-SNG demonstration plant in UK. These two plants represent the multifaceted nature of VESTA catalytic methanation. Indeed, the most important feature of the VESTA process is that it can handle syngas of wide qualities and coming from different sources such as coal, biomass, petroleum coke, and solid waste.

In this article a summary of the technology as well as an overview of the state of development will be presented for the various available applications including coal gasification and renewable process schemes.

# “Deal of the Year” for Norte III, Mexico

By force of creativity and prestige, Techint Engineering & Construction helps save a combined-cycle power plant project in northern Mexico from bankruptcy

Techint E&C Communication Depart.



It all started in 2014. Mexico's electricity authority (CFE, Comisión Federal de Electricidad) opened the bid for the construction of a power plant in the northern State of Chihuahua. It also reached an agreement for natural gas supply for the future plant and the construction of the gas pipeline from Texas. Power consumption in Chihuahua is expected to grow by more than 3% a year over the next decade and the region was singled out as a weak point in the country's power distribution system. The plant was to be running by November 2017.

In early 2015, the project was awarded to the Spanish firm Abengoa under a 25-year contract with CFE. However, as construction got started, thanks to a USD 200 million bridge loan from a group of international

banks, Abengoa's parent company sank in financial dire straits in Spain. Fearing that they might not be able to recover their funds, the banks did not provide the project with long term financing. By March 2016, the project ran out of funds and stalled.

Macquarie, an investment and financial advisory firm, was trying to put together a solution to save the project from collapse and reached out to Techint to form a consortium. The CFE authority was willing to give the new players some time to get a rescue plan going. "We all had to be very creative in structuring this deal", explains Alberto Moscosa, now Techint Construction Manager at the project. "As Abengoa had already carried out 70% of the detail engineering, we had to go through a due diligence process. We didn't know

## Techint's Profile

Compagnia Tecnica Internazionale - soon named TECHINT after the original telex code - was founded in Italy as an international corporation in 1945. The founder, Agostino Rocca, was an innovative engineer, manager and entrepreneur, and a key force behind the development of the Italian steel industry in the 1930s.

The company began providing engineering services to a growing number of clients in Latin America - to where Agostino Rocca had traveled after World War II - and Europe.

In a few years Techint E&C grew in terms of strength and experience to become a recognized player in many sectors: oil & gas, upstream, midstream and downstream, mining, power, industrial plants and infrastructures.

Techint E&C professionals from all around the world are committed to developing timely and competitive solutions to complex project requirements, complying with the highest industry safety and quality standards, while protecting the environment and promoting the development of local communities.

Milan Techint E&C specialized engineering center offers high added-value services in areas where it has significant experience, such as oil & gas, in particular LNG regasification, refining, power, and hospitals. Over the last years it has expanded its range of services to include environmental consultancy, green technology solutions, applied innovation technologies, asset management and optimization solutions, in line with the Company's specific strategy of offering its customers a unique value proposition.

The Milan office utilizes cutting-edge project design software and simulation tools, in particular for dynamic process simulation, BIM (Building Information Modeling) applications for civil and infrastructure design, as well as many others specialist techniques.

proposed by the new lenders. This included a detailed report with technical and financial information in order to get the approval of the new lenders' Credit Committees. An interdisciplinary team had various sessions with around 10 banks that would ultimately fund the continuation of the project to explain the proposed plan to restart construction. "Our team had to explain every detail of Techint's takeover plan, as well as its financial strength to back it up", explains Techint Finance and Treasury Manager, Juan Martín Quihillaborda.

The lenders were not the only ones being overly cautious. For all of the stakeholders involved, Norte III was a source of concern and frustration. Spread over the United States, Europe and Japan, the project's main suppliers and contractors, which included the likes of General Electric and Toshiba, had lost considerable time and money and were not amenable to further concessions.

In a race against the clock in February 2017, Techint executives toured Frankfurt, Brussels and Tokyo to define the commercial terms with the critical suppliers and bring them on board. At the same time, Techint's legal team finalized the project's major agreements on plant construction, the concession with Mexican authorities, partnership with Macquarie Capital and loans with the banks.

"Techint's reputation played in our favor during the negotiations," notes Moscosa. "The suppliers' main concern was that they were not being paid - and Techint is well known for always meeting its obligations." On July 13, 2017, just over a year after Techint mobilized its team, CFE's Board of Directors approved the change of guard for the Norte III project from Abengoa to the Macquarie-Techint consortium. On

exactly what we would find in there".

The process required an extremely thorough analysis of the terms and conditions of Techint's EPC contract as well as the new terms of the long-term financing





August 31, 2017, the consortium finally secured USD 716 million, which would be used to repay part of the bridge loan and resume work. Within the following three months, Norte III moved from three people to over 500 people working on site.

Thomson Reuters' Project Finance International chose Norte III as the "Latin American Power Deal of the Year" for having revitalized a crucial plant for northern

Mexico. Euromoney's IJGlobal awarded the project with "Latin American Power Deal of the Year" and the prestigious "Overall Deal of the Year". "We are on track to deliver the power plant on November 30, 2019," Moscosa said. "All the people involved, from the authorities to the banks and suppliers, believed in us. Our reputation got us the project, now we have to honor it."

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# How Saipem Innovation Strategy Embraces the Holonic-Virtual Paradigm

In the current market environment, marked by strong competition and uncertainty regarding prospects for development, innovation is a strategic lever for strengthening and consolidating the competitive positioning of companies for tackling future challenges. Saipem's innovation lab, aimed at increasing productivity and discovering new value propositions, is one of the building blocks of the company's innovation strategy. While 2017 was the year dedicated to the Proofs-of-concept, 2018 must be the Scale-up one. The paper details how Saipem wants to achieve this transformative target.

Antonio Careddu, Andrea Boscacci, Luca Pagani, Saipem



The oil & gas industry is experiencing a transformation of its complex system. The period ranging from the year 2000 to 2014 was characterized by colossal investments, driven by high oil prices, in what were at times difficult environments, such as deep water, that put major general contractors to the test with challenging projects. Almost all the mega-projects, however, incurred extra-budgetary expenses and significant delays in their execution.

The global crisis of aggregate demand, large plants entering into production and, above all, the development of technologies associated with fracking in North America, have led to a temporary abundance in the supply of hydrocarbons, and the subsequent collapse in prices. Turnover for contractors and service providers have fallen, with serious consequences for employment. Although aware that the demand for hydrocarbons will continue to be sustained thanks to the economic

recovery and an increase in world population, the entire industry is wondering how to make the search, the transformation and the exploitation of fossil sources sustainable, thus ensuring that the two billion more people who will be inhabiting this earth, as well as the current population of 7.5 billion, will have water, food and well-being, and at the same time a planet that is livable and clean.

It is for these reasons that Saipem undertook a number of analyses. The first of these concerned productivity. Unlike other industries (automotive, aerospace, logistics), productivity indicators such as hours/equipment or tonnes per worker in the period of time have worsened.

The second analysis focused on the impact of digital transformation on processes and methods. Whereas in field engineering and geology the use of calculation systems has led to valuable results, yet to be confirmed on a number of significant discoveries, there is a feeling that relating to engineering and construction we have

Fig.1 – New stakeholders' expectations

## Over the last 10 years

- Project cost increased **5-fold**
- Productivity declined
- Project schedule slippage increased **1-2 yrs**
- Construction cost **25% -> 50%** of EPC
- Craft labour ~ **30% to 40%** of project budget
- Competition stronger than ever
- O&G projects increasingly complex

Fig.2 - The industry productivity evolution

remained pretty much where we were in the nineties. Processes in workshops and on site are still dangerous, with a very high intensity of manual labour. Engineering uses CAD 3D, ERP, calculation and simulation programs that have no interconnection whatsoever, with a very low rate of data reuse.

The third analysis looked at procurement and logistics. Although communications with suppliers occur on a daily basis, and there may be some sort of collaboration, contractual relations are still transactional, regulated by contracts that are increasingly voluminous and crammed with pitfalls, penalties and often absurd presumed shifts of liability. The consequences mean having to resort to risk coverage that has an effect on prices and limited transparency in the relationship between client and supplier. Moreover, the legacy level as well as the mistrust that exists between the internal functions of the same company (for example, project management, procurement, audit) do not allow managers to privilege decisions in favour of the business instead of the "rules". This translates into further burdens on the purchase prices of goods and services and into the automatic exclusion of small and new suppliers, even if these might be offering innovative solutions.

Fig.3 - The Innovation Factory integrated approach

The fourth analysis examined the internal culture and the organisations. The organisational structures appear very fragmented, divided into silos, with lengthy,

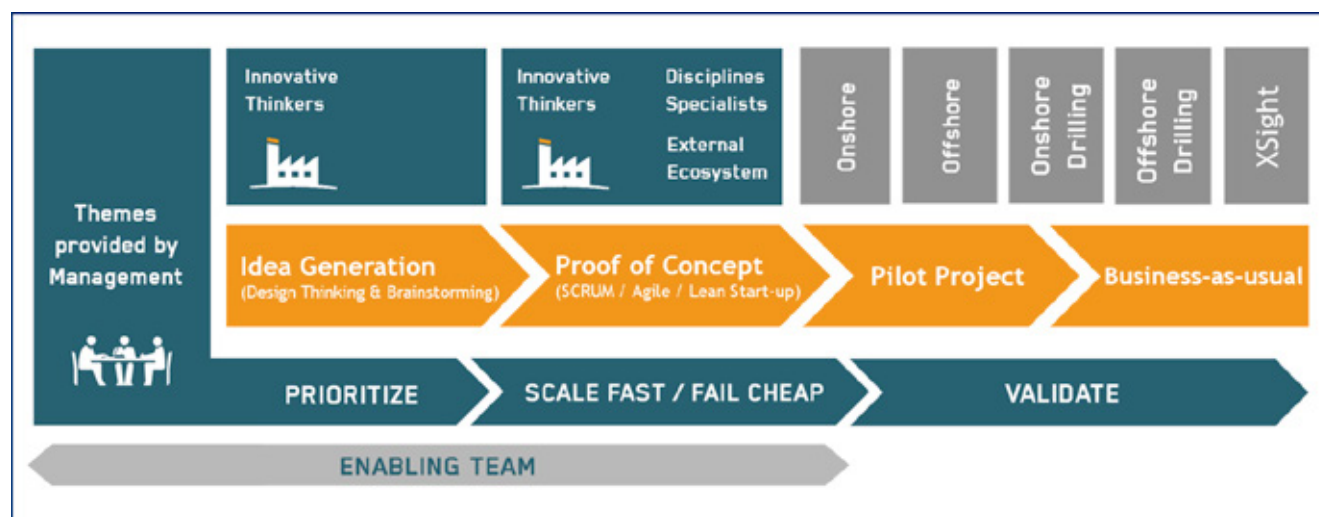
bureaucratic decision-making processes and with little accountability on the part of middle and top management.

## The Innovation Factory

It was on the basis of these studies that, in 2016, the Innovation Factory was launched, an incubator for ideas and a fast-prototyping lab that aims to tackle problems holistically, and to develop ground breaking responses to the sector's challenges. In a very short time, and not without difficulty, a physical and cyber network environment was created that was different from the usual offices of traditional companies. The objective was, and still is, to modify behaviors through viral change whilst at the same time trying out innovative technological solutions.

The apparent contrast in the name Innovation Factory aims to place the accent on the need for concrete substance in the pursuit of tangible results, consistent with company traditions. At the same time, it aims to consolidate an agile approach to innovation, focusing on the rapid study and experimentation of potentially transformative ideas. One is dealing, therefore, with a "sprinting" method, which together with technology scouting supports the "marathon-running" pillar of the corporate innovation strategy, technology development, focusing on innovation projects with medium and long-term time-to-market.

The Innovation Factory is run by a cross-functional team of innovative thinkers, selected within the organization according to their propensity for lateral thinking, creative problem-solving, entrepreneurship and collaboration skills. The Factory continuously hosts working groups in a physical and digital space where people organise and manage their activities independently: what counts are the results. The challenges they are called upon to tackle are identified directly by Top Management, and are steered and



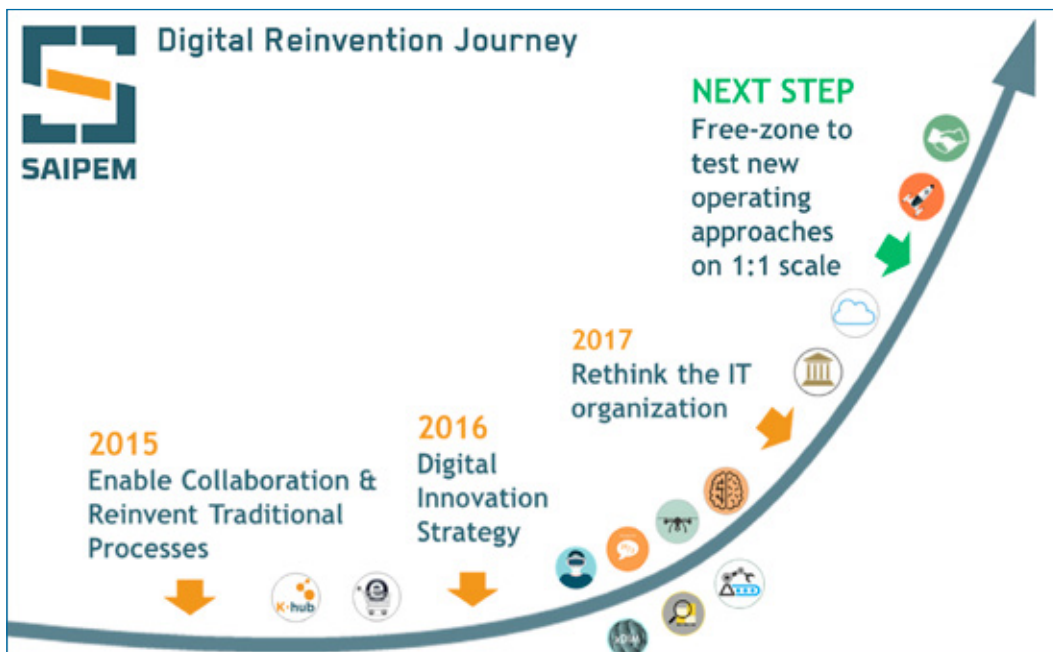


Fig.4 - Saipem Digital Reinvention Journey

aligned to company strategy by senior managers as project sponsors.

The main contribution of the colleagues involved in the programme consists in generating creative ideas emerging during design thinking sessions. The key to success, therefore, is the human factor of in-house innovative thinkers and the external ecosystem.

The sessions are organized and managed by the Enabling Team, colleagues from the Innovation, Systems and Corporate Marketing function, who support the activities with methodologies (Scrum, Agile, Lean start-up etc.) guaranteeing the constant coordination of activities with internal and external stakeholders.

The set of ideas resulting from the sessions is presented in the form of storytelling for the approval of the sponsors, who select the most promising ideas on which to concentrate prototyping efforts on a “scale fast or fail cheap” basis, thus seeking to assess their effective potential through an efficient investment in time and resources.

### Topics currently under study

During the Proof of Concept (PoC) phase, the support offered by disciplines specialists is fundamental in the ideas being developed. They help to integrate the skills available in the groups thanks to their specific know-how. The results are submitted for the approval of the Advisory Committee. The experiments considered valid are then scaled-up in the Saipem business divisions, where the benefits offered are checked and validated. If the prototype does not reach the desired outcomes, the experience gained is capitalised, and the team is ready to move on to a new challenge.

The topics currently under study concern virtual reality,

automation and predictive maintenance for the Saipem fleet (the Smart Ship), digital technologies, robotics and new materials and processes for fabrication and construction, big data and machine learning to speed up tendering and basic engineering activities, artificial intelligence to better support the decision makers and the employees in general.

### The collaboration with the Ecosystem

It is interesting to note how the whole innovation cycle is based on promoting the intermingling of experiences, methodologies and technologies that are already used successfully in industrial sectors to which the company is not traditionally linked. As an example, during 2017 a strategic collaboration agreement was signed with NTT Data (a Japanese system integration company) for the co-development of innovation projects in the field of augmented and virtual reality and the application of cognitive computing. At the same time, the Innovation Factory started a collaboration with an important Client for the development of a smart wearable devices platform to improve the safety conditions of the field operators and it is hosting the activities of the first executive pilot project for the digital and data-centric collaborative methodology for the management of the entire project life-cycle called xDIM™.

In the meanwhile, in lieu of traditional “built-to-last” approach, Saipem has re-invented its IT organization by embracing the adaptive sourcing and signed a long-term partnership with three major players of digital services (Accenture, DXC and Tata Consulting Services). As a crucial enabler, Saipem has also started a full migration on Microsoft Azure Cloud platform.

## New and good ideas for the future

And what about the future? The Factory has demonstrated that with an open innovation system, one that is creative and comfortable for those taking part, it is possible to arrive more rapidly at the prototyping of really interesting technological, relational and process solutions. Nonetheless, the scale-up is virtually impossible to achieve quickly. Indeed, the departments of companies still perceive innovation merely as problem solving: finding good and new solutions to old problems. The general tendency consists in the digitization of existing processes that maintain the silos and the comfort zones with little sharing of data.

It is likely that the way to speed up innovation and enjoy the benefits that digital technology has to offer is what in ecology is called “niche construction”, that is to say the creation of environments in which one responds to

problems of the future with new and good ideas. Basically it is a free zone in which to experiment and at the same time expand on a large scale.

Digital technology would make it possible, in fact, to experiment with the holonic-virtual enterprise, characterized by numerous interactive clusters capable of responding to the needs of customers and stakeholders with high levels of innovation and flexibility. More in general, it constitutes, on a case-by-case basis, the most appropriate value chain for pursuing business. The individual clusters can belong to different companies, and together they can create a more powerful virtual enterprise. This requires a significant cultural leap, in terms of cooperation and trust, in which creativity and intelligence are decentralised and the system organises itself so that the project known at any point of the network can mobilise all the required resources, quickly and effectively.

To quote Socrates: “The secret of change is to focus all your energy not on fighting the old, but on building the new”.



### Antonio Careddu

Antonio is Saipem Director for Innovation, Systems and Corporate Marketing.

After graduating in Engineering at the Politecnico di Milano, he has gained a long experience in the oil&gas sector. He first worked for Snamprogetti, then for Saipem worldwide, in particular in Saipem France as

Chief Operating Officer, Chairman and Chief Executive Officer. He returned to Milan in 2013 to manage Corporate Quality department and, since November 2015, has been Corporate Director for Innovation, Systems and Corporate Marketing.



### Andrea Boscacci

Andrea is Saipem Corporate Head of Marketing and Innovation Factory.

After graduating in Law at the Università degli Studi di Milano, in 2006 he started his career in the Saipem Legal Department as Contract Administrator. In 2013 he was called upon to manage the Contract Management

Planning & Methodologies office, before moving to the Strategies and Innovation department in December 2015. He has been the Project Lead for the set-up of company Knowledge Management tool, and the PMO for Supply Chain Optimization Programme.



### Luca Pagani

Luca is member of the Team of Saipem's Innovation Factory.

He graduated in Automation and Control Engineering at the Politecnico di Milano. In 2012 he joined Saipem as Offshore Technology Innovation engineer. In 2014 he

joined the Change Management, Engagement and Community function dealing with human resource change and improvement programs. In 2016 he joined the Strategy and Innovation department. He is a member of the Saipem Knowledge Management Team.



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# New Engineered Pumps Production Plant in the Urals (Russia)

Thanks to its strong experience in Russia, Termomeccanica Pompe has been able to seize the opportunity created by the recent localization policy followed by the Russian government aimed at strengthening the country's independence in strategic industrial sectors and has opened an engineered pumps production plant in joint venture with local partners

**Cristian Ricci**, Termomeccanica Pompe

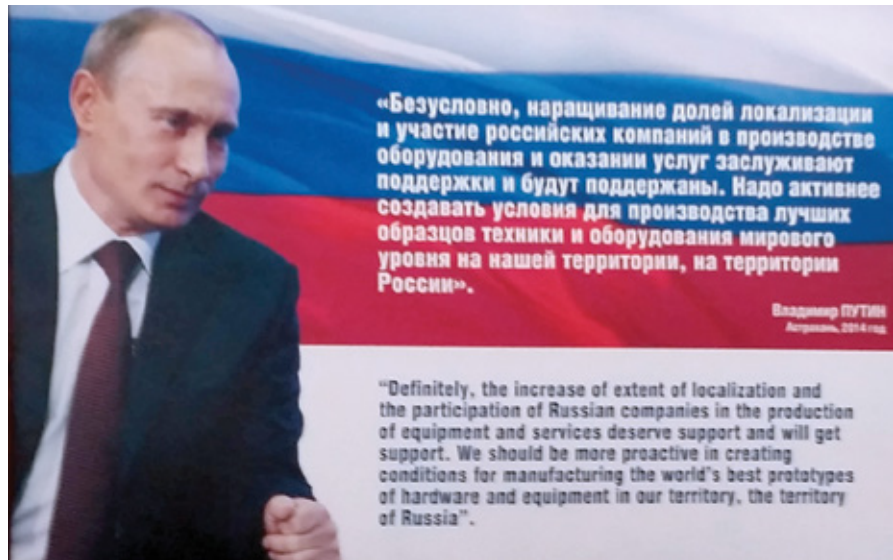


*Transneft Oil Pumps facilities: production area*

Having good references, finding the right partners and being perseverant are key ingredients to establish a successful joint venture in Russia.

Termomeccanica Pompe's experience in the country dates back to the Seventies. Over the years, it gained the reputation of a reliable supplier for both new products and after-sales service, and, in 2013, it opened its first local company based in Moscow in order to better evaluate the market and create a logistics / sales base. That, however, was only the beginning.

In 2014, Termomeccanica came in contact with an important local company and got involved in setting up a joint venture whose aim is to engineer, manufacture and test pumps for the oil&gas market, in compliance with Russian and international standards.



*Poster on Russia's localization policy with President Putin's picture*



The partners involved in the joint venture are:

- Transneft PJSC (51%), the local giant company managing pipeline transport in the country;
- Konar CJSC (24%), a local manufacturer of key components for the oil & gas sector;
- Termomeccanica Pompe (25%), the foreign company chosen as technological partner.

*From left: Transneft PJSC's Chairman, Nicolay Tokarev (with his arm up) and Russian President, Vladimir Putin, in front of a pump produced by TOP*

On April 25<sup>th</sup> 2016, Transneft Oil Pumps JSC (TOP) was inaugurated in the presence of the Russian Prime Minister, Dmitry Medvedev.

Following the Russia-Kazakhstan Interregional Cooperation Forum which took place in Chelyabinsk on November 9<sup>th</sup> 2017, TOP received another prominent visit, that of the Russian President himself, Vladimir Putin. Both visits testify to the crucial importance of this company for the government's industrial localization program undertaken several years ago in sectors considered "strategic" following the international sanctions resulting from the Crimea crisis, which started in 2014.



*TOP's inauguration on April 25<sup>th</sup> 2016; from left: the Italian Ambassador in Moscow, Cesare Maria Ragaglini, the Russian Premier, Dmitriy Medvedev, and Transneft PJSC's Chairman, Nikolay Tokarev*



*Transneft Oil Pumps facilities in Chelyabinsk: external view*

The production facility, built in only 11 months (from February to December 2015) and with an investment of 45 M€, employs today a staff of around 400.

Its location in the Chelyabinsk industrial district is not random: it is a very important industrial area for the country and an area where other companies with Italian stakeholders have been operating for some time in the same sector.

The facility covers a total area of 23,000 m<sup>2</sup>, of which 15,000 m<sup>2</sup> are dedicated to operations (workshop and test center). Its production capacity is of about 180 pumps a year, including "main oil" pumps and "booster" pumps. Particularly noteworthy is the 3,800 m<sup>2</sup> test center, which offers the possibility of carrying out tests with powers up to 25 MW and capacities up to 35,000 m<sup>3</sup>/h.

Over 2016 and 2017, TOP produced about 200 pumps dedicated to pipeline projects for the Russian market and tested complete pumping units consisting

of pump, electric motor, inverter and lubrication control unit with an absorbed power of about 12 MW.

In the future, new investments allowing the expansion of TOP's production capacities, in terms of both pump range and market sectors, are not excluded.

During the same period, Termomeccanica Pompe also acquired a series of important contracts with key local customers operating in the oil & gas and power generation sectors, contracts in which TMP involved other Italian companies for strategic sub-contracts related to electric motors, auxiliary packages and castings.

In conclusion, it can be said Termomeccanica Pompe's joint venture project is not only an example of good business in Russia, achieved at a difficult time, but also shows the Italian industrial system a possible way to avoid losing further market shares to the advantage of countries which are not involved in tensions / sanctions with the Russian Federation.



## Cristian Ricci

Born in 1978, Cristian has an Aerospace Engineering Degree from the University of Pisa. After 2 years of work experience in the Marine Industry, he joined Termomeccanica Pompe in 2008 where he started as Project Manager in the company's Service Division. He was promoted to Sales Engineer of the same Division in 2011 and, a year later, was chosen for the newly

created position of Country Manager for the Middle East and Far East.

At the end of 2014, with Termomeccanica Pompe's new Russian joint venture project, the company appointed Cristian Project Manager to develop the project as well as the contracts acquired with the new partner Transneft PJSC.

# Quality Risk Management in Oil & Gas Industry

Projects today are getting larger and more complex and several factors combined increase the level of project-related risk within the sector. The challenge therefore is to manage the political and other risks that are unavoidable in the industry. How well these risks are analyzed and managed will often be key to a project's success. The main techniques proposed by Xylem are: condition-based monitoring, predictive maintenance, critically-based maintenance, performance center or center of excellence.

**Massimo Rebecchi**, Xylem Srl President and Ceo

My multinational Client asked Xylem to explore the Operational Risks faced by Construction companies in today's business and regulatory environment, and how the right information technology can help mitigate those risks. Operational risk is experienced at the corporate level, but these considerations mainly focuses on what impacts can have every day on construction plants activities.

The purpose of this reflection is to encourage and facilitate the development of a more systematic, prioritized, risk-based approach to quality management to support the principles of "Good Construction Practice" and to complement existing quality practices, requirements and standards.

Quality in this context is commonly defined as fitness for purpose. Construction activities are about generating information to support decision making while protecting the safety and rights of participating subjects. The quality of information generated should therefore be sufficient to support good decision making.

Each step of the business process is setting the stage for decision making by one or more of the parties involved. Quite a number of these decisions are formalized by legislation and by design applicable standards.

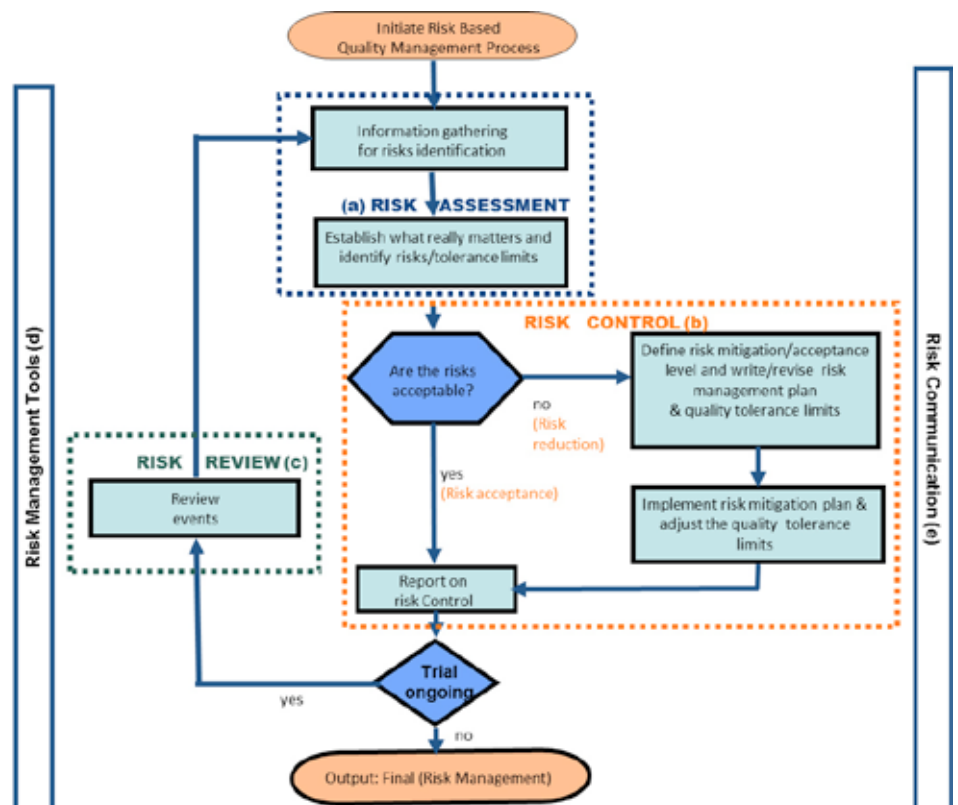
The challenge for oil & gas industry is to manage the political and other risks that are unavoidable in the industry with effective returns.

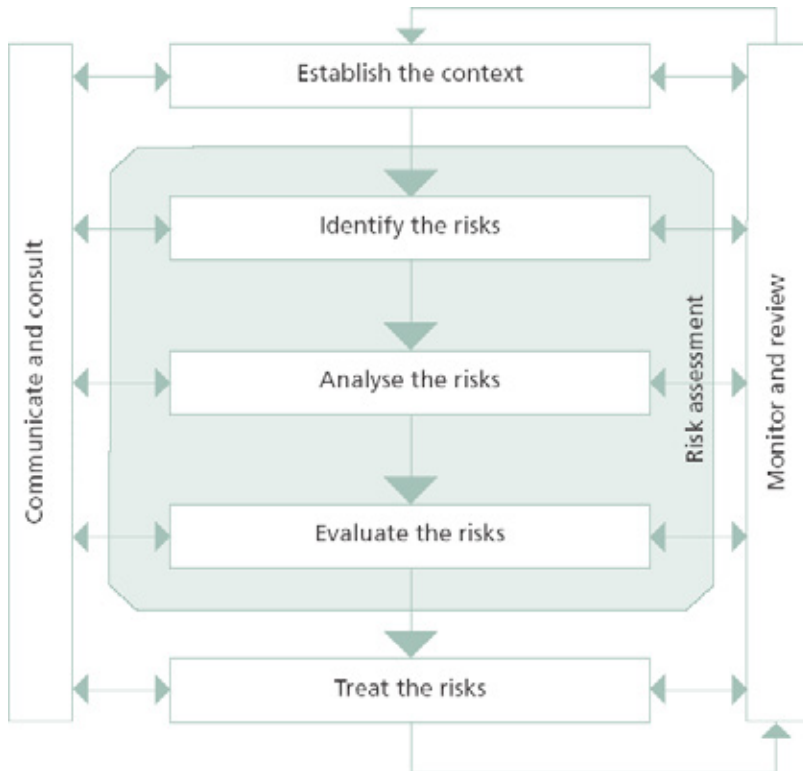
## Decision Making Process, Value of Information and Flexibility

Many complex decision problems in petroleum exploration and production involve multiple conflicting objectives. Under these circumstances, managers have a growing need to employ improved and systematic decision processes that explicitly embody the firm's objectives, desired goals, and resource constraints.

Over the last two decades, the advances in computer-aided decision making processes have provided a mechanism to improve the quality of decision making in modern petroleum industry. Walls (1996) developed a decision support model

Fig. 1 - Quality Risk Management Process





**Fig. 2 - Risk Process Evaluation Loop:**  
 1. Credit risk,  
 2. Liquidity risk,  
 3. Operational risk,  
 4. Market risk,  
 5. Political risk,  
 6. Foreign exchange risk

that combines the toolbox systems components to provide a comprehensive approach to exploration petroleum planning from geological development through the capital allocation process.

### Right Information in Time

Most oil & gas companies would agree that the most significant challenge for their enterprise is management of information. Oil & gas companies continue to work to be able to create intelligence from the massive amount of technical and business data, both structured and unstructured, that they have collected. The ultimate goal in collecting all this information is to speed time to first oil, reduce risks, and meet compliance requirements with information life-cycle management.

**Fig. 3 - Stakeholders in small business**



Some companies are establishing new information governance structures to harness OT and IT (Operational Technology and Information Technology) data sources, and we expect others to follow.

### Data Quality

When it comes to information related to assets the issue of data quality hits oil and gas companies. These are typical complaints that I collect:

- asset databases are incomplete;
- documents (including drawings) are not updated;
- information stored in the different company systems are not consistent or integrated;
- information is not available or not properly synchronized on mobile devices;
- data quality is not systematically audited. Poor data quality heavily impacts the decision-making process, increasing the risks of operational mistakes. Oil & gas companies need to carefully tackle this issue to avoid reducing effectiveness of operations. Additionally inconsistent data across systems (typically GIS, Geographic Information Systems, and EAM / ERP, Enterprise Asset Management / Enterprise Resources Planning) increases the risk of fines from regulators.

### Prevention of Non Compliance

Every time there is a not approved deviation from procedures and specifications we have a non conformance. With the increasing regulatory pressure, oil & gas companies cannot afford the risk of being non-compliant to some rules. For this reason the possibility to meet a non conformance can be considered in medium-high level.

The non conformance has always a deep impact on project plan to search for a deviation or to rebuilt

materials, or to obtain new authorization to proceed with site and camp operations.

Is very important (and only few companies do it) to analyze the non conformances to understand how our project setup distribute the non conformances value.

More stringent requirements for timely reporting on operations and accidents might be required, as well as risk mitigation plans for critical operations such as drilling. Oil & gas companies need to ensure that vital documents, including approvals for drilling, building, and maintenance, are available throughout the enterprise and across enterprise boundaries to minimize risk and ensure regulatory compliance.

## Real Time Monitoring and Predictive Maintenance

During the construction phase, major uncertainties are related to volumes in place and economics. As the level of information increases, these uncertainties are mitigated and consequently the importance of the uncertainties related to the recovery factor increases. The situation is more critical in offshore fields and for heavy-oil reservoirs.

In order to avoid excessive computation effort, some simplifications are always necessary. The key point is to define the simplifications and assumptions that can be made to improve performance without significant precision loss. Simplifications are possible, for instance, in the modeling tool, treatment of attributes and in the way several types of uncertainties are integrated.

Best-in-class companies use a variety of techniques to reduce maintenance costs, increase uptime, and increase availability.

These techniques include the following points.

### Condition-based monitoring

Placement of sensors to measure various conditions (temperature, vibration etc.) to detect situations that may indicate potential equipment failure. The more sophisticated systems have alerting capabilities and are integrated with enterprise asset management applications that can automatically generate inspection or work orders.

### Predictive maintenance

Predictive maintenance goes beyond condition-based maintenance in applying advanced analytics to predict potential equipment failures, providing enough notice to procure complex non-commodity replacement equipment. Xylem identify a departure from normal operating levels of a piece of equipment rather than comparing performance with expected performance levels for the equipment class.

Risk criterion	Objective
Safety	Safety must be upheld at all times. No injuries or fatalities will be accepted
Financial impact	Project costs should remain within allocated budget
Media exposure	The project must ensure that the reputation of the business is protected from negative media exposure
Timing	The project must be completed within the contractual timeframe
Staff management	The project must utilise existing staff skills. Where a particular skill set is not available, sub-contracting may be considered
Environment	The project must operate within requirements of environmental legislation and be consistent with the business's environmental commitment

Fig. 4 - Examples of risk criteria for a project business



Fig. 5 - Market risk: the viewpoints of three participants

### Criticality-based maintenance

This technique informs decisions on maintenance strategy by identifying which assets are critical to the process and what the process impacts would be if the asset were to fail. Criticality-based maintenance also informs procurement strategy so that inventories, and the costs associated with keeping them, are reduced but not at the expense of increased downtime.

### Performance center or center of excellence

The most advanced companies have adopted centers of excellence where engineering staff are able to bring together engineering knowledge for root cause analysis when potential problems are identified. Centers of excellence can also have a view of multiple assets to support decision making and maintenance planning and even suggest future equipment design modifications.

## Operations and Decisions

Making important decisions in the petroleum industry requires incorporation of major uncertainties, long time horizons, multiple alternatives, and complex value issues into the decision model. Decision analysis can be defined on different and embedded levels in petroleum exploration and production stages. Decision analysis is a philosophy,

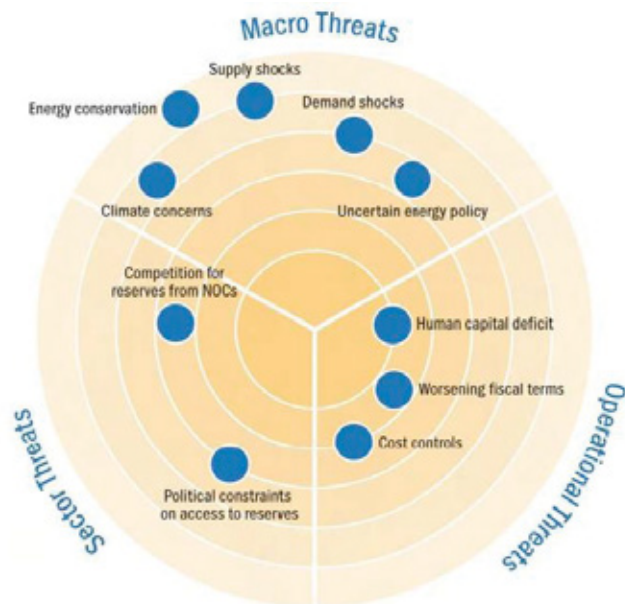


Fig. 6 - Threats: oil and gas industry

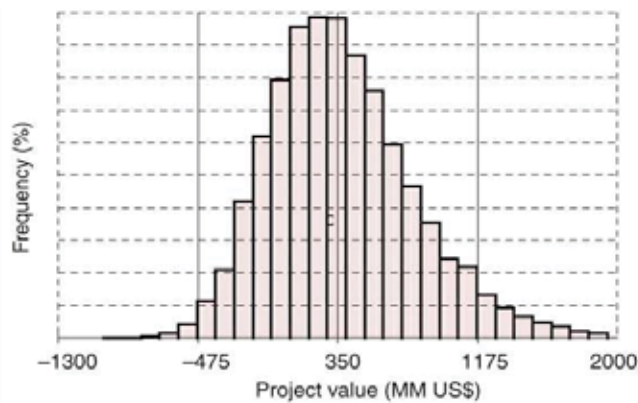


Fig. 7 - Cumulative risk frequency at project's value level

articulated by a set of logical axioms, and a methodology and collection of systematic procedures, based upon those axioms, for responsibly analyzing the complexities inherent in decision problems.

## Conclusions

Projects today are getting larger and more complex. The attraction of upstream profits is also driving many companies to consider expanding their investments, moving from investor to operator, or entering into the space from adjacent energy sectors. At the same time,

the graying of experienced project managers is reducing available capabilities. These factors combined increase the level of project-related risk within the sector.

Unless a company follows a strategy of complete risk avoidance and stays solely within its national boundaries, it will be faced with the need to consider political risk when investing outside its home country. The challenge therefore is to manage the political and other risks that are unavoidable in the industry. How well these risks are analyzed and managed will often be key to a project's success.

Classic political risk in the form of expropriation and nationalization remains a threat, although it is not as prevalent as it once was. Remember, that expropriation or nationalization does not in and of itself violate international law, provided there is prompt, fair and adequate compensation to the investor. Risks of contract repudiation such as was experienced by Enron in India, and so-called "creeping nationalization" as evidenced by punitive taxation, burdensome labor and environmental regulations, price and monetary controls, pose a greater and probably more likely risk today.

While political risk can be managed through insurance, strategic alliances and partnering, it can also be minimized, by taking some actions, which may seem obvious, but are too often ignored. Effective techniques include keeping a low profile, maintaining close relationships with the host government, anticipating change and working with it, avoiding geographical concentration, being a good corporate citizen and utilizing local suppliers and personnel to the greatest extent possible so as to create an economic link with the host country that establishes a national constituency with a stake in your continued political survival. However, no form of political risk insurance can protect a company if it engages in bribery or corruption, or pollutes the environment. Such actions would probably void any political risk insurance that was obtained.

Information technology can help mitigate operational risks. Organizations that understand their risk profile and take concrete action to mitigate risks will be better positioned to be successful in the marketplace.



## Massimo Rebecchi

Massimo Rebecchi is graduated in Civil Geotechnical Engineering. He has achieved PhD in Minerals and Petroleum Engineering in the United States. For years he was freelance professional as Mud Logger and Drilling Project Manager. He attended important construction projects under CCC-Sicon Oil group.

As a GE consultant in Nuovo Pignone since 2010, he attended several strategic Projects. During this experience

he established Xylem srl in Milan. As President and Managing Director he satisfied the Operations, Project and Quality requirements of several Main Contractors.

Today Xylem is a Lead Business Consultant Company in Industrial Construction (Oil, Gas, Process, Mills, Rail) for Operations, Project Management and Sourcing Quality Management located in Italy, Emirates, France and Algeria.

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# Implementation of a Gas Plant Updating its Electrical System

The need to expand and modernize the electrical capacity and power supply of the plants of a strategic gas power plant in Egypt has placed the end user in the condition not only to physically add a new electric station, but also to redefine the whole study of electrical engineering and loads of all the electrical stations present in the plant.

Costruzioni Elettrotecniche Cear Srl, having worked in the past on the same site, was called to redefine the new electrical engineering study and its supply for the improvement of the electrical power plant.

**Alessandra Ranno,**

Sales and Marketing Manager, Cear Srl



*Fig. 1 – The Power Motor Control Center*

**D**uring the last years the oil&gas sector has turned to new plant management approach based on increasingly frequent redevelopment of sites, an improvement and optimization of extraction process, growing up efforts in the exploration and research of new buckets from which to draw the raw material (subsea and shale gas). Thanks to these new investments, both revamping and exploration, the map of potential and effective development areas was redefined; in this territory, that includes some places located in the Mediterranean area, it was decided to invest resources and consequently studies for the expansion of LNG (Liquified Natural Gas) plants.

In the last ten-year period, particular attention by the oil companies, has been focused on the Egyptian coasts, where we remember the recent discovery of gas field realized by Eni in 2015, the now famous site called

“Zohr”. In fact, not only “Zohr” site, but also other deposits already active on the Mediterranean coast, are object of the attention of Governments that, based on specific investment plans, are focused resources and energy on expanding and improving the sites for the management and production of the plants.

## Finding the proper Electrical Engineering Solution

The need to expansion and modernization of the electrical capacity and power supply of the plants of a strategic gas power plant in Egypt, has placed the End User in the condition not only to physically add a new electric station, but also to redefine the whole study of electrical engineering and loads of all the electrical stations present in the plant.

Cear, having worked in the past on the same site, was called to redefine the new electrical engineering study and its supply for the improvement of the electrical power plant.

According to the evaluated LNG plant new electrical power requirement for the project and after some site survey, Cear in cooperation with the technical department of the Engineering Company, they defined

*Fig. 2 – A view of Electrical Power Module Building*



the modification/updating to be performed on the existing electrical power plant.

Cear has carried out a document defining the electrical Power System Operating Criteria for the area located in the existing plant section and in the new plant section. The scope of this document was to describe the power system operating criterion and the different scenarios in which the electrical system may operate. In particular, the document described the overall power system configuration, with the representation of the operation criteria of generation, existing 6.6 kV Medium Voltage switchgear, existing Low Voltage switchgear and new Low Voltage switchgear.

Aim of the new electrical study was also to re-define and translate in a workstation's software the control and monitoring of the extended electrical power plant. In addition to that, the customer required to have the whole power study calculation, to check the protective relays setting value in order to assure protection to the users and obtain selectivity in case of faults into the electrical network.

Basically, the protective philosophy was based upon the knowledge that the faults or abnormal operating conditions can be lead to:

- overloads;
- ground faults;
- phase to phase and three phase faults.

The study was conducted with the following power

system study detailed as:

- short-circuit current calculation;
- load flow calculation;
- motor starting analysis.

## The improvement of the Power Plant

Consequently, according to the electrical studies, Cear has developed a new "Overall Single Line Diagram" that was representing an update of the present power plant extended with an additional electrical station for the new plant.

As per updated Overall Single Line Diagram, Electrical system configuration included some modification on the electrical equipments installed in the existing electrical substations; existing 6.6 kV Medium Voltage switchgear needed to be updated and modified to connect the relevant outgoing circuit breakers as follow:

- Two *existing* outgoing CB (Circuit Breaker) connected to the existing two 1.6 Mva step down (6.9 / 0.38 kV) transformers for feeding the 0.38 kV LV (Low Voltage) switchgear of the existing substation;
- Two *existing* outgoing CB connected to the new two 2.5 Mva step down (6.9 / 0.4 kV) transformers for feeding the 0.38 kV LV switchgear of the new plant;
- Two *new* outgoing CB (obtained adapting the existing independent 6.6 kV cb) connected to the new two 2 Mva step down (6.9 / 0.38 kV) transformers for feeding the existing 0.4 kV LV power center in case of loss of power generation in its substation;
- One *new* outgoing CB (added) connected to a new flashed gas compressor main motor.

The improvement of the plant required also some new electrical equipment as:

- Two *new* gas generators each of rating 2.5 MW to feed existing 6.6 kV switchgear in existing substation;
- One *new* diesel generator 1.6 Mva connected to the new 0.38 kV LV switchgear to be used either as emergency or as stand-by generator.

In addition to that, was foreseeing also a *new Electrical Power Module Building* based on a modular metallic structure covered by insulated panels designed and supplied by Cear including all technological facilities required by the environmental condition as:

- HVAC (Heating, Ventilation, and Air Conditioning) system;
- Pressurization system;

Fig. 3 – The Medium Voltage Switchgear



- F&G (Fire & Gas) detection and extinguishing system;
- Internal and external lighting;
- Power socket system;
- Voice and telecommunication system;
- Grounding system;
- Lightning system.

Inside the building were located all electrical equipments that Cear as designed and manufactured as per project requirement:

- the *Engineering Workstation*, hosting SCADA and PMS System monitoring the overall electrical power plant;
- the *Interposing Relay Panels*, to manage the control and status signals between DCS (Distributed Control System) and the 0.38 kV LV switchgear;
- the *Auxiliary Service Panel*, for 220 Vac auxiliary service circuits (space heaters and internal lighting of the electrical panels);
- the 110 Vdc *Dual Redundant Battery Charger*;
- the *load shedding panel*, to manage the outgoing load shedding of 0,38 kV LV switchgears (new ATOLL switchgear and the existing 0.38 kV WHX LV switchgear);
- *two new 4000 A Low Voltage Bus Ducts* to connect the new 0.38 kV LV switchgear Incomers to the new 2500 kVA power transformer;
- *a new 0.38 kV Power Motor Control Center*, intelligent type, that had to manage the new field equipment (pumps, valves, compressor etc.) required by the additional gas production power plant.

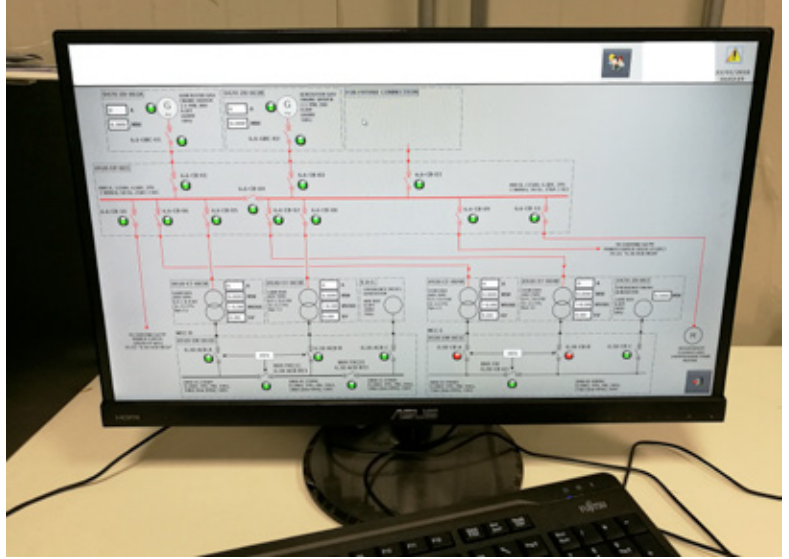


Fig. 4 - The Plant Workstation

## Conclusion

All the modification and new installations have been delivered according to a specific planning and were installed locally with the supervision of Cear's specialized technicians that worked with local workforces to complete the project on time.

Cear has respected delivery time required by the customer and within eleven months has completed the job, putting the customer in condition to make the start-up of the new gas plant.

This ambitious target have been reached by Cear, with a proper co-ordination of miscellaneous engineering disciplines (mechanical, electrical and instrumental) that put the Company in condition to have a complete know-how and commitment towards the Customer and its needs, taking care of it from engineering to on site installation and completion of activities.



## Alessandra Ranno

Alessandra studied Languages and Communication, then graduated in Marketing and Communication at the University of Milan. She's in Cear Srl since 2010 and

she's in charge as Sales and Marketing Manager for coordinating marketing activities, sales team and implement international markets.



## POLICARPO IMBALLAGGI SNC

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Our main activity is to offer to our customers tailor-made packaging solutions for shipments via land, sea and air.



# The Importance of the Right Maintenance Procedure for Heat Exchangers

Since 1961 Maus Italia's core business has been developing new tools and technologies to facilitate maintenance and production of shell and tube heat exchangers. In particular, it has developed a complete series of tube bundle pullers and lifters, which fall into two categories: aerial and self-propelled, available for on-shore and off-shore operations in dangerous area.

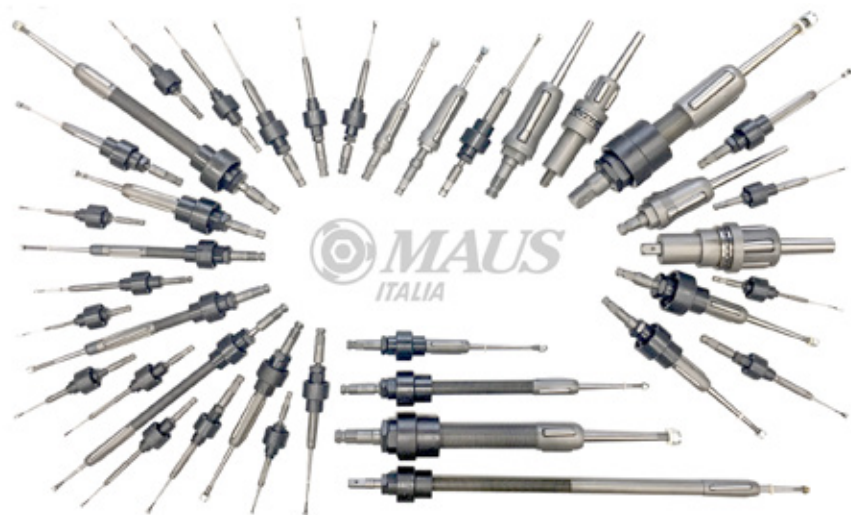
**Anna Agostino**, Executive Office, Maus Italia SpA

**W**hen a certain plant or factory starts its operations, all further activities are maintenance. In the past a repair / maintain principle was applied, meaning work was only carried out when equipment stopped functioning. Such a principle increases the risk for equipment and people on a daily basis.

The capacity of heat exchangers - and specifically shell and tube heat exchangers - to efficiently perform their function has a direct impact on the overall efficiency of power plants.

Fouling is an inherent problem that results in reductions in heat transfer and an increase in production costs. This requires an ongoing and annual heat exchanger cleaning and maintenance protocol.

The influence of maintenance costs on production costs can reach values higher than 30%, not to mention the costs incurred, which may duplicate the maintenance costs in critical production systems whose inadequate maintenance may put the operation safety at risk. The solutions proposed by Maus Italia allow not only to perform maintenance more effectively but also to transform it into an effective process that can contribute to the ultimate goal of business success. Overcoming a traditional approach to maintenance conceived as a limited action at operational level with a short-term perspective is necessary to implement this kind of change, so that it can take on a tactical-strategic role with a broad, medium-to-long term vision. This way of performing maintenance aims to transform it from a cost unit to a unit capable of producing results



*Fig. 1 – Tube expander for shell and heat exchanger*

and opportunities. This step requires the development of a new organizational culture dominated by values such as integration, prevention, continuous improvement, knowledge, technology and innovation. All those values are the basis of Maus Italia's philosophy and consequently of the solutions proposed by this company.

## Tube bundle maintenance

Since 1961 Maus Italia core business has been developing new tools and technologies to facilitate maintenance and production of shell and tube heat exchangers (**figure 1**). During its life-cycle this particular kind of heat exchanger is subject to fouling and scaling and should therefore be cleaned periodically. A light sludge or coating on the tubes greatly reduces their

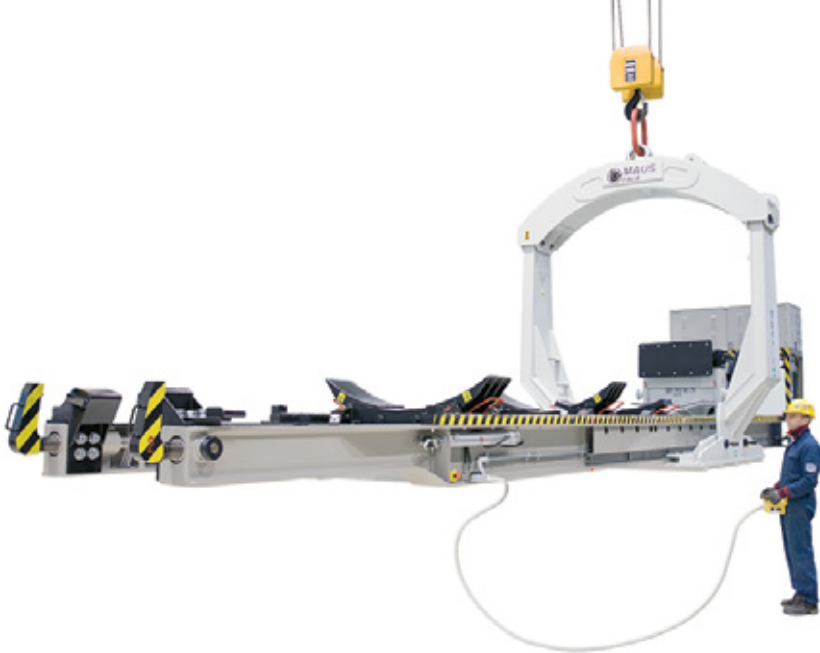


Fig. 2 – MEF express

efficiency. A marked increase in pressure drop and/or reduction in performance usually indicates they need cleaning.

After having carried out all testing operations and having excluded any possibility of partial reparation on site the bundle must be removed from the shell. When removing tube bundles from the exchangers you must make sure they are not damaged by improper handling. The total weight of the tube bundle must not be carried by the tubes only: it should rest on the parts designed to carry it instead, e.g. tube sheet, baffles or tube supports. This is a very critical phase, as adverse conditions may often arise when moving tons of tube bundles to tens of meters of height and the working activities must be performed safely.

To avoid any possible damage during such removal from the shell, a pulling device should be attached to the eyebolts screwed into the tube sheet. If the tube

sheet does not display any tapped holes for eyebolts, steel rods or cables inserted through tubes and attached to bearing plates may be used. Do not handle the tube bundles with hooks or other tools which might damage the tubes. Baffles and support plates can be easily damaged by dragging a bundle over a rough surface.

## Maus Italia's bundle pullers and lifters

Maus Italia has developed a complete series of tube bundle pullers and lifters, which fall into two categories: aerial and self-propelled. They are available for on-shore and off-shore operations and with a special treatment for operation in dangerous classified area:

- *aerial*: “MEF express” and “Bundle Tutor”; designed to be used with the help of a crane, it can reach all the working positions accessible overhead;
- *self-propelled*: “MEF mobil” and “MEF Truck”; it has the advantage of avoiding the crane but clearly has a more determined and limited range of use.

During the extraction and transport operations it is essential that the tube bundle is not damaged or deformed. Maus Italia technical office has years of experience and invests thousands of hours in research and development to study customized solutions for every situation, geometry, size, area and position.



Fig. 3 – MEF express: aerial tube bundle puller

### MEF express

MEF express (**figure 2** and **figure 3**) is a bundle puller entirely designed and manufactured by Maus Italia. The hydraulic hooking of the tube plate makes it possible to quickly insert and pull out the tube bundles when refineries experience a shutdown with a consequent work time reduction. The great solidity and sturdiness of the structure as well as its innovative improvements make this machine extremely reliable and safe. MEF express is produced in different standard dimensions according to the tube bundles weight, length and diameter. A portable console enables to remotely control all the operations with a consequent reduction in the needed personnel and increase in final safety margins. It is supplied with diesel or pneumatic motorization and as well as motors for hazardous classified working area (Atex).

Maus Italia studied a special version of MEF express to meet the need for the extraction of tube bundles on petroleum platforms and installations at sea on large vessels known as FPSO (Floating Production Storage and Offloading). The machine is a MEF express Navy produced for this purpose following the highest standards concerning shipbuilding. There are many similarities with the on-shore MEF express as a rapid extraction system. However, it is equipped with a special device that blocks any bundle oscillations due to sea swell. It is very compact and light, suitable for handling in small spaces and powered by a mobile power unit. This machine is designed to work in force 10 sea conditions.

### MEF mobil

The MEF mobil tube bundle puller (**figure 4**) is designed for areas difficult to access and is completely self-sufficient, as it is presented as a global solution in petrochemical plants for the extraction of tube bundles. This kind of puller operates autonomously without the assistance of a crane for positioning and hoisting or trucks for transport to the tube bundle maintenance area after extraction. It is solid, robust and stable and it autonomously raises to a height of 4,2 m (166"), hence enabling to approach the heat exchanger in a rapid and precise way.

Furthermore, inserting the tube bundle after maintenance becomes extremely rapid and precise thus guaranteeing reduction in plant stopping times. Just like MEF express, MEF mobil also comes in the Navy version. In view of the unusual nature of its off-shore application, the dimensional details of MEF Navy are based on the designed installation specifications provided by the final client or engineer in change of the project in a spirit of close collaboration.

### MEF Truck

MEF Truck, thanks to the original project of the



Fig. 4 – MEF mobil

telescopic rotating column, allows the quick pulling/inserting of the bundle. Once the truck is positioned, it is easy and quick to lift the extractor and to proceed with the extraction.

This system is particularly advised for the maintenance companies which operate continuously in the petrochemical plant field.

## The problem of moving tube bundles

Generally, during the lifting phase slings are used and if the distance from the OTL (Outside Tube Limit) to the baffle diameter is small, the tubes easily bend and consequently these break. If instead this distance is high the baffle deformation is obtained.

For this reason in 2017 Maus Italia designed and patented the Bundle Tutor (**figure 5**). This machine brilliantly solves the problem of grabbing and tube bundles lifting during handling (production / maintenance), while operating in total safety and eliminating the risk of damaging the baffles or crushing the tube bundle tubes. The independent adjustable cables of the Bundle Tutor ensures compensation for any asymmetrical positioning errors of the *saddle* bands located underneath the tube bundle. The bands and the central jaws ensure perfect balancing of the bundle along its longitudinal axis, preventing flexions and deformations of the tube ends caused by the weight of the projecting portions of the bundle.

The Bundle Tutor features some independent telescopic hydraulic beams to ensure balancing and adaptation of the Bundle Tutor to the geometry of the tube bundle longitudinal extension Y: +1000 mm (39.4") on each side.

It also has a symmetrical jaws opening and closing system relating to the axis of the tube bundle to ensure perfect centering (transverse opening X: +600 mm (23.6") on each side.

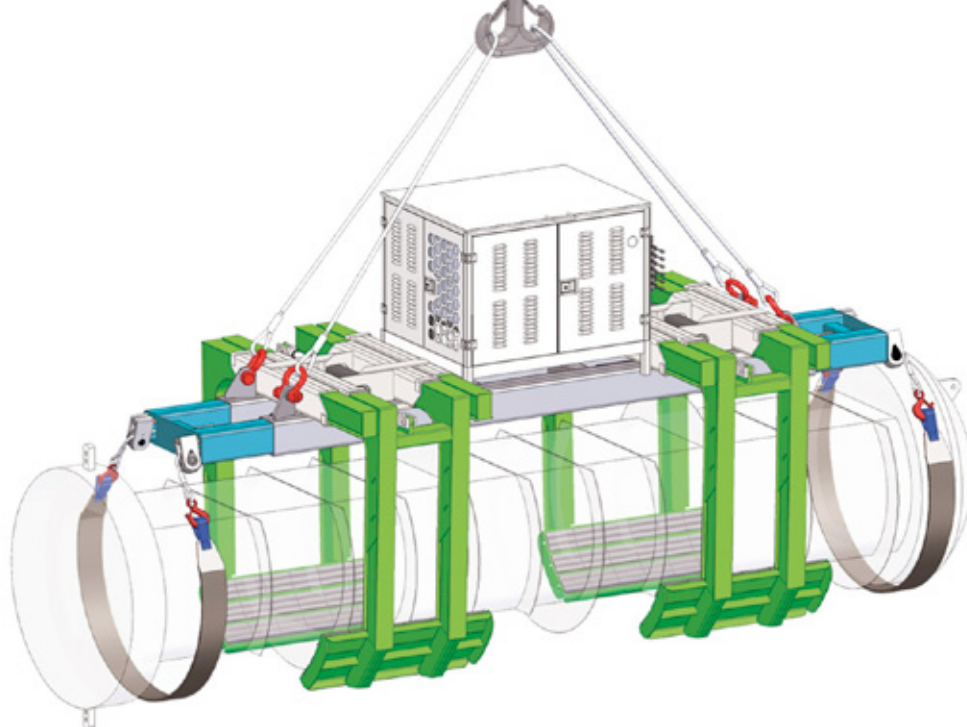


Fig. 5 – Bundle Tutor

The Bundle Tutor was designed to be used most frequently together with Maus Italia MEF series for tube bundle puller, such as the aerial MEF express and the independent mobile MEF Mobil in both on-shore and off-shore (Navy) models.

## Conclusion

The aforementioned solutions represent a small part of what Maus Italia has designed over the years. The company has acquired an unrivaled experience in its field by designing and promoting the maintenance

techniques best suited to any specific situation. Maus Italia promotes a continuous improvement in terms of technical performance of systems and maintenance costs, development and enhancement of maintenance skills as well as development / improvement of working methods hence constituting a reference point in its field.

Maus Italia started with the production of tube expanders and improved its business with the introduction of a series of machines that allow machines for bundle removing, tube removing, tube pulling, tube rolling and pneumatic tube cleaning.



## Anna Agostino

Graduated in Management Engineering in 2011 and in Mechanical Engineering in 2015 at the Politecnico di Milano, Anna is registered with the Professional

Association of Italian Engineers and currently an Area Councilor of it.

Now she is in the Executive Office of Maus Italia SpA.

# Enhancing Terminal Business Performance

New levels of profitability can be achieved with modern terminal management systems

**Aaron Boettcher**, Director Product Marketing, Systems, Services, Software Remote Automation Solutions

**T**oday's terminal operator is faced with a variety of challenges to remain profitable in an increasingly complex market environment. For operators, efficiently maximising the throughput of the terminal is critical in order to remain as key suppliers to their customers and to be financially successful.

Surprisingly, many terminals are still operating without an integrated terminal management system to plan and manage loading and unloading operations and – more importantly – to provide visibility and management of the terminal's inventory and commercial activity. Terminal management software is not new, but many terminal operators do not realise the value implementing modern terminal management software can provide for their operation and overall business.

Terminal management software has historically been targeted at managing the loading operations and efficiently moving trucks through the facility in an automated way. In addition to managing truck loading, modern terminal management software systems provide a single integrated platform to manage the entire terminal business process: bringing in customer orders, executing the loading operation, charging for services, managing inventory, and billing activity back to the customer.

These new systems are built not only to move products but to efficiently move information, which in turn optimises the order to cash cycle for the terminal and helps streamline the customer's supply chain logistics activities.

Using modern terminal management software platforms, such as Emerson's Terminal Manager, terminal operators are reaching new levels of profitability and customer satisfaction by achieving greater connectivity to customer needs, optimising loading operations, and streamlining the entire order to cash commercial management cycle.



## Enhancing customer satisfaction

As with most businesses, a terminal can only be successful if its customers are satisfied and willing to return to the same terminal for repeat business in the future. Terminals are 24/7 operations and often subject to a constant stream of communications and requests for information from customers.

Operators often struggle to manage these requests because they do not have accurate and available information to respond at the time that it is needed, they lack efficient coordination between the operational and commercial staff at the terminal, or they have to pull the data out of multiple, disparate systems.

Terminal customers, aware of the internet's pervasiveness in everyday life and the continued advancement of IIoT technologies, now increasingly expect to be able to access this critical operational and financial data at any time without delay.

Modern, integrated terminal management systems can simplify the customer management process. Out-of-the-box web portals can extract transactional data from a completely integrated backend to provide complete self-service capability for customers.

The terminal's customers can log onto the portal and place or modify orders, achieve complete visibility to

*Fig. 1 - Fully automating the loading process is a core capability of any modern terminal management system*



*Fig. 2 - Integrated commercial and operations management is key to optimizing the order to cash cycle*

outstanding orders in real time, and visualise easy-to-use KPIs associated with their account and activity at the terminal.

Operator benefits include reduced workload on the terminal staff; a reduction of overall incoming customer communications traffic via phone, fax or email; and ultimately improved customer satisfaction due to enhanced availability of accurate transactional information.

In today's complex terminal market environment, this type of solution can be the edge that an operator needs to provide differentiation from the competition.

## Improving the efficiency of loading operations

Realising the maximum throughput potential of any terminal site depends on efficiently managing the loading and unloading process. In non-automated terminals, managing truck traffic can be a labour-intensive activity requiring multiple staff members to control access to the site, check and validate driver credentials, validate the order versus the currently available inventory in the site, and then manually assign the truck a loading bay.

Fully automating the loading process is a core capability of any modern terminal management system. Customer order data is managed centrally and provides the permissive information to automatically validate trucks and driver information at arrival. Flexible integration to commonly used card readers and other biometric or RFID devices ensures that driver validation is automatic

and performed quickly and efficiently based on the regulatory requirements of the local market.

Advanced features in modern terminal management software can manage truck traffic inside the gates in busy terminals, directing trucks to queue at the bay in question or even managing driver staging areas until automatic notification is given that the needed loading bay is available. After arriving at the specified location, the driver may be directed by the terminal management system (through the preset controller or other local HMI) to revalidate the critical order information and then execute the loading process.

Once the load or unload is completed, the transaction is automatically archived to the terminal management system for inventory accounting, and customers and the terminal operator can be automatically notified (either by email or by accessing the integrated web portal) that the loading activity has been completed. Terminal operators have achieved real gains in throughput by implementing terminal management systems such as Terminal Manager to manage their loading operations, with 15% to 30% improvements of terminal throughput over the baseline.

## Maximising revenue potential

Operators are providing an increasing array of services to store and manage product within the terminal. Most of the time these services and the rates charged for services depend on contractual relationships on a customer-by-customer basis. Many terminal operators are managing contracts and charges in a completely separate way from the core terminal management system, using either another standalone software platform or with homegrown spreadsheet tools. Dealing with disparate systems and information in this way leads to errors in the month-end close: gathering up the movements and services that have occurred from the operations environment, and then applying charges based on contractual terms for each customer can be an error-prone, time consuming process.

With modern terminal management software platforms, contracts and charges are handled within the same system, providing a single source for all customer related information. Additional efficiency is gained through automatic application and tracking of contractual charges on a customer-by-customer basis. As orders are executed, service charges are automatically applied to the customer's account. Terminal operators can easily apply more complex types of service charges, realising real gains of 2% to 3% of topline revenue on a yearly basis. Customer satisfaction is also enhanced by a significant reduction in transactional errors and lost data resulting in timely and automatic communication of invoices back to the customer.

## Shortening the month end closing cycle

At the end of the month, reconciling the terminal's inventory so that customers can be invoiced on the measured, physical value of the products and services provided compared to the ordered (book) amount is perhaps the most time-consuming and error-prone process that terminal operators must manage.

This is further compounded in the area of losses and gains, which must be allocated back on a customer-by-customer basis depending on the contractual terms. Measurement errors are also commonplace and often found after the customer order has already been completed, necessitating a painful and time-consuming process of adjusting historical tickets to correct the error.

Modern, integrated terminal management systems significantly shorten the inventory management and reconciliation process. Further, these systems are easily integrated to real-time tank gauging systems such as Emerson's TankMaster. Inventory transactions and tank levels are captured automatically and available on a real-time basis in the terminal management system. As meter proving is performed throughout the month and errors are found, any measurement issues are easily corrected for any time period with integrated measurement management tools and any corrections are automatically reflected in the charges applied to the customer's account.

Instead of waiting until month-end to gather up transactional data and inventory measurements from multiple disparate systems, the operations staff can engage in an easy and proactive process of inventory management on a daily basis. At the month end, tying up loose ends, reconciling inventory for the month, automatically allocating loss/gain, and closing the books can be a simple process. The terminal management system can then automatically invoice the monthly activity back to the customers for payment. This significantly reduces the workload on the terminal operations staff, shortening the month-end closing process from 10 or more days to as few as two or three days.

## Growing the terminal business

To be successful in today's market, terminal operators must differentiate themselves from their competitors both by providing a superior level of service to their customers and by realising the maximum efficiency of their terminal assets. Today's modern, integrated terminal management systems give terminal operators the tools they need to reach new levels of business performance, customer satisfaction, and overall profitability, all in a single integrated platform for management of the entire terminal business process.

Reprint from *Tank Storage Magazine*, February / March 2017



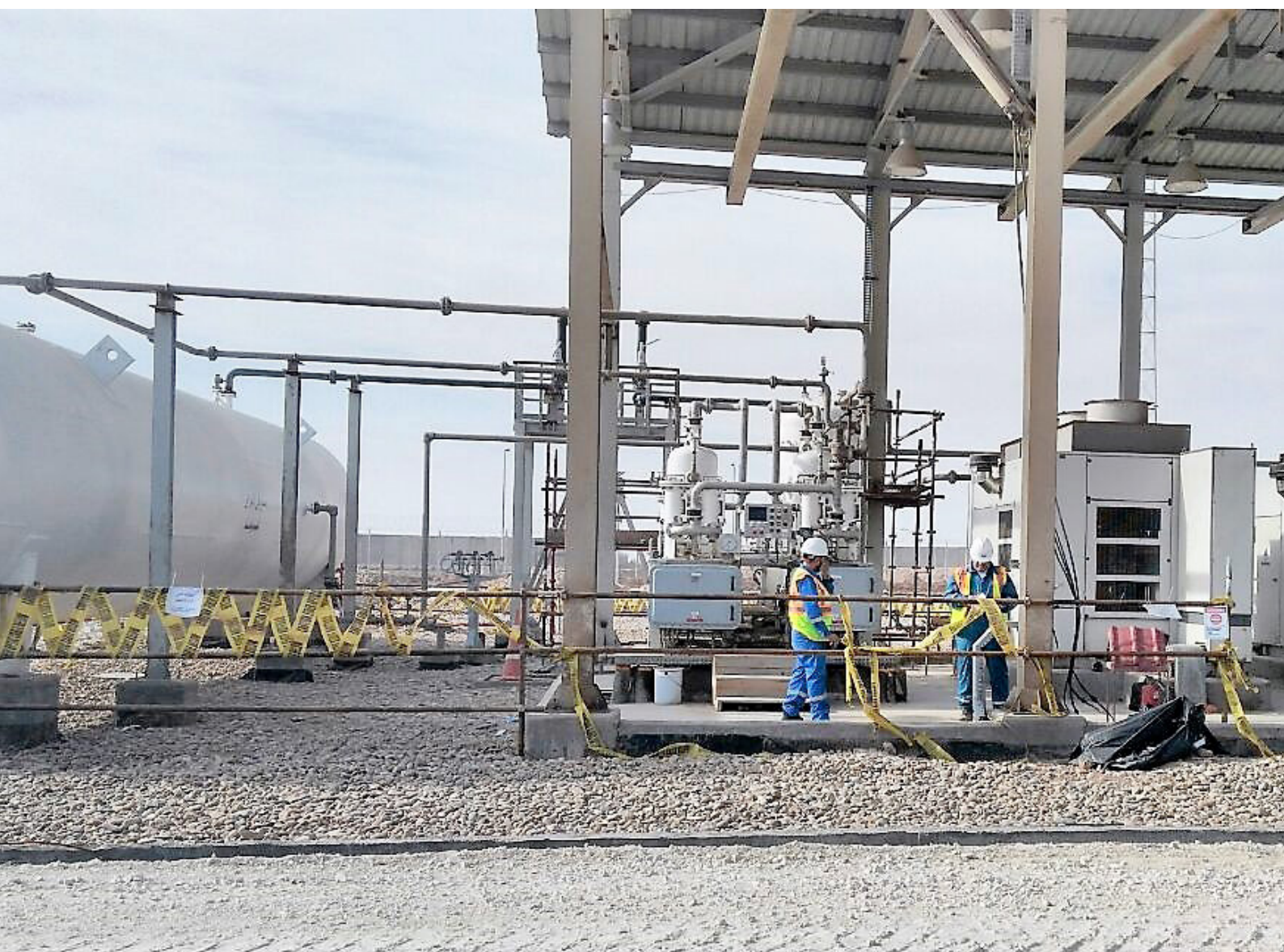
## Aaron Boettcher

Leading a team of product managers to develop and implement customer /market-driven global business plans, strategies, and tactics for the business group's oil and gas software products and systems / services offering.

Develop plans for new software product development, product improvement, and new systems / services

offerings through interacting with sales channels, other Emerson business units, competitive analysis, and customer input.

Develop and implement promotional programs and collateral materials specific to software products and systems, services offering. Manage strategic planning function.



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## Reliable Compressed Air in the Desert

Blutek is specialized in the design and production of totally engineered turnkey packages for service air, instrument air and nitrogen generation, offshore and onshore, for any application and environment.

Awarded in 2015 by Petrojet / Kuwait Energy, Blutek proposed for the project one instrument air package with compressors able to resist to the terrible hot temperature of the Iraqi desert (+58 °C) and to the frequent sandstorms of this region, as well as with the important feature to be easy to service.



Development Project combines the aspects outlined above in a very synthetic concept: only machinery build to resist can be selected. Units must resist to the terrible hot temperature of the Iraqi desert (+58 °C) and to the frequent sandstorms of this region, plus they must be easy to service.

*Installation site of Blutek IA package - Iraq*

For this project, Blutek has been selected between all the competitors: the proposed solution was fully in compliance with all the requirements and within budget.

In detail, for the above project, Blutek scope of work was the design, the manufacturing and the test of one instrument air package including three oil free screw type compressors packages, air cooled, (1200 Nm<sup>3</sup>/h, 9,5 barg) and two heatless desiccant dryers (65 °C inlet temperature, -40 °C dew point) suitable for desert environment with temperatures reaching up 55-60 °C and sandstorms. To achieve the target, Blutek studied a special cooler suitable for the area and designed the complete skid for reducing the operator maintenance and for ensuring the maximum reliability to guarantee a continuous compressed air flow through the plant.



Let's think about the most challenging environments on earth, such as deserts (55-58 °C), arctic areas (-48 °C) or offshore rigs, and let's think about resistant and reliable machinery able to perfectly work in such harsh environments. Just there you can find Blutek products, that are totally engineered for any application.

Instrument air is a critical element in the oil & gas plants: it allows valves movement, therefore without such utility the plants cannot run at all (or be commissioned). The reliability is essential in the oil & gas: every second that a plant is stopped it is a huge monetary loss.

In these pictures we present one of Blutek most successful projects: it has been designed and manufactured by Blutek in Italy and currently successfully running in Iraq.

Awarded in 2015 by Petrojet / Kuwait Energy, with Mott Mc Dermott as PMC, the Siba Field

Among all the innovative solutions applied, the skid has self-cleaning pulsejet inlet filters that reduce the cleaning operations and twin oil filters that allow the cleaning operation without stopping the compressors. Furthermore, all components have been realized in SS316L ensuring the best quality and durability of each single part, enhancing the guaranteed life and performance of the machine in a place where each and every substitution may represent a serious logistical problem.

Furthermore, the installed compressor package included skid mounted MCC (Motor Control Centre) with soft starter, common control panel PLC based SIL2 and EX\_d, stainless steel coolers and piping. Besides, equipment I&C was fully in compliance for installation in Atex Zone two area classification.

Unit is now perfectly running continuously.



PROJECT: 112-15  
 CUSTOMER : KUWAIT ENERGY LIMITED  
 EPC: PETROJET  
 PMC:MOTT MCDONALD  
 SCOPE : INSTRUMENT AIR COMPRESSOR PACKAGE WITH:  
 N 3 OIL FREE SCREW COMPRESSOR RATED FOR 55°C AMBIENT TEMPERATURE  
 N 2 HEATLESS DRYER RATED FOR 65°C INLET TEMPERATURE  
 SIL 2 PLC ASSEMBLED ON EX\_D BOX  
 ENGINEERED SOFTWARE FOR LOAD BALANCING AND LEAD/LAG MANAGEMENT.



BLUTEK is specialized in the design and production of totally engineered turnkey packages for service air, instrument air and nitrogen generation. Packages are designed for any environment (desert/artic), for any application (onshore/offshore) and in accordance with any local/International Standards and Certifications (i.e. API 619- ISO 10440-1/2 - ATEX - API R14 - EN60034 - ASME VIII DIV. 1 AND U STAMP - PED) . Thanks to the consolidated experience and to the innovative approach, Blutek is capable to understand the real need of every customer in the world and to design and deliver the most suitable package in time and within the budget.

Taylor-made packages may include compressors, dryers, nitrogen generators, filtration, air receivers, lifting frames, dedicated control systems.

The totally customized units, designed for each specific purpose, assure the best performances and maximum reliability to the entire oil and gas supply chain.

Blutek is actually present in more than 50 end users approved vendor list of the oil & gas sector and its references extend from the offshore in Northern and the Chinese Seas, to the inland of the Equatorial Africa or Sahara and Iraq deserts.

Located in Italy, BLUTEK is present worldwide with its strong network of Agents and Service Centers. Blutek is certified ISO9001: every product is designed and manufactured following the highest standards in terms of Quality, Safety and Ambient preservation.

Blutek is nowadays one of the major players in the world in the compressed air and nitrogen generation.

See more at [www.blutek.eu](http://www.blutek.eu)

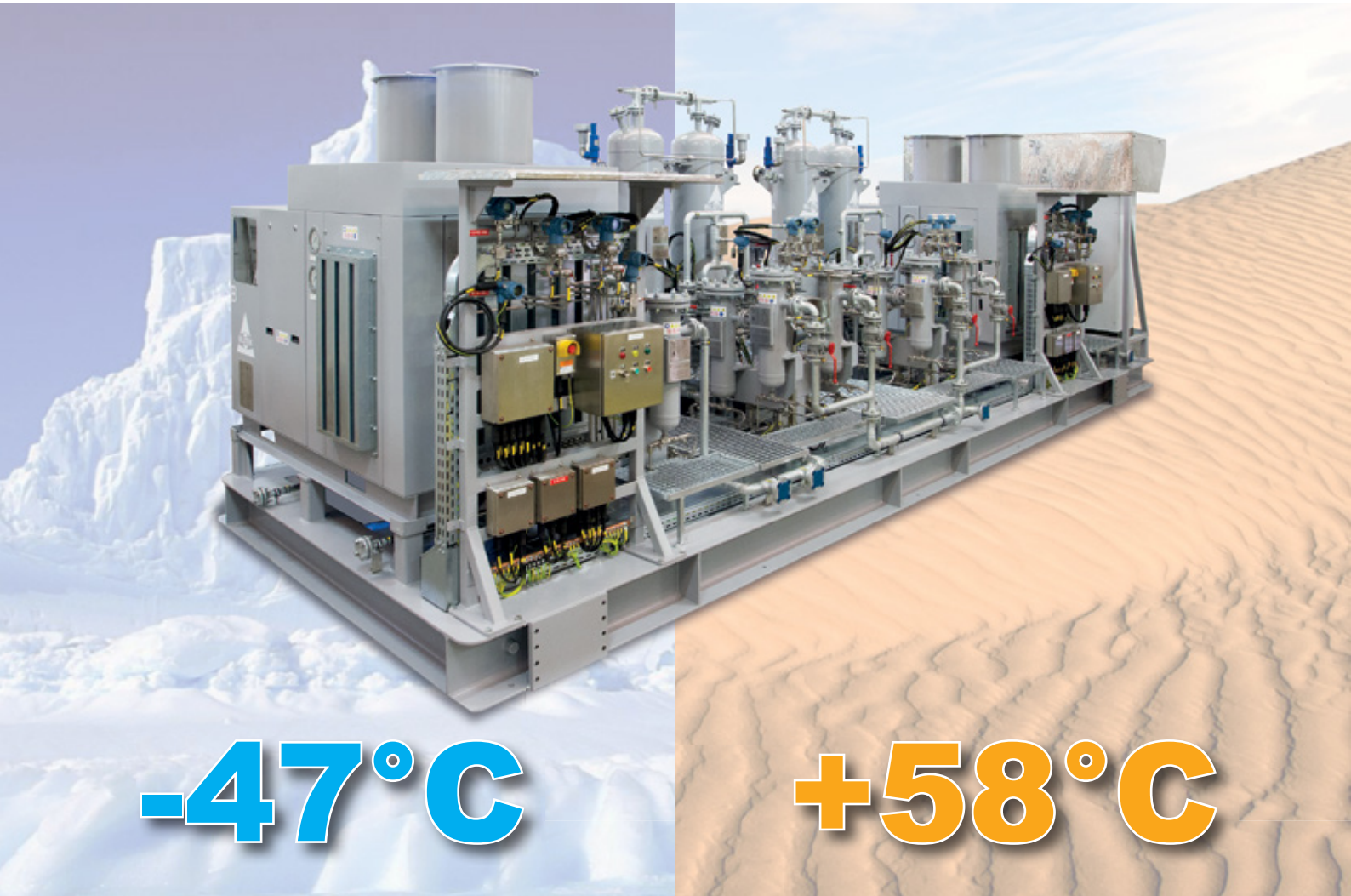


*Another successful installation - Unit: IA package with oil-free compressor 3200 Nm<sup>3</sup>/h; Location: Jordan onshore refinery Zone 2*

## Blutek History

Blutek, founded in 2002 by its actual President, Danilo Viganò, and the Managing Director, Cristina Modolo, is an Italian independent Company.

# ENGINEERED AIR AND NITROGEN GENERATION PACKAGES FOR ANY ENVIRONMENT



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www.blutek.eu - mail: info@blutek.eu



SIAD Factory in Osio Sopra (Bergamo), Italy

# How to Properly Manage Documents in a Complex Project

SIAD Macchine Impianti SpA – Italian-based Company – and its subsidiary in China, SIAD Engineering (Hangzhou) Co. Ltd. (SEH), concluded an important project to optimize its knowledge and document management system with the implementation of EDM software, an Errevi System's product designed and dedicated to the engineering document management in the EPC world. Thanks to EDM software, two of the SIAD Group's companies have optimized the management of contractual data, engineering documentation and transmittals in order to maintain a structured business archive and to be able to store and share all the information and documents of complex projects with customers and suppliers worldwide.

**Davide Rovesti** - Errevi System Business Solutions Division Director



information and documents; moreover, the collaboration among different subjects involved in the process was too complicated.

According to statistics, both SIAD Macchine Impianti and SEH manage an average of 1000 state changes and transmittals of documents for every single contract.

## A new way to work thanks to EDM

To manage this complex set of processes, SIAD Macchine Impianti decided to adopt a dedicated solution capable of managing multiple contracts with pre-approved templates and configurable clauses.

Errevi System has been selected by SIAD Macchine Impianti among other realities to implement this solution because it demonstrated its capabilities to provide an application based on a Knowledge Management and Business Process Workflow Management platform.

SIAD Macchine Impianti can now rely on a scalable and flexible framework able to respond to future needs of other business areas.

Given the impressive results after introducing the software to SIAD Macchine Impianti, the project was extended to its Chinese subsidiary.

According to Claudio Sangaletti, SEH General Manager: *"EDM software, by Errevi System, is based on a proprietary framework named KBS 5.0. The SIAD Group's engineering companies chose to adopt it because it allows handling the documentation of many contracts simultaneously and our users, regardless of where they are connected, can edit and share information and documents easily and safely. One of the strengths of EDM is that you can personalize the system according to your needs and specific contractual requirements"*.

EDM allows the two SIAD's companies to configure various parameters, for each contract, in complete autonomy:

- definition of pre-approved templates and contract clauses;
- definition of document stages combinations to create templates and assign a progress percentage;
- definition of plants registries;
- customizable WBS list;
- definition of numbering standards for documents and transmittals.

## An easy interface to use and share

Thanks to a web interface, SIAD's users can now access to all information and documents from everywhere and the consultation is easy with no

For SIAD Macchine Impianti SpA and SIAD Engineering (Hangzhou) Co. Ltd. (SEH), to manage an engineering contract means to handle hundreds of documents of different type such as Office, PDF, CAD drawings and image files. These documents have different requirements, scope and size and are shared among different departments inside the organization and outside issued to clients and suppliers.

For every contract, all the documents follow a complex and different approval process consisting of progressive stages.

Customers are allowed to check, comment and approve documents before the files move from one stage to another. The two SIAD Group's companies needed to easily track all the exchanged documents by means of transmittals - which reported all relevant information and data - and then to archive them in the system.

In the past, the companies managed these complex projects using information technologies with limited functionalities that were unable to give a complete overview of the contract situation. It was hard to share

need of software installation.

External users, whether they are customers, suppliers or staff located directly on construction sites, have access to all information and documents using a web browser.

## Everything under control

Thanks to email alerts, configurable dashboards, to-do lists and reports, SIAD's users can rely on data updated in real time.

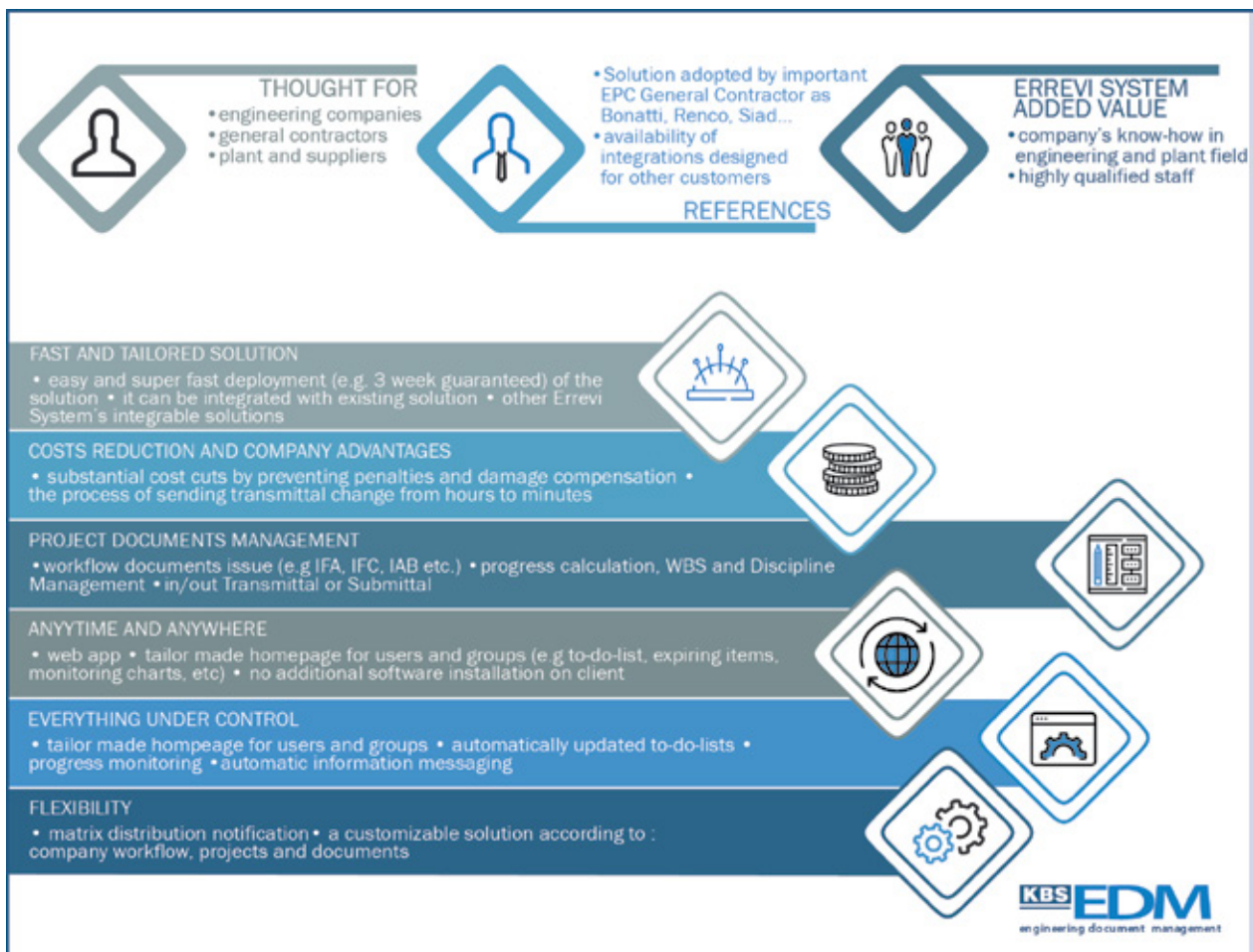
For example, engineers in charge of creating, reviewing, controlling and approving the documents can configure automatically updated to-do list to have a clear and complete overview of the status of documentation. The software allows them to implement alert messages for any pending activities or any change in the stage of the document. It is also possible to create a proper dashboard to list the documentation in delay behind the schedule contractually agreed with the customer.

Project managers and authorized users can monitor the contract progress at any time: with a simple click, they can obtain a complete report.

## Benefits

SIAD companies have obtained several benefits, since EDM:

- ensures a single point of truth and aligns organizational knowledge of commitments;
- ensures to all stakeholders an accurate and current information;
- provides greater control over critical engineering documentation;
- ensures adherence to contractual obligations;
- allows documentation to be revised concurrently by multiple parties through a controlled revision tracking dashboard;
- facilitates secure collaboration and coordination across the extended enterprise by using structured processes for new document introduction, revision, and master record updates;
- it is scalable to support globally distributed engineering projects and facilities – even in remote locations;
- ensures a smooth handover by controlling all transmittals, engineering submissions and documentation in a secure environment structured according engineering standards;



- creates custom reports for immediate performance analysis;
- substantial cost cuts by preventing penalties and damage compensation;
- saving up to 55% in man-hours (e.g. Engineers, document controllers, etc.);
- the process of sending transmittal changes from hours to minutes;
- procurement management;
- management of material requisition and rfq (request for quotation);
- suppliers document management.



## Davide Rovesti

Davide is a Business Process Management expert. His career starts as a software designer for the banking sector. In 1997 founds, together with Agostino Vertucci, Errevi System, an ICT company that soon becomes reference point in the North of Italy for both workflow management solutions and whatever concerns the data

center environment.

In the company he deals with project management and has gained great experience in the oil&gas field leading projects related to engineering document management solutions for international EPC contractors.



*Loading procedures on heavy trailer for shipping*

# Fire Solutions at Extreme Environment Conditions

SANCO SpA has been asked to face a big challenge by one of the largest German EPC: a 7 million euro project for the protection of an ethylene cracker unit in Siberia, Russia. Stringent requirements and severe temperature conditions (-52 °C) have been a major test which SANCO has successfully overcome thanks to its long-term experience and by favoring the Italian supply chain, as a guarantee of superior quality and expertise.

**Nico Zorzetto**, *Export & Marketing Director, Sanco SpA*

**A**fter an important audit and through an international and competitive tender SANCO SpA has been assigned a 7 million euro project for the protection of an ethylene cracker unit in Siberia (Russia) by one of the largest German EPC. The supply has consisted of three main items:

- fire detection systems;
- high-pressure CO<sub>2</sub> systems skid-mounted (for indoor installation);
- groups of deluge valve skids in container (for outdoor installation).

Not an easy task since requirements on tender documents were very stringent and, particularly, it was important to take account of severe weather conditions such as a temperature of -47 °C during the coldest day with 98% coverage and an absolute minimum of -52 °C. Moreover, the design and manufacturing of systems were due to comply with following regulations, standards and Russian laws:

- NFPA regulations which apply to every single item in the contract. NFPA15: Standard for Water Spray Fixed Systems for Fire Protection;
- Federal Law No.123 FZ Technical Regulations on Fire Safety Requirements;
- SP 5.13130.2009 Fire Protection Systems, Automatic Fire Alarm and Fire Suppression Systems;
- SP 6.13130.2009 Code of Practice, Fire Protection Systems, Electrical Equipment, Fire Safety Requirements;
- NPB 88-2001 Fire Extinguishing and Fire Alarm Installations, Design Norms and Rules;
- GOST R 50680-94 Automatic Water Fire Extinguishing Systems, General Technical Requirements, Test Methods;
- GOST R 12.3.047-2012 Fire Safety of technological Processes;
- GOST R 51043-2002 Automatic water and foam fire fighting systems. Sprinkler, spray nozzles and water mist nozzles – General Technical requirement.

Thus, preliminary studies and manufacturing of systems were carried out by taking into consideration EAC certified equipment and instrumentation intended for very low temperatures, with particular regard to temperature-resistant steels.

In depth, the supply has comprised the following three items.

### **Fire fighting detection systems**

The system includes 4 GOST-R and EAC (EurAsian

Certificates) certified control panels whose software and hardware is property of SANCO.

### **High pressure CO<sub>2</sub> systems skid-mounted**

Four buildings have been protected with CO<sub>2</sub> self-standing rack-mounted systems equipped with self-checking weighing devices. A piping distribution system and stainless steel fittings were individually tested at more than 200 bar. 1116 cylinders were also included in the systems which obviously comply with the aforementioned GOST / EAC regulations.



### **Deluge systems**

These systems were made up of a series of manifolds on which more than 100 deluge valves are installed and they were located in special containers. These prefab units (some of which longer than 14 m and with an average weight of more than 23 tons) were built strictly in accordance with customer's specifications as follow:

- compact systems suitable for road and rail transport;
- suitability for the use at very low temperature and proper thermal insulation. In this regard, one of the requirements was: for winterization two electrical heaters, a thermostat, cable connected in a junction box shall be installed to maintain the temperature (also during the transportation) of the heated enclosure above 5 °C. Heaters to be equipped with alarming function for failure detection;
- weather-resistance, especially to roof snow load (240 kg/m<sup>2</sup>);

*Deluge valves special containers in factory*



*Deluge valve: typical container, interior layout*

or locked both from the inside and the outside (by means of a panic bar) for a quick getaway of the operators during emergencies. These doors have been equipped with status switches (open / close) as well as vocal and remote alarms.

All equipment was carefully chosen, by giving priority to national Companies' products which were deemed to meet project criteria, while bearing in mind important requirements such as:

- suitability for very low temperature (-52 °C);
- hazardous areas (Atex etc.);
- EAC certification;
- FAT and SAT double check;
- all internal and external connectors according to GOST and EAC certifications.



*Containers view with opened safety doors*

According to Russian standards, the ground distance of the supporting structure was a further aspect to consider for avoiding frozen ground effects. In addition, EAC certification was required even for prefab units and their content, for a total amount of 23 containers hosting more than 100 low-temperature carbon steel deluge valves with stainless steel trim.

Also the transport service required special conditions so as to ensure the proper storage of the equipment inside containers. For this reason, each prefab unit was fitted with a couple of electric generators (one working and one on stand-by status) intended to keep containers at constant temperature all the way up to site. And finally, all delivery terms were fulfilled and no deviation from contract specifications was observed.

- high-efficiency lighting (LED) in compliance with a specific Russian regulation;
- heating system c/w a double redundant control panel;
- instrumentation and equipment suitable for hazardous areas (1, gas group IIC, class T3);
- adequate spaces for an easy servicing in compliance with Russian Safety Rules, including a series of very close doors which can be opened

This project was indeed a major challenge that SANCO has tackled - being one of main actors in the firefighting sector at both national and European level - with its long-term experience, while mostly favoring the Italian supply chain as a guarantee of superior quality and expertise. An Italian know-how that SANCO exports to 100 plus world markets every year, and that accounts for approximately 90% of its production.



## Nico Zorzetto

Nico Zorzetto, Export & Marketing Director as well as shareholder of Sanco SpA., has been working in the fire fighting field for the last 43 years. Even if he graduated in Economics, he has always been dedicating its interest to technological innovation for "reliable products".

He has been participating to the realization of several new products and systems; in particular he is co-creator

of airmobile fire fighting systems (fixed type and rotating wing) for the fire fighting of bushfires. He has been publishing several articles – National and International - relevant to fire fighting subjects.

He operates also with National and International organizations for the Civil Protection Organizations, as well as with security matters, with jobs also with NATO.



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# What about **HIPPS**?

## Cut process lines costs by increasing the safety level

### We provide the core of the system through our **MODULAR MANIFOLD HP-IM-SIL4**

HIPPS, a high integrity pressure protection system is a type of safety instrumented system (SIS) designed to prevent over-pressurization of a plant. The HIPPS will shut off the source of the high pressure before the design pressure of the system is exceeded. HIPPS is the barrier between a high-pressure and a low-pressure line at installation.

#### TECHNICAL FEATURES

- Double block and bleed configuration 1002 – 2003 - 1004
- Single-piece body in St.St.316/316L dual grade
- Process connection 2" # 2500 - Api 10000 (6000 & 10000 psi)
- Quick installation with safe continuous operation & maintenance
- Unique key for sequential operation
- Ped Compliant
- Atex Compliant
- Asme B16.34 / Asme VIII, DIV 1/Asme B1.20.1/Api Compliant
- IEC 61508.2010 and IEC 61511:2003 Compliant
- Fire safe to API 607

#### OPTIONALS

- IP 65 weatherproof box in St.St. 316 with/without windows; with/without insulation
- Heater with thermoregulation
- With breathing plugs
- Terminal boxes for cables wiring
- Body in Duplex St.St. (ASTM A182 F51); Inconel 625 (ASTM B564 UNS N06625); LTCS carbon steel (ASTM A350 LF2)



# Engineered Heavy Lifting and Transport for On-shore and Off-shore Plants and Buildings

Mammoet Italy is working on the new Yaoundè Stadium in Cameroon providing four cranes, including a tracked one with a 600 ton lifting capacity, that is used to lift and install the steel structures of the building, starting from the western tribune and then going to the lifting and positioning of the roof covering the stadium stands

During a signing ceremony in Lagos on, January 16 this year, the Nigerian Dangote Group of Companies and Mammoet, the global leader in engineered heavy lifting and transport, signed the contract for the new 12-billion dollar refinery is being built by Dangote in the Lekki Free Zone to the South-East of Lagos. It will have a capacity of 650,000 barrels per day and will boost economic growth in the country and generate thousands of jobs. The refinery is scheduled to come on stream in 2019 and will increase the country's oil exports and reduce its reliance on imports of refined petroleum products. The Lekki refinery covers a 2100 hectares area and will be the largest single-train facility in the world.

The refinery will include specialized plants for production of urea (3 million ton per year), polypropylene (3.6 million tons per year) and natural gas processing (85 million cubic meters per day of gas brought to Lekki via a 1,100 km-long submarine gas pipeline). Total refinery output will 33 million ton per year of oil-derived products, including gasoline, diesel and jet fuel and a number of chemical intermediates.

Under the contract Mammoet, will be transporting, lifting and installing all over-dimensional cargo for the refinery. The Dangote contract is but the last of a long series of jobs Mammoet completed in the last few months in the expanding oil-and-gas, chemical and industrial plant construction, upgrading, including integrated transportation and lifting operation, so called "factory-to-foundation".

## Working both on-shore ...

The Onsan refinery is South Korea's premier refining facility and a major contributor to the country's thriving



economy. With the aim to increase output, the Koren S-OIL company was looking to expand the refinery. A joint venture lead by Daelim was engaged to construct a Residue Upgrading Complex (RUC). The new facility would convert low value residue into high value products such as gasoline and olefin downstream products. As part of the construction of the RUC, three distillation columns needed to be lifted into an upright position. The challenge posed was that the columns weighed up to 2000 tons each and had to be lifted within the confined space of the running refinery. The initial plan to use a gantry system was projected to take three months to complete because of the need to relocate it for each lift.

However, before these works could begin the project experienced a delay, leaving the installation behind schedule. To optimize the construction schedule and

work around the space constraints, S-Oil turned to Mammoet to provide a faster lifting solution that would reduce construction downtime. Mammoet responded immediately and proposed the PTC 200 DS ring crane as the best solution for the job. The PTC 200 DS has a small footprint with a long reach and high capacity for lifting. As opposed to the gantry system, it could lift all three columns from a single location.

Time was also saved in the assembly and disassembly of the PTC. It would usually take up to 12 weeks to complete both activities. Mammoet sped up and

mobilized an international crew that worked in double shifts. They completed the whole process in less than 7 weeks. Mammoet was on-site and off-site in a record time of 57 days, one month ahead of the original timeline based on the gantry system. This was the first ever deployment of the PTC 200 DS in South Korea.

Mammoet's approach to use the PTC 200 DS reduced the impact of the works on neighboring areas within the refinery and saved a significant amount of time. By cutting 30% off the original timeline, Mammoet was able to help put the project back on track. Civil works were able to swiftly resume, minimizing the project's construction downtime and bringing S-OIL closer to opening their new Residue Upgrading Complex.



*Fertilizer vessel installation*

### ... and off-shore...

Providing more – and more reliable – electricity to Indonesian households is an important step to Indonesia's growing population future prosperity. Which is why, in 2016, a consortium led by Saipem was commissioned to tap an important gas field off the Indonesian coastline. Essential to this project was a floating production unit: a facility capable of processing, storing and transporting gas to the mainland via underwater pipelines. To save time, the unit, called Jangkrik, was built in two parts – the hull in South Korea and the topside module on the Indonesian island of Karimun. It was the first time anyone had ever attempted to skid and load-out a 14,273 ton module onto a floating production unit hull.

Mammoet had engineered and executed complex

skidding projects before, but Jangkrik was different. To begin with, at over 192 m long and 46 m wide, the Jangkrik module was massive. Secondly, early on in the process the decision was made to construct the topside on land and skid the integrated module in its entirety onto the hull. Not only would constructing the topside on land save a significant amount of time in building and testing, but it would also significantly increase the project's safety by avoiding the challenges and risks of connecting and integrating smaller modules onto the hull at sea. However, to achieve this required a close collaboration by all the parts involved, who needed to adjust the module's design and engineering so that it could eventually be skidded into place. The hull design needed to be adjusted as well.

During preparations, construction and load-out, nothing was left to chance.



*Ballasting during load-out*



*Platform from the above*

The solutions engineered focused on maximum precision and safety to ensure uninterrupted operations. A team of Mammoet professionals deployed a hydraulic skidding system controlled by specially designed software. Built-in vertical jacks lifted the module off its construction supports where it was then skidded along 9 tracks, each 133 m long. Once on quayside, the module was slowly skidded across 9 bridges and onto the hull.

To offset Karimun's wide tidal variations and keep the hull level with the quayside during load-out, Mammoet engineered two computer-controlled ballasting systems. The first capable of monitoring and offsetting the tidal variations; the second managing the balancing of the hull. To successfully load-out within Karimun's tight tidal time frames required employing a pumping system capable of displacing 56,000 m<sup>3</sup> of water per hour. With no room for error, a crew of Mammoet professionals confidently inched the massive module onto the awaiting hull.

The Jangkrik project is a benchmark of precision engineering and proof that even 14,273 ton integrated topside modules can be assembled and installed in one go. By stretching the limits of modular construction and enabling faster, safer and more controlled construction at a larger scale, Mammoet helped save their partners a significant amount of time and helped Indonesia fuel its future growth.

## ... and doing factory-to-foundation too

A fertilizer company in Southern Alberta, Canada, was updating and replacing aged components from the

1970's in their nitrogen complex. The main item that needed replacing was a reactor vessel, which assists in creating urea to create fertilizer. Problem: the new vessel was made in Austria and the client required the most efficient way to get it installed at its final destination. So, four years before the actual exchange they engaged Mammoet. The early involvement enabled us to deliver and execute a comprehensive plan that optimized the overall approach that identified and seized several time saving opportunities.

Mammoet orchestrated all transport modalities; barging, ocean transport, rail transport, jack & slide, and finally SPMT transport. Mammoet ensured these modalities were well-aligned to one another in order to realize the most efficient logistics possible. To accommodate transport of the vessel Mammoet designed shipping saddles that were optimal for ocean and rail. The saddles eliminated the need to re-secure the vessel at each transloading point. This helped save

*Ring crane installation of-the final column*



time and money and contributed to a safe journey for the vessel.

But, before installing the new, the old had to be removed. The original vessel, weighing 410 tons, was located in a 70 m high building. For its exchange, the client had at first planned to dismantle the entire side of the building. The Mammoet solution was different: using a LR 11350 crane – with a boom length of 126 m and maximum lifting capacity of up to 1,350 metric tons. The crane would be able to perform the exchange without the need to dismantle and reconstruct part of the building. This reduced expensive downtime and reconstruction costs.

Mammoet's comprehensive approach provided for a safe and efficient exchange of the reactor vessel, helping the customer to restart fertilizer production earlier than originally planned.

## The twist for stadiums



*Alberto Galbiati, CEO of Mammoet Italy - Paul Biya Stadium a Yaoundé Cameroon*

Naturally, the very same technologies and expertise in extreme transportation and lifting that Mammoet masters in industrial plant buildign, are applied by the company in other type of large engineering projects. Stadiums are a very good example. Since the end of the '90s, building of collective sports stadiums around the world has changed profoundly. Modular construction methods have supplanted traditional ones, and where

there are large "objects" to move and lift, there is Mammoet. Since twenty years the company contributed in more than 20 new-construction or radical restructuring of stadiums jobs, including iconic locations like Wembley, the Philips Stadion in Eindhoven, the olimpic ones of Moscow, Athens and Beijing, and so on.

Mammoet Italy has worked and works in this area. They transported, lifted and installed the roof of the Allianz Arena in Turin, and now they are working on the new Yaoundé Stadium in Cameroon. Mammoet is supplying the cranes for the building of the Paul Biya Stadium in Olembé, a suburban district 13 km from the city center. The new stadium will be able to host 60.000 seated watchers, all under a cover roof.

Beside the main soccer playground, the sport complex will offer two workout fields with 3000 seats each, playgrounds for handball, basketball, volley and tennis, an olympic-size swimming pool, an hotel, a shopping

center, five restaurants, a 6000 m<sup>2</sup> VIP hospitality area, a movie theatre, a congress center and a hall-of-fame. Mammoet Italy is providing four cranes, including a tracked one with a 600-ton lifting capacity, that is used to lift and install the stell structures of the building, starting from the western tribune and then going to the lifting and positioning of the roof covering the stadium stands.



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**Sodium Sulphate (NaS) 10,8MW/81MWh Scampitella (AV - Italy)**



**Lithium (LiFePO4) 1MW/1MWh Ciminna (PA - Italy)**



**Lithium (NCM) 2,5MW/2,2MWh Prottes (Austria)**

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**Lithium (LiFePO4) 1MW/1MWh Codrongianos (SS - Italy)**



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# A New Fire Alarm and Extinguishing Control System

It is the first system fully integrated in a safety PLC platform. Integrated in an Allen-Bradley Logix solution and based on the Rockwell Automation platform; it is certified according to European standards and offers multiple benefits

**Gianbattista Zago**, SAFCO Engineering SpA

**S**AFCO Engineering, established in 2003, designs and manufactures fire and gas systems and equipment for the industrial field. At the beginning, the company's main activity was related to equipment sales. Subsequently, according to customer needs and its developed skills, SAFCO Engineering focused more on system integration. Through better experiences it has maintained rapid growth and has invested in its business competence by recruiting the best professional and experienced engineers who are fully aware of this critical area of safety supply.

With offices in Milan and Abu Dhabi (UEA), the company uses its integral engineering expertise to customize any system to perfectly match all its customer's requirements. It provides genuine support to major contracting project teams during feasibility, conceptual design, detailed design engineering, build and commissioning.

SAFCO Engineering's core business focus is on integrated fire & gas systems, addressable and conventional fire alarm systems, fire & gas detection devices, alerting systems & devices, clean-agent-gas based fire fighting systems and inert-gas based fire fighting systems.

SM Addressable Fire Detection and Extinguishing Control System Plant-wide safety systems must provide confidence that both people and plant are fully protected in hazardous industrial working environment.



## Advanced technological solutions

SAFCO Engineering can give this confidence with a new fire alarm and extinguishing control system SM Series. This is the first system addressable fire-detection control and extinguishing control system that is fully integrated in a safety PLC platform. It is designed to be configured as an integrated card in an Allen-Bradley® Logix®-based solution – comprising an Allen Bradley ControlLogix® programmable automation controller with redundancy module and the RSLogix™ 5000 programming environment – alongside networking devices and IO cards, in order to realize a completely addressable and conventional Fire and Gas system. The Allen-Bradley PAC is complemented by an Allen-Bradley PanelView™ Plus

*SAFCO SM System is the first system addressable fire-detection control and extinguishing control system that is fully integrated in a safety PLC platform*

operator interface and logic module and a FactoryTalk® View Site Edition (SE) station.

The SM System comprises an SM-ALM addressable loop card, the SM-GEC extinguishing control card and the SM-SWITCH for networking connection. All cards are housed in a 19" SM-RACK. The SM-ALM is designed to control all addressable initiating and notification devices, including those from Notifier and Apollo SIL2 devices. The SM-GEC is designed to control a gas-extinguishing system with several monitored I/O in order to comply with different extinguishing system configurations. Both cards are the first in the market that can be configured in single- or hot-redundant backup; and both cards are hot swappable and SIL2 certified, according to IEC61508.

The SM-System/Allen-Bradley PAC combination is the first PLC-based fire alarm system available in the market that is certified to EN 54-2, EN 54-4, EN12094-1 and SIL 2.

## A technological pairing with multiple benefits

SM-System, which is an evolution of the previous C-LIB card, is a true innovation in the fire & gas market and is equipped with the latest technology to provide a robust and flexible solution that can be integrated to meet the high demands of industrial plant locations. Certified according to European standards it provides flexibility and ease of maintenance, too. In fire & gas installations, the traditional approach is to have separate fire and gas safety systems for the plant and the office buildings. The individual needs of both areas often relying on

completely different communication protocols and associated networks.

The innovative aspect of the solution developed by SAFCO Engineering is the use of a PLC through SAFCO's SM-System, to not only address the plant's fire and safety requirements, but also to control and communicate with the addressable fire alarm devices in the buildings and – new to the market – it can be fully redundant.

The SM-System is designed to be configured as integrated card in the standard RSLogix 5000 software platform and can be used in conjunction with all the ControlLogix PAC components, including SIL2 certified cards, networking devices and IO cards, in order to realize a completely integrated addressable and/or conventional fire and gas system.

This technological pairing provides multiple benefits. These include a single system language, an open architecture; the removal of additional protocol converters, cabling reduction, hot replacement, common maintenance & management, redundancy and greater reliability. We also see a streamlined design process, reduced programming, easier troubleshooting and greater flexibility for future enhancements. Our customers enjoy reduced energy consumption. Easier maintenance, reduced training, improved personnel and plant safety and minimized start up and installation times. Additionally, it is the first system certified according to European standard in single and full redundant configuration. The solution is based on the Rockwell Automation platform of a number of reasons.

As well as the technical considerations above, we also appreciate its global presence, support infrastructure and its product availability.



## Gianbattista Zago

Gianbattista (age 50) is SAFCO's Chief Operating Officer and he is responsible for the direct oversight of both domestic and international sales activities. He has more than 25 years of experience in the fire & gas detection sector, primarily in design and sales roles.

Prior to joining SAFCO Engineering, Mr. Zago started his career as a site engineer in SES Enser, he worked in Kidde Italia (UTC) and Faro Antincendi. He is fluent in English and he is graduated as Perito Elettrotecnico.

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# Switchboards for the Giant of the Offshore

A highly specialized team of Imesa technicians has followed the realization of the “electric heart” of the catamaran Pioneering Ship



*Pioneering Spirit*

**P**ioneering Spirit (ex Pieter Schelte) is the giant ship which was built by the shipyards of Daewoo Shipbuilding in South Korea, on behalf of the Swiss group called Allseas. This is one of the most impressive and sophisticated

projects in the shipbuilding industry and it has an “electric heart” by Imesa SpA.

The original project dates back more than twenty years ago and since then, there have been various stages of study to identify the best technical solutions for the offshore: the installation and removal en bloc of large offshore platforms

## *Switchboards M.V. for Pioneering Spirit*

- 78 panels of medium voltage divided in 4 main switchboards
- voltage: 11 kV
- current: 1600 A
- short circuit current: 50 kA
- internal arc: 50 kA
- power: 8 generators of 11 MW



*Switchboards for  
Pioneering Spirit*

for oil. Imtech, the Dutch who was entrusted with the electrical part of the project, wanted Imesa for the provision of the main switchboards. The president of the Group, Sergio Schiavoni, said: "It was a great pride to take part in this amazing project. The total reliability of technical equipment was an essential element and the amount of power that the Pioneering Spirit needs is very high and it requires a high standard of safety". Since 2009, a highly specialized team of Imesa technicians has followed the progress

of the construction site.

The "giant catamaran," which was named after Pioneering Spirit - pioneer in heavy lifting, was launched on January 26, 2013 and came into operation in 2015. It is 382 meters long with a maximum width of 124 meters, and it has a displacement at full load from 900,000 tons, it is able to lift up to 25 thousand tons at a time and, thanks to sophisticated technological systems, it is able to work in adverse weather conditions.



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# ANIMP represents the whole Italian industrial plant engineering sector.

Founded to foster cooperation between academia and companies, for over 40 years the driving force behind ANIMP has been its passion for research and for progress in the industrial engineering field. Its members include:

- Engineering & Contracting companies;
- SME's that supply materials and services, installations and fittings;
- end-users;
- academics, experts and researchers.

All of them are involved in designing and building industrial systems, large-scale projects and infrastructure.

ANIMP's mission is to build a network connecting people, skills, businesses and researchers in the industrial engineering field to develop a strategic vision for the development of the sector.

Sections are ideas incubators that animate the life of the community and correspond to a professional, research, business and specialist area of interest. Through the Sections, members can:

- analyse in depth themes of interest relating to the sector and identify new opportunities for development;
- share knowledge and professional experiences;
- maintain relationships with industry, academia and other associations;
- propose training activities;
- organize workshops, seminars and conferences regarding areas of interest, also in cooperation with other Sections.

How they work:

- all members can join and participate in the activities of the Sections;
- the activities are proposed by the Sections' Steering Committee, that meets once a month;
- the Steering Committee is made up of representatives elected during the meeting and by other guests, invited by the Committee to make up the number established by the Section regulations; the Steering Committee is established for two years;
- the Director of the Section, appointed by the CD in its first meeting, coordinates activities and he represents the Section in the ANIMP council.



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Training is a valuable choice to broaden the horizons of professionals and companies. ANIMP training activities have developed continuously since 1986 with a view to collaboration between the academic and the business world in order to stimulate innovation and improve corporate performance.

Thanks to the interactive method and the use of case studies and exercises that simulate real cases, the teachers, among whom there are many corporate managers, bring experience gained in the field and create targeted training courses together with the participants.

The aim of the ANIMP courses is to share with participants the tools and methods for developing the skills required to carry out their business functions in an autonomous and creative way.

The training courses are divided into three areas of interest:

- Company Management;
- Project Management;
- Execution.

They are provided through:

- scheduled courses planned on an annual basis; they develop and examine in depth topics related to areas of interest;
- *ad hoc* courses on topics agreed with companies to meet specific training needs;
- local multi-company courses addressed to companies situated far away from Milan;
- interactive workshops.



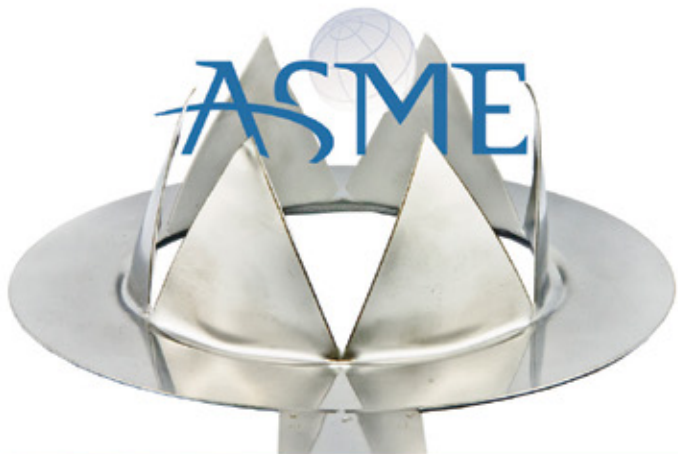
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## INDUSTRIAL PLANTS

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May/June 2018

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The logo for the company 'wood.' is positioned in the top right corner. It features the word 'wood.' in a white, lowercase, sans-serif font. The background of the entire advertisement is a photograph of an industrial facility at dusk or dawn, with large storage tanks in the foreground and tall distillation columns in the background, all illuminated by warm lights against a twilight sky.

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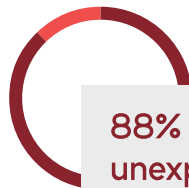
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