iINDUSTRIAL PLANTS

May 2024

ITALIAN ENGINEERING, CONTRACTING AND PLANT COMPONENTS SUPPLIERS

ANIMP

ITALIAN ASSOCIATION OF INDUSTRIAL PLANT ENGINEERING

Special issue of "IMPIANTISTICA ITALIANA" Official magazine of ANIMP Italian Association of Industrial Plant Engineering

DELTA ENGINEERING

PROCESS EQUIPMENT


THERMAL DEAERATORS


HAIR PIN HEAT EXCHANGER


TEMA TYPE HEAT EXCHANGER


HP STEAM DRUM

SKID SOLUTION


GAS TREATMENT


FILTRATION

Delta Engineering Srl – Via Bastone 148/150 24044 Dalmine (BG) ITALY
www.deltaeng.it – Tel. +39 035.56.11.40 – info@deltaeng.it

DELTA ENGINEERING

Contents

Boldrocchi

MAUS ITALIA

mausitalia.it

We take care of your tube bundles

Tube bundle handling

DNV
ST-0378 | ST-E273
MARITIME

Off shore

Maus Italia design and produce exclusive machines for extraction, movement and insertion of heat exchangers tube bundles.

Maus Italia presents, for the extraction, transportation and insertion of tube bundles in the plant, a complete new range ofmachines: ***Mef Express HT, BundleTutor Lifter*** and ***BundleTutor Mobil***, for use both within the plant and during the production of heat exchangers.
By lifting the tube bundle easily and safely, these machines eliminates the risk of destroying the baffles and damaging the tubes.

For production & onshore/offshore maintenance

The Maus Italia team is available to design custom solutions for extreme circumstances and ***ATEX / NAVY*** versions for the offshore market.

Every day in over 80 country worldwide

Our extensive sales network guarantees full availability and satisfies even the most demanding customers. In its over 60 years up and running, Maus Italia has built an efficient business organisation and a dense international sales network, with agents and distributors in more than 80 countries all over the world.

MANAGEMENT SYSTEM CERTIFICATION
DNV
ISO 9001 - ISO 14001
ISO 45001

- BAFFLES FLARING HOLES
- PREWELDING AND TUBE LOCKING
- TIG ORBITAL WELDING SYSTEMS
- TUBE ROLLING
- TUBE END FACING
- TUBE BUNDLE INSERTION
- TUBE BUNDLE HANDLING
- TUBE AND TUBE BUNDLE CUTTING
- STUB AND TUBE PULLERS
- TUBE BUNDLE CLEANING
- MEASUREMENTS TOOLS

GENERAL COUNCIL 2022 ÷ 2026

updated April 2024

HONORARY PRESIDENT

Maurizio Gatti*

PRESIDENT

Marco Villa*
COO TECHNIP ENERGIES
President TECHNIP ENERGIES ITALIA

VICE PRESIDENTS

Alberto Matucci*
Vice President Equipment & Projects
NUOVO PIGNONE, BAKER HUGHES

Marco Pepori*
Senior Advisor Business Development
ATV Advanced Technology Valve

PAST PRESIDENT ANIMP

Antonio Careddu*
Project Sponsor
SAIPEM

TREASURES

Pierino Gauna*

COUNCIL MEMBERS

Fabrizio Botta
Chief Commercial Officer
SAIPEM

Davide Caparini
Presidente MESIT
Assessore al Bilancio e Finanza
REGIONE LOMBARDIA

Roberto Castelli
Direttore Commerciale
BONATTI

Andrea Cignoli*
Amministratore Delegato
TECHINT

Paolo Cremonini
Strategic Development Director
SAN GIORGIO DEL PORTO

Massimiliano De Luca
Global Major Projects Director
Energies & Chemicals Segment
Global Sales Industrial Automation Business
SCHNEIDER ELECTRIC

Michele Della Briotta
Amministratore Delegato
TENARIS

Luca G. Donelli
Sales and Marketing Manager
IMPRESA DONELLI

Stefano Donzelli
Vice President - Global Business Development Process & Chemicals
WOOD

Stefano Riemma
Presidente AIDI

Alberto Garanzini
Group Vice President
ABB

Edoardo Garibotti*
Chairman
TRILLIUM PUMPS ITALY

Claudio Andrea Gemme
Amministratore Delegato
FINCANTIERI INFRASTRUCTURE

Guido Gentile
New Units Project Management
Senior Vice President
ANSALDO ENERGIA

Oscar Guerra
Amministratore Delegato
ROSETTI MARINO

Antonio Ieraci
Direttore Generale
ENEXIO ITALY

Alfredo Lambiase
Prof. Ordinario di Impianti Industriali
UNIVERSITA' DI SALERNO

Alberto Ribolla*
Consigliere
ARKAD

Andrea Sianesi
POLITECNICO DI MILANO

Massimo Sicari
Commercial & Operations Vice President
MAIRE TECNIMONT

Alessandro Spada
Vice President & Chart Corporate Advisor VRV Group
Presidente ASSOLOMBARDA

Paolo Trucco*
Prof. Ordinario di Impianti Industriali
POLITECNICO DI MILANO

COLLEGE OF AUDITORS

Luciano Mancini
Schneider Electric

Stefano Salvatorelli
Technip Energies Italia

Carlo Tenti
Arkad

ARBITERS

Mario Bernoni

Massimo Massi

Roberto Piattoli

GENERAL SECRETARY

Anna Valenti

** Presidential Council*

ANIMP
Italian Association of Industrial Plant Engineering

Via Chiaravalle 8
20122 Milan
Tel. 02 67100740
animp@animp.it

Section rappresentative

Automazione
Franco Jodice
Instrumentation e Control Lead Engineer
TECHINT

Componentistica
Edoardo Garibotti
Chairman
Trillium Pumps Italy

Construction
Giordano Gariboldi
Consulente

Energia
Lorenzo Stocchino
General Manager
SEINGIM

Flussi Multifase
Francesco Ferrini
Amm. Delegato – Dir. Tecnico
TECHFEM

Giovani
Antonio Ieraci
Direttore Generale
ENEXIO ITALY

H_2O
Silvio Oliva
Consulente

Internazionalizzazione
Edoardo Garibotti
Managing Director
T.M.P. Termomeccanica Pompe

IPMA Italy
Diego Lelli
Executive Business Operator Director
BAKER HUGHES

Logistica, Trasporti e Spedizioni
Enrico Salvatico
STUDIO LEGALE MORDIGLIA

Manutenzione
Antonio Ceniccola
Commercial Manager
CESTARO ROSSI Group

Packages
Guido Maglionico
Consulente

Digital & Innovation Management
Francesco Lippo
Group Information Technology Director Engineering Systems
TECHNIP ENERGIES

GENERAL CONTRACTOR

ansaldo energia

Arkad SpA

Bonatti

cefla

IMAGRO CONSTRUCTION

MAIRE

ROSETTI MARINO

SAIPEM

SIMECO ENGINEERS & CONTRACTORS

TECHINT Engineering & Construction

T.EN TECHNIP ENERGIES

wood.

SUPPORTING MEMBERS

ABB

accenture

AVEVA

EDISON EDF GROUP

FLOWSERVE Flow Control Division

FORES ENGINEERING

Group YOUR JOB, OUR WORK

HEXAGON PPM

IMESA ELECTRICAL ENGINEERING

Nidec ASI S.p.A.

PALL

Schneider Electric

SIAD MACCHINE IMPIANTI

COLLECTIVE MEMBERS

3UNITS TECHNOLOGY – CHIASSO (CH)
A.S.T.R.A. REFRIGERANTI – NOVARA
A.V.R. ASSOCIAZ. COSTR. VALVOLAME RUBINETT. – MILANO
AG REFRIGERATION SRL – MILANO
AI GROUP – ROVIGO
AIDI ASSOCIAZIONE ITALIANA DOCENTI IMPIANTISTICA INDUSTRIALE – ROMA
AM SOLUTIONS SRL – CONCORREZZO (MB)
APPLUS ITALY SRL – DALMINE (BG)
APRILE PROJECTS DIVISION – GENOVA
ASCO FILTRI SRL – BINASCO (MI)
ASSOCIAZIONE COSTRUTTORI CALDARERIA-UCC – MILANO
ASSOPOMPE – MILANO
ASSTRA ITALIA SRL – TRESCORE BALNEARIO (BG)
ATB RIVA E CALZONI – RONCADELLE (BS)
ATLAS COPCO ITALIA SPA – CINISELLO BALSAMO (MI)
ATV ADVANCED TECHNOLOGY VALVE SPA – COLICO (LC)
AUCOTEC SRL – MONZA
AUMA Italiana S.r.l. – CERRO MAGGIORE (MI)
BAGGIO SRL TRASPORTI COMBINATI – MARGHERA (VE)
BALLESTRA– MILANO
BARTEC FEAM NASP - TREZZANO SUL NAVIGLIO (MI)
BBV HOLDING SRL – MILANO
BEA SRL – SOLBIATE OLONA (VA)
BENTLEY SYSTEMS ITALIA SRL – ASSAGO (MI)
BIS 67 TRASPORTI MULTIMODALI SPA – BASSANO DEL GRAPPA (VI)
BLUTEK SRL – GORLE (BG)
BOFFETTI SPA – CALUSCO D'ADDA (BG)
BOLDROCCHI SRL – BIASSONO (MI)
BOLLORÉ LOGISTIC ITALY SPA – PANTIGLIATE (MI)
BOSCO ITALIA SPA – S.MAURO TORINESE (TO)
BRUGG PIPE SYSTEMS SRL – PIACENZA
BUHLMANN ROHR FITTINGS STAHLHANDEL GMBH – BERGAMO
BURCKHARDT COMPRESSION (ITALIA) SRL – Villasanta (MB)
CADMATIC ITALY – MILANO
CANNON ARTES SPA – PESCHIERA BORROMEO (MI)
CASALE S.A. – LUGANO (CH)
CDB ENGINEERING SPA – CASALPUSTERLENGO (LO)
CEG SRL ELETTRONICA INDUSTRIALE – BIBBIENA STAZIONE (AR)
CESTARO ROSSI & C. SPA - BARI
CJ ICM ITALIA – SAN DONATO MIL.SE (MI)
CLAUGER TECHNOFRIGO SPA - CASTEL MAGGIORE (BO)
COMMERCIALE TUBI ACCIAIO – GRUGLIASCO (TO)
COMUNICO SRL – GENOVA
CORTEM SPA – MILANO
COSTRUZIONI ELETTROTECNICHE CEAR SRL – GESSATE (MI)
D-ENERGY - CESANO BOSCONE (MI)
DE NORA WATER TECHNOLOGIES ITALY - MILANO
DE PRETTO INDUSTRIE SRL – SCHIO (VI)
DELTA ENGINEERING SRL – DALMINE (BG)
DELTA-TI IMPIANTI SPA – RIVOLI (TO)
DEMONT SRL – MILLESIMO (SV)
DEUGRO ITALIA SRL – SEGRATE (MI)
DG IMPIANTI INDUSTRIALI SPA – MILANO
DHL GLOBAL FORWARDING ITALY SPA – POZZUOLO MARTESANA (MI)
DIGITAL CONSTRUCTION WORKS – MILANO
DNV – VIMERCATE (MI)
DOCKS ECS SRL – RAVENNA
DRESSER ITALIA – CASAVATORE (NA)
DSV SPA – LIMITO DI PIOLTELLO (MI)
DUCATI ENERGIA SPA – BOLOGNA
ENERECO SPA – FANO (PU)
ENEXIO ITALY srl – VARESE
ENG.CO ENERGIES SRL – MORTARA (PV)
ENGITEC TECHNOLOGIES SPA – NOVATE MILANESE (MI)
ERREVI SYSTEM SRL – REGGIO EMILIA
ESAIN SRL – GENOVA
EUROGUARCO SPA – LA SPEZIA
EUROTECNICA CONTRACTORS & ENGINEERS SPA – MILANO
EXERGY INTERNATIONAL - OLGIATE OLONA (VA)
EXPERTISE SRL – VADO LIGURE (SV)
F.B. SPA - ALBERONE FE
FAGIOLI SPA – SANT'ILARIO D'ENZA (RE)
FARESIN FORMWORK SPA – BREGANZE (VI)
FELM SRL – INVERUNO (MI)
FILTREX SRL – MILANO
FINCANTIERI – Sestri Levante- Riva Trigoso (GE).
FINDER POMPE SPA Gruppo Aturia – MERATE (LC)
FISIA ITALIMPIANTI SPA – GENOVA
FIVES ITAS SPA – MONZA
FLENCO FLUID SYSTEM SRL – AVIGLIANA (TO)
FLOWSERVE WORTHINGTON – Desio (MB)
FLUITEN ITALIA SPA – MILANO
FUMAGALLI VALVES SPA – TREZZANO S/NAVIGLIO (MI)
G.A. SRL – FIRENZE
GEA PROCESS ENGINEERING SPA – SEGRATE (MI)
GI.EFFE.M. SNC – LANDINARA (RO)
HARPACEAS SRL – MILANO
HEVOR SRL – MILANO
HYDAC SPA – AGRATE BRIANZA (MB)
HYDROSERVICE SPA – MILANO
I.N.T. SRL – CASTELVERDE (CR)
IDI SPA – MILANO
IGNAZIO MESSINA & C. SPA – GENOVA
ILF Engineers Italia S.r.l. – GENOVA
IMPRESA DONELLI SRL - LEGNANO (MI)
INCICO SPA – FERRARA
INDRA SRL – MAGENTA (MI)
INPROTEC INDUSTRIAL PROCESS TECHNOLOGIES SPA – CINISELLO BALSAMO (MI)
INSIRIO SPA - ROMA
INTERGLOBO PROJECT SRL – GENOVA
INTERTEK ITALIA SPA – CERNUSCO SUL NAVIGLIO (MI)
ISCOTRANS SPA – GENOVA
ISG SPA (IMPIANTI SISTEMA GEL) – MILANO
ISS GLOBAL FORWARDING ITALY SRL – MILANO
ISS INTERNATIONAL SPA – ROMA
ISS PALUMBO SRL – LIVORNO
ISSELNORD – Follo (SP)
ITALFLUID COSMEP SRL – Notaresco (TE)
ITALGESTRA SRL – NOVA MILANESE (MB)
ITEX SRL QUALITY SERVICES – SAN DONATO MILANESE (MI)
JAS Jet Air Service SPA – GENOVA
JOHN CRANE ITALIA SPA – MUGGIO' (MB)
K&L GATES STUDIO LEGALE ASSOCIATO – MILANO
KENT SERVICE SRL – MILANO
KERRY PROJECT LOGISTICS ITALIA SPA - MILANO
KEYST1 ITALY SRL – MILANO
KOSO PARCOL – CANEGRATE (MI)
KROHNE ITALIA SRL – MILANO

COLLECTIVE MEMBERS

KUEHNE + NAGEL Srl – GENOVA
LA TECNOVALVO SRL – BOLLATE (MI)
LEVER – NEGRAR DI VALPOLICELLA (VR)
LEWA NIKKISO ITALY – RHO (MILANO)
LOGIMAR SRL – CAROBBIO DEGLI ANGELI (BG)
LRQA ITALY SRL – MILANO
M.M. SRL – UDINE
M2E PROJECTS SRL – MILANO
MACCHI – ADIVISION OF SOFINTER SPA – GALLARATE (VA)
MAINTENANCE GLOBAL SERVICE SRL – LIVORNO
MAMMOET ITALY SRL – MILANO
MAUS ITALIA F.AGOSTINO & C. SPA – BAGNOLO CREMASCO (CR)
MAYEKAWA ITALIA – MILANO
MESIT SRL – MILANO
MILANI SPA – OSNAGO (LC)
MONSUD SPA – AVELLINO
MONT-ELE – GIUSSANO (MI)
MULTILOGISTICS SPA – LISCATE (MI)
MVN SRL - MILANO
NEUMAN & ESSER ITALIA SRL – MILANO
NEWAY VALVE EUROPE - MILANO
NIPPON EXPRESS ITALIAN SPA – GENOVA
NORD EST GROUP SRL – SAN VITO AL TAGLIAMENTO (PN)
NTT DATA ITALIA SPA – MILANO
NUOVO PIGNONE INTERNATIONAL SRL – FIRENZE
OFFICINE TECNICHE DE PASQUALE SRL – CARUGATE (MI)
OILTECH - MILANO
OMECO S.R.L. – Monza (MB)
ORION SPA – TRIESTE
OTIM – MILANO
PANTALONE SRL – CHIETI
PEPPERL+FUCHS - Sulbiate (MB)
PES ENGINEERING SRL - ROSIGNANO SOLVAY – LIVORNO
PHOENIX CONTACT SPA – CUSANO MILANINO (MI)
PIETRO FIORENTINI SPA – MILANO
POMPE GARBARINO SPA – ACQUI TERME (AL)
PRECISION FLUID CONTROL SRL – MILANO
PRODUCE INTERNATIONAL SRL – MUGGIO' (MB)
PROFILE MIDDLE EAST CO. WLL ITALIA – MAGENTA (MI)
PROGECO NEXT– Rosignano Solvey (LI)
PRYSMIAN CAVI E SISTEMI ITALIA SRL – MILANO
QUOSIT SISTEMI PER L'AUTOMAZIONE – BARI
R.STAHL SRL – PESCHIERA BORROMEO (MI)
R.T.I. SPA – RODANO MILLEPINI (MI)
RAC ENERGY – BONATE SOPRA (BG)
RACCORTUBI SPA – MARCALLO CON CASONE (MI)
RAM POWER SRL - FIRENZE (FI)
RENCO SPA – PESARO
REPCo SRL – MILANO
RIGHI ELETTROSERVIZI - Mercato Saraceno (FC)
RIGHINI F.LLI SRL – RAVENNA
RIVA E MARIANI GROUP SPA – MILANO
ROCKWELL AUTOMATION SRL – MILANO
ROXTEC ITALIA SRL – MILANO
RPLT RP LEGALITAX – TORINO
RUHRPUMPEN GLOBAL - MILANO
S.I.E. SRL - GENOVA
SA FIRE PROTECTION - SAN PIER NICETO (ME)
SAET SPA – SELVAZZANO DENTRO (PD)
SANCO SPA – GALLIATE (NO)
SATIZ TPM Dipartimento Oil & Gas – FIRENZE
SAVINO BARBERA – Brandizzo (TO)
SB SETEC SPA - Melilli (SR)
SCAE – Grassobbio (BG)
SCANDIUZZI STEEL CONSTRUCTION SPA – VOLPAGO DEL MONTELLO (TV)
SCHWEITZER ENGINEERING LABORATORIES SRL – MILANO
SEID - Songavazzo (BZ)
SEINGIM - Ceggia (VE)
SGS ITALIA SPA Divisione Industrial – MILANO
SIIRTEC NIGI SPA – MILANO
SINERGIA S.P.A. – Albino (BG)
SITVERBA SRL – VERBANIA
SPEDIZIONI TRASPORTI PASQUINELLI ENNIO SPA – MILANO
SPEKTRA SRL – VIMERCATE (MB)
SPINA GROUP – SAN GIULIANO MILANESE (MI)
SPIRAX SARCO SRL – NOVA MILANESE (MI)
SPLIETHOFF – PRINCIPATO DI MONACO
SRA INSTRUMENTS SPA – CERNUSCO S/NAVIGLIO (MI)
STANDEX INTERNATIONAL SRL – MILANO
STUDIO LEGALE MORDIGLIA – GENOVA
SUPPLHI – MILANO
T. EN ITALY SOLUTIONS SPA – ROMA
T.A.L. TUBI ACCIAIO LOMBARDA SPA – FIORENZUOLA D'ARDA (PC)
T&T SISTEMI SRL - BUCINE (AR)
TC2 GROUP SRL – DALMINE (BG)
TECHFEM SPA – FANO (PU)
TECHNOR ITALSMEA SPA – GESSATE (MI)
TECNEL SAS – GENOVA
TECNICA TRE SRL – CASSOLA (VI)
TECNOPROJECT INDUSTRIALE – CURNO (BG)
TECTA SRL - MILANO (MI)
TECTUBI RACCORDI SPA - PODENZANO (PC)
TENARISDALMINE/TENARIS PROCESS AND POWER PLANTS SERVICES – SABBIO BERGAMASCO (BG)
TENOVA – CASTELLANZA (VA)
TERMOKIMIK CORPORATION – MILANO
TM.P. SPA TERMOMECCANICA POMPE – LA SPEZIA
TREVI GROUP – Cesena (FC)
TRILLIUM FLOW TECHNOLOGIES – Nova Milanese (MI)
TURBODEN SPA – BRESCIA
TUXOR SPA – TORINO
UAMI/ANIMA – MILANO
UNITERM SRL – COLOGNO MONZESE (MI)
UTC MEDITERRANEAN SRLU - GENOVA
VADO GATEWAY – VADO LIGURE (SV)
VALPRES – MARCHENO (BS)
VALSAR SRL – CESANO BOSCONE (MI)
VALVITALIA SPA – RIVANAZZANO (PV)
VED SRL – PRIOLO GARGALLO (SR)
VEGA ITALIA SRL – ASSAGO (MI)
VERGAENGINEERING SPA – MILANO
VOITH TURBO – REGGIO EMILIA
VRV SPA – ORNAGO (MB)
WATLOW ITALY SRL – CORSICO (MI)
WEG ITALIA SRL – LISSONE (MB)
XYLEM SRL – S.AMBROGIO DI TORINO (TO)
ZANOTTI - PEGOGNAGA (MN)

INDUSTRIALPROJECTS

SPECIALIZED LOGISTICS. SAFELY DELIVERED.

DHL Industrial Projects help customers of all sizes execute their most important and challenging cargo movements, ad-hoc shipments, major capital projects, or maintenance, repair and operations contracts.

Our dedicated project teams ensure global reach and local knowledge. They are complemented by global chartering specialists, in-house engineering assurance, HSE and sector-specific SMEs. DHL Industrial Projects provide best-in-class service and complete project ownership from a technical and operational point of view, utilizing our Material Management System (MMS 360) software for visibility, control and direct cost savings.

projects.it@dhl.com
dhl.com/it

DHL Global Forwarding - Excellence. Simply delivered.

Editorial

The Italian industry is embracing new challenges and opportunities

Marco Villa
Chief Business Officer, Technip Energies
President of ANIMP

As the President of ANIMP, the Italian Association of Industrial Plant Engineering Companies, I am pleased to introduce the latest number of *Industrial Plants*, our yearly publication for international audiences.

Our Association includes energy providers, engineering firms and general contractors, plant component manufacturers, service suppliers as well as universities and consulting firms, with the main focus on designing and building large industrial plants in every corner of the world.

With more than 500 current members, ANIMP strives to develop a world-class supply chain, competitive globally in any industrial plant market, in order to promote growth, development, innovation and international cooperation.

In our world, there is no shortage of uncertainties and dramatic events! Just as we thought that we have put the pandemic behind us, wars have exploded in Ukraine and more recently in the Middle East. At the time of writing, both of these are affecting our markets significantly, although fortunately they are still regional and have not run out of control on the global basis.

We hope also to have a "soft landing" in world markets, to exit gradually but softly out of the recession and inflationary pressures, with prices stabilization and a good balance between energy accessibility, availability and sustainability.

Overall, today our Associates are quite optimistic regarding the future of our industrial plants industry. Firstly, we see a renewed growth in demand of energy products, after the pandemic-induced recession, with a significant increase in global investments in building and modernizing oil&gas and petrochemical industries, particularly in natural gas and LNG, all markets in which our companies are playing a substantial role. r modernization is also a significant component of the growing overall investment scenario.

"We are quite optimistic regarding the future of our industrial plants industry, as we see a growth in demand of energy products driving a significant increase in the global investments in the traditional oil&gas and petrochemical industries

> **"We welcome the evident increase of 'clean' solutions, where the overall investments and employment are fast outpacing the traditional sectors, worldwide: decarbonization, emissions control, new transportation systems, etc. open huge new opportunities for our industries**

Secondly, we welcome the evident increase in "clean solutions", where the overall investments and employment have already quickly outpaced the traditional sectors, worldwide. Decarbonization, emissions control, new fuels and new transportation systems, etc. open huge new opportunities to our industries.

The majority of our companies are not only ready, but indeed already very active in meeting the new challenges to design and build these "green" solutions for global markets: from offshore wind-farms to green hydrogen production,

from CCUS plants to hydrogen pipelines and ships fueled with new green fuels.
Furthermore, the great majority of our Associates already have in place decarbonization and emissions control programs and targets in their factories and offices. They participate actively in all aspects of the ESG initiatives, including quantitative measurements based on the maximum use of digitalization. This is a big organizational and cultural endeavor.

"The great majority of our Associates already have in place decarbonization and emissions control programs in their factories and offices, and they participate actively in all aspects of the ESG initiatives, including quantitative measurements based on the maximum use of digitalization

Therefore, in spite of the numerous current difficulties, risk and uncertainties, we look at the future with substantial optimism. We trust our skills, capabilities, flexibility, imagination and experience. Historically, the Italian industry has always excelled in entrepreneurship, in inventiveness, in its capacity to adapt to new and unpredictable circumstances, in the speed of adoption and optimization of new breakthrough technologies. Indeed, in the industrial plants sector, we are one of the world leaders, with more than 5,000 companies, large and small, employing more than 400,000 people active in this field, in Italy and globally.
We are therefore ready for the new challenges. In ANIMP, we also remain particularly grateful to the Italian and other partner industries for their strong and continuing commitment and support.

"The Italian industry continues to look at the future with optimism, since historically we have always excelled in inventiveness, flexibility and capacity to adapt to new and unpredictable circumstances

Marco Villa

Marco Villa

Marco Villa, the President of ANIMP since 2022, is the Chief Business Officer of Technip Energies, after having held the position of Chief Operating Officer. Prior to these assignments, he was the President of TechnipFMC Onshore/Offshore (now, Technip Energies) for Europe, the Middle East, India and Africa. From 2003 to 2017, Marco Villa held various management positions in Technip, including President Europe, Middle East, India and Africa, President and CEO of Region B, Chief Financial Officer of Region B and Head of Export & Project Finance of Technip Italy. Before joining Technip, he had worked as a financial specialist in Finmeccanica, the italian multinational company specializing in the aerospace, defense and security industries, and as the head of the Finance and Risk Management Division of Telespazio (Telecom Italia Group), a European services company for space flights. He graduated with honors in Economics and Commerce at the University of Rome.

CORTEM® GROUP

To be sure to be safe.

FastEx, EXTRA FAST EXTRA SECURE CONNECTORS

Explosion-protected solutions for the interconnection of electrical circuits in areas classified with risk of explosion

IP66

cortemgroup.com

Dry-Gulch view

Dry Gulch HDD Crossing: a challenging pullback operation

The spread 5B on the Trans Mountain Expansion Project presented challenges in a rugged area of British Columbia, Canada, characterized by extreme geomorphological conditions, typical of mountainous regions. The pipeline route intersected the Dry Gulch channel at KP 993, a deep canyon formed as a glacial meltwater channel

Pier Maria Bruzzo, Pipeline Projects Engineering Coordinator
Giacomo Marinelli, Project Engineering Manager and Deputy Manager at Pipeline Engineering Excellence Centre

Bonatti S.p.A.

The existing NPS 24 Trans Mountain Pipeline (TMPL) system, built in the early 1950s, stretched approximately 1,176 kilometres from a storage terminal in Edmonton, AB to the Westridge Marine Terminal in Burnaby, BC.

Trans Mountain proposed the Trans Mountain Expansion Project (TMEP), involving the expansion of the existing TMPL system. Spread 5B of TMEP entailed constructing approximately 89 kilometres (from KP 987+100 to KP 1,076+000) of 914 mm (NPS 36) OD pipeline. Bonatti, in a joint venture with Kiewit Corporation, was responsible for pipeline construction activities from KP 987+100 to KP 1,038+100.

Dry Gulch Geomorphological, Geological, and Geotechnical Setting

Dry Gulch is a steep V-shaped canyon near the Coquihalla Summit, approximately 39 kilometres northeast of Hope, BC. The pipeline route crossed the canyon near KP 993+000, about 200 metres northwest of the Dry Gulch bridge on Coquihalla Highway 5. The distance between the top of the northeast wall and the top of the southwest wall is approximately 225 metres. The invert of the gulch is at an elevation of 1,101.3 metres above sea level on the pipeline alignment.

The northeast wall of Dry Gulch is about 94 metres high, with the upper portion featuring a rock outcrop with a slope angle of about 57 degrees (locally as steep as 78 degrees) and extending for about 45 metres. Further below, there is a blocky rock colluvium lower slope with a slope angle of about 37 degrees extending for about 94 metres to the bottom of the gulch.

The southwest wall of the gulch is 97 metres high, mostly featuring a rock outcrop with a slope angle of about 42 degrees (locally as steep as 58 degrees) and extending about 121 metres downwards. This is followed by a rock block colluvium lower slope with a slope angle of about 29 degrees and about 32 metres long up to the bottom of the gulch.

Dry Gulch is frequently affected by snow avalanches, making the bottom inaccessible for most of the year. Geologically and geotechnically, Dry Gulch is unique due to the contact between two stratigraphic units (Eagle Gneiss to the northeast and Falls Lake Suite granitic rocks to the southwest), resulting in brittle faulting and fracturing of the rock mass.

"Frequently affected by snow avalanches, making the bottom inaccessible for most of the year, geologically and geotechnically Dry Gulch is unique, due to the contact between two stratigraphic units, resulting in brittle faulting and fracturing of the rock mass

Another important aspect is the unknown thickness of accumulated talus and depth to the groundwater table at the bottom of the gulch. There is unconfirmed moderate metal leaching and acid rock potential associated with the stratigraphic unit to the southwest of Dry Gulch. Depending on the chosen crossing method, management of rockfall hazard and snow avalanches prior to and during construction could have required extensive temporary and/or permanent retention measures.

Construction Schedule Restriction & Method Selection

One of the key considerations for the construction of the crossing was the schedule for completion of the works and the available time window. The completion of the project had been forecasted for the end of 2023, necessitating the completion of the Dry Gulch crossing by summer 2023. Additionally, work conditions in this area were very challenging during the winter season due to low temperatures, snow precipitation, and high avalanche risk.

"One of the key considerations for the construction of the crossing was the schedule for completion of the works and the available time window, with the completion of the project forecast for the end of 2023

Considering the complex geomorphological, geological, and geotechnical settings and the schedule restrictions, the feasibility of the crossing, related to the construction methodology, was carefully assessed. Initially, "Open Cut" was considered as the default option; however, after a detailed study, it was deemed too complex in terms of safety, environmental impact, durability, and schedule. After a wide comparison of various technologies (HDD, Direct Pipe, Microtunnel, Raise boring), the TMEP Project Management team identified the HDD methodology as the most sustainable option for the crossing execution.

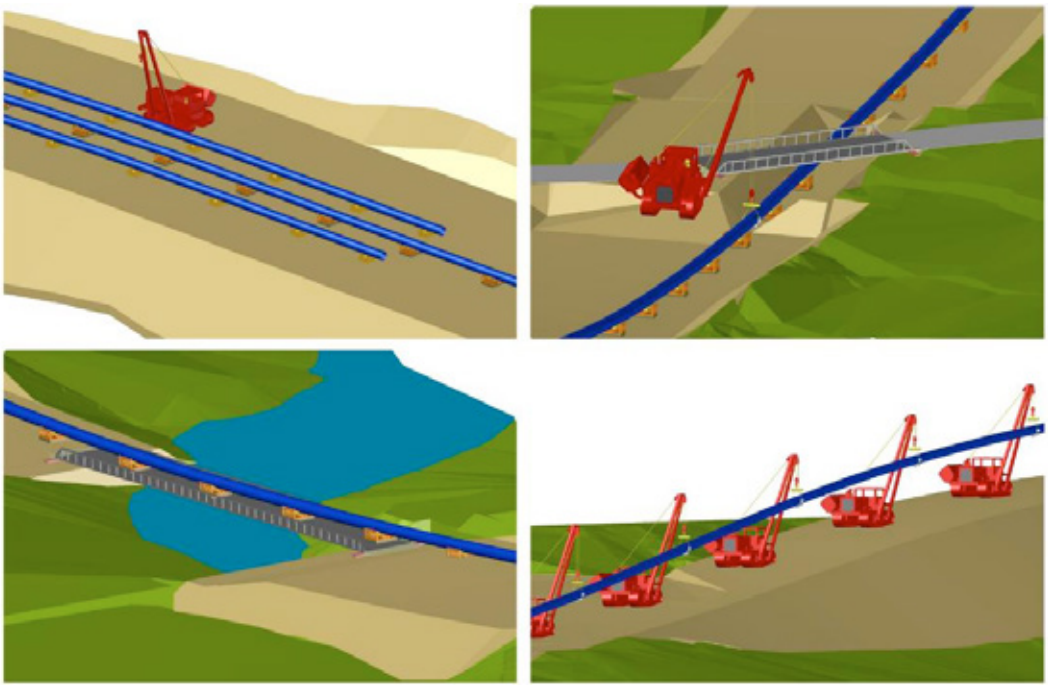


Figure 2 - 3D Model for pipeline string preparation works

HDD Preparation Works Design

The selected HDD profile had a total length of 1,842 metres, with a horizontal distance of 1,794.4 metres. The feasibility of the HDD was confirmed in August 2021 when a 1,622 metres exploration borehole had been successfully drilled along the actual pilot hole alignment from the South pad to about 200 metres from the North Pad exit point.

The exploration borehole confirmed a low risk of frack out and bore hole collapse within the rock strata, increasing to moderate risk in the surficial layers (up to 10-14 metres depth from the drilling surface at both North and South pads). To manage this risk, installation of 60 metres – 70 metres casing pipe was the selected mitigation measure.

Particular attention was given to the design of the pullback section and the fabrication of the pipeline string, as the area surrounding Dry Gulch featured uneven terrain, steep slopes, several creeks, and a winding right-of-way, due to environmental constraints.

"Particular attention was given to the design of the pullback section and the fabrication of the pipeline string, as the area surrounding Dry Gulch featured uneven terrain, steep slopes, several creeks, and a winding right-of-way, due to environmental constraints

By the end of 2021, a detailed pullback study analysed several options, including single or multiple strings from both the Northern and Southern sides of the gulch. The final selected option was to pull three pipeline strings (the longest of about 1,100 metres) from the Southern side. This was primarily driven by the limitation of earthworks and environmental impact and supported by the low risk of bore collapsing, as it required two tie-in welds during the pullback.

The selected pullback ROW was challenging, featuring hilly and rocky terrain with horizontal and vertical deviations, a 17 degree slope 220 metres long, the crossing of two watercourses and one road. The overbreak section, spanning 280 metres with a maximum height of 15 metres to allow the pipeline string to pass through the contingency thruster and meet the 11 degree entry angle, was supported by seven cranes (six 120 tons cranes and one 160 tons crane) as well as four side booms. The remaining 820 metres of the drag section had been placed on 100 roller supports designed for the pullback and hydrotest loads (40 tons).

To ensure a successful pullback, a comprehensive study for the string preparation was performed, including an integrated 3D Model/Finite Element Analysis (FEM) Analysis.

Additionally, a FEM analysis was conducted to analyze both the static and dynamic behaviour of the pipe string during the pullback phase. In particular, FEM simulation produced the following results:

- Verification that the maximum stress induced in the string during lifting and pulling operations was within acceptable limits, guaranteeing the integrity of the pipe string;
- Definition of the distribution of the equipment and the vertical and lateral loads required for equipment sizing and design additional anchoring systems;

Figure 3 - Preparation of Launching Platform and drilling Pad

- Definition of the optimal distribution of roller supports and the vertical and lateral loads required for designing their foundations, under pullback and hydrotest conditions;
- Identification of the optimum positioning of the station for the tie-in of two strings, guaranteeing minimal longitudinal stress and bending moment;
- Calculation of any possible longitudinal or vertical uplift displacement, possibly requiring additional restraints or anchors.

Pipeline Strings and Rollers Way Preparation

Given the project timeline, Bonatti/Kiewit developed a suitable schedule to accommodate the required deadlines, using different teams working in parallel.

Regarding the proper works of the HDD execution, the pilot hole was executed from August to October, 2022 from the North pad to the South pad, confirming the findings of the exploration borehole executed in 2021 and the low risk of bore collapse along the majority of the HDD alignment. Subsequently, the reaming phase started in late October, 2022 and progressed through the winter.

In parallel, works for the preparation of the prefabricated string and its associated working ROW were carried out: initially grading and blasting of the section upslope near Falls Lake Road starting June, 2022. Later, the section between Falls Lake Road and the Drilling Pad required significant earthworks to build a 10 metres high launching pad for the overbreak section. The preparation of the pullback ROW required about 91,000 cubic metres of earthworks overall and 16,000 cubic metres of imported material from adjacent areas. By Fall 2022, the preparation of foundations and installation of bridges on Falls Lake Rd. and Falls Lake Creek was completed, and further grading of the drag section was completed in late 2022.

Afterward, stringing and welding of the first two strings (each 378 metres) was completed by the end of January, 2023, while fabrication of the main string (1,100 metres) was completed in March, 2023.

A preliminary hydrotest of the strings had been planned for April, 2023 – one month before the planned pullback – allowing the completion of support installation and equipment mobilization.

Pullback Execution

The final pullback preparation activities started in September, 2023, with the mobilization on-site of the

Figure 4 - Secondary strings pre-fabrication

Figure 5 - Pullback execution

Figures 6 and 7 - Pullback – Falls Lake Road crossing & overbreak section detail

eight cranes and the 17 side booms required for pipeline string management during pullback and the installation of the HDPE buoyancy control pipe inside the NPS 36-inch pipeline strings.

The pullback had eventually started on October 18, 2023, and was smoothly and safely completed in about 52 hours, 30 of which had been required for the two tie-ins and with an average pulling rate ranging from 80 metres/hour to 120 metres/hour, exceeding the best estimate scenario. The maximum pulling force was within the expected range, and also the continuous monitoring of the vertical and lateral loads on the cranes and side booms confirmed the loads being consistently within the calculated acceptable limits.

Conclusions

The Dry Gulch Crossing was a critical activity of the Trans Mountain Expansion Project, and the pipeline pullback posed a significant challenge for Bonatti/Kiewit since their involvement in Spread 5B.

Considering the exceptional length and project available work space, the engineering, planning, and setting up of the Dry Gulch HDD pullback required extraordinary effort and multidisciplinary coordination from late-2021 to mid-2023 to match high safety and quality standards, minimize environmental impact, and optimize the execution schedule. In particular, feasibility studies, detailed design, and construction engineering was developed from Q4-2021 to Q1-2023, including different stages of stress analysis, in static and dynamic conditions, and 3D modelling of the rollers to size the equipment required for string management and pipeline anchoring.

"Meticulous planning and design allowed the identification of the most reliable and efficient solution for the Dry Gulch HDD pullback, executed safely and smoothly in only 52 hours, with eight cranes and 17 Bonatti SAFE T-Rex sidebooms - a major accomplishment for TMEP and Bonatti, due to compliance, execution and challenging schedule constraints

The engineered pullback required three pipeline strings (1,100 metres, 380 metres, and 380 metres in length), to traverse across 900 metres of rollers across rocky terrain with significant horizontal direction and vertical elevation changes, while crossing two watercourses and one road and being lifted at about 15 metres elevation for the 200 metres long over-break section. Meanwhile, other civil works required to prepare the rollers were completed in the second half of 2022, and the pipeline strings had been welded, hydrotested, and positioned on the rollers from Q1-2023 to Q3-2023.

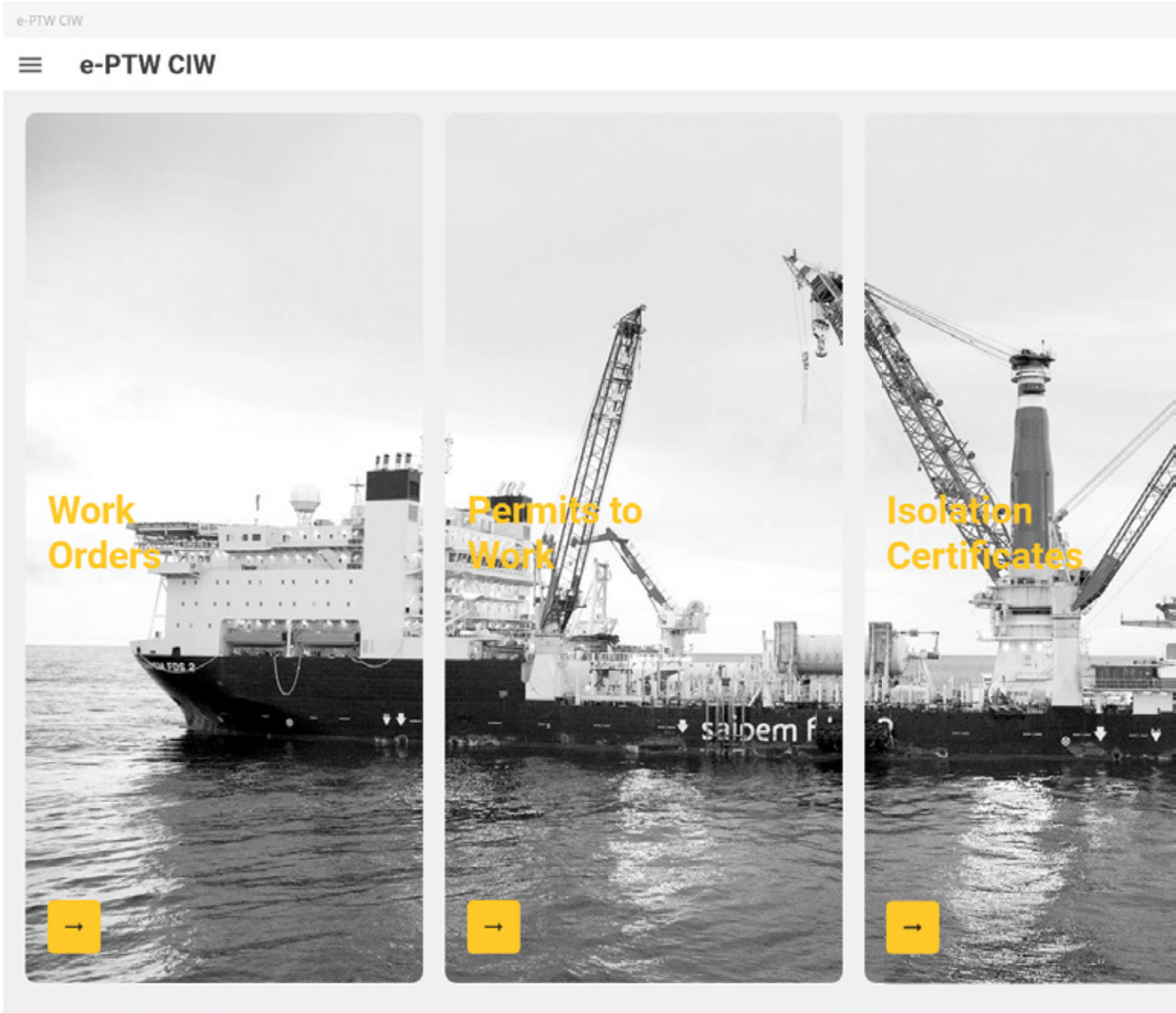
In conclusion, meticulous planning and design allowed the identification of the most reliable and efficient solution for the Dry Gulch HDD pullback. The pullback was executed safely and smoothly in only 52 hours, with eight cranes and 17 Bonatti SAFE T-Rex sidebooms. This was a major accomplishment for TMEP and Bonatti due to the compliance, execution and challenging schedule constraints.

Pier Maria Bruzzo

Pier Maria Bruzzo is a highly experienced Lead Pipeline Engineer and Engineering Manager with 20 years in hydrocarbons production, transportation, and distribution. His expertise spans design, construction, and operations of oil and gas systems globally. Past roles include Project Manager at Rina Consulting, and Pipeline Principal Engineer at Enereco SpA. He joined Bonatti S.p.A. in 2021 as the Technical Manager for the Field Engineering team for Spread 5B of the Transmountain Expansion Pipeline Project in British Columbia, Canada. Today he is the Pipeline Projects Engineering Coordinator.

Giacomo Marinelli

Giacomo Marinelli graduated in Civil Engineering in 2013 from the University of Bologna and, in the same year, started working in Oil and Gas as Pipeline Engineer for a consultancy company in several national and international pipeline projects. In 2018 he joined Bonatti as Senior Pipeline Engineer for the Newly born Pipeline Engineering Excellence Centre. In the last years he took part in the big diameters Pipeline Projects built by Bonatti, in the roles of Pipeline Department Lead and Project Engineering Manager. His main job interests are related to routing studies, crossing methodology selection and mitigation of geohazards related to pipeline construction.Today he is a Project Engineering Manager and the Deputy Manager at Bonatti Pipeline Engineering Excellence Centre.



Innovative ePTW Solutions

Saipem and Accenture collaborated to implement an innovative ePTW (electronic Permit to Work) solution, able to overcome the traditional paper-based process supporting the hazardous works performed on offshore construction and offshore drilling units

Paolo Allara, Head of Digital Transformation – Saipem SpA
Francesco Colletti, HSE Project Manager - Saipem SpA
Natale Torchia, Digital Project Manager - Saipem SpA
Antonio Di Micco, Managing Director, Energy Lead Italy – Accenture
Pietro Muzzio, Managing Director, Energy – Accenture

Thanks to the latest available technology, leveraging the Accenture Connected Industrial Worker solution, the new and innovative ePTW process is now supported by a mobile application, which can run even offline, without internet or intranet connection.

Benefits of the ePTW Solution

The ePTW solution brings several benefits, such as:

- Defined and controlled profiles: The application and approval process are standardized, increasing accountability through a rigorous approval process.
- Traceability: Digital approvals and authentication technology provide traceability.

"The new and innovative ePTW solution is currently running on more than 20 vessels worldwide, is under deployment in Saipem's Yards and additional deployments are planned onboard FPSO vessels

- Coordination: The location and type of PTW subject to approval are visualized, facilitating coordination.
- Detection of conflicting activities: The solution can detect potential conflicting activities, such as multiple PTW in the same area.
- Real-time visibility: The solution provides real-time visibility of ongoing activities.
- Notification and alerts system: The solution includes a notification and alerts system to guide the correct implementation of the PTW process.
- Comprehensive audit trail: The solution provides a comprehensive audit trail.
- Dashboard: The solution includes a dashboard to analyze data and evaluate insights.

The solution is currently running on more than 20 vessels worldwide, is under deployment into our Yards and additional deployments are planned onboard FPSO (Floating, Production, Storage, and Offloading) vessels.

Saipem's business profile and innovation goals

Being a worldwide energy industry leader, mainly as an EPC (engineering, procurement, and construction) and drilling contractor, requires continuing to strive for effectiveness in business operations, as well as fostering innovation, always in line with the latest HSE (health, safety, and environmental) standards. This story is about the digitalization of the PTW system on board operational vessels, supporting both drilling and offshore engineering, construction, and installation projects.

The traditional permit to work system

The traditional permit to work system process was essentially paper-based. It involved filling out different forms compiled by different people in multiple carbon copies. Once filled, those forms needed to be manually signed by the relevant involved parties. After approval, the HSE team displays them on a map to see where those PTW are located. Even though the process in place was fully compliant, a paper-based system has

several limitations. A paper-based system leaves more room for human error in the application of a flow or approval signatures, increasing the risk of being out of compliance with the PTW procedure. It can lead workers to spend too much time decoding ineligible handwriting, cutting down on their time on tools. Additionally, manual permitting processes are typically limited to the knowledge and care of personnel preparing the permit.

The need for a modern approach

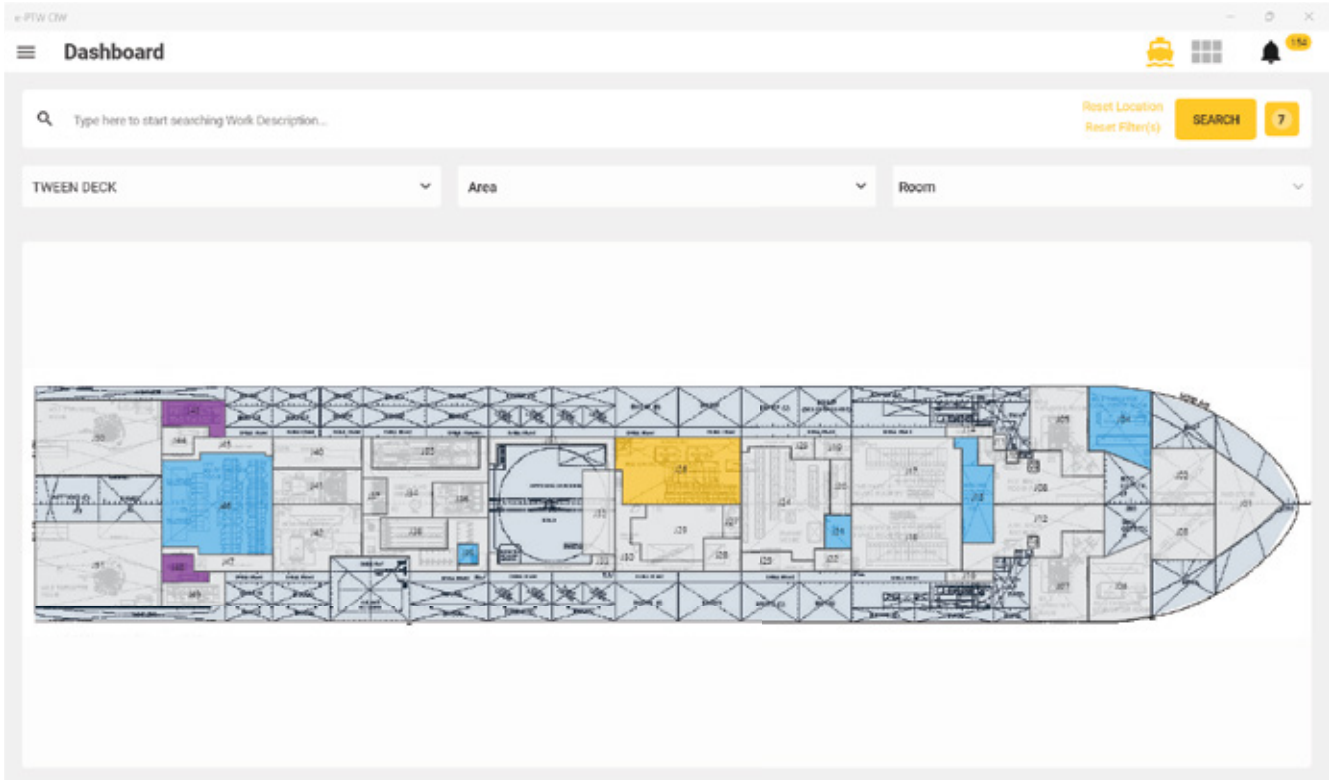
Over time, a modern approach based on information systems has been thought and tried several times, but the main reason it has not been implemented so far was mainly related to the need for a strong and persistent internet - or at least intranet - connection, which is not always available on-board vessels in all operational areas. The situation has changed lately, thanks to the latest available technology that finally allowed the implementation of an electronic permit to work solution, able to overcome the existing process limitations.

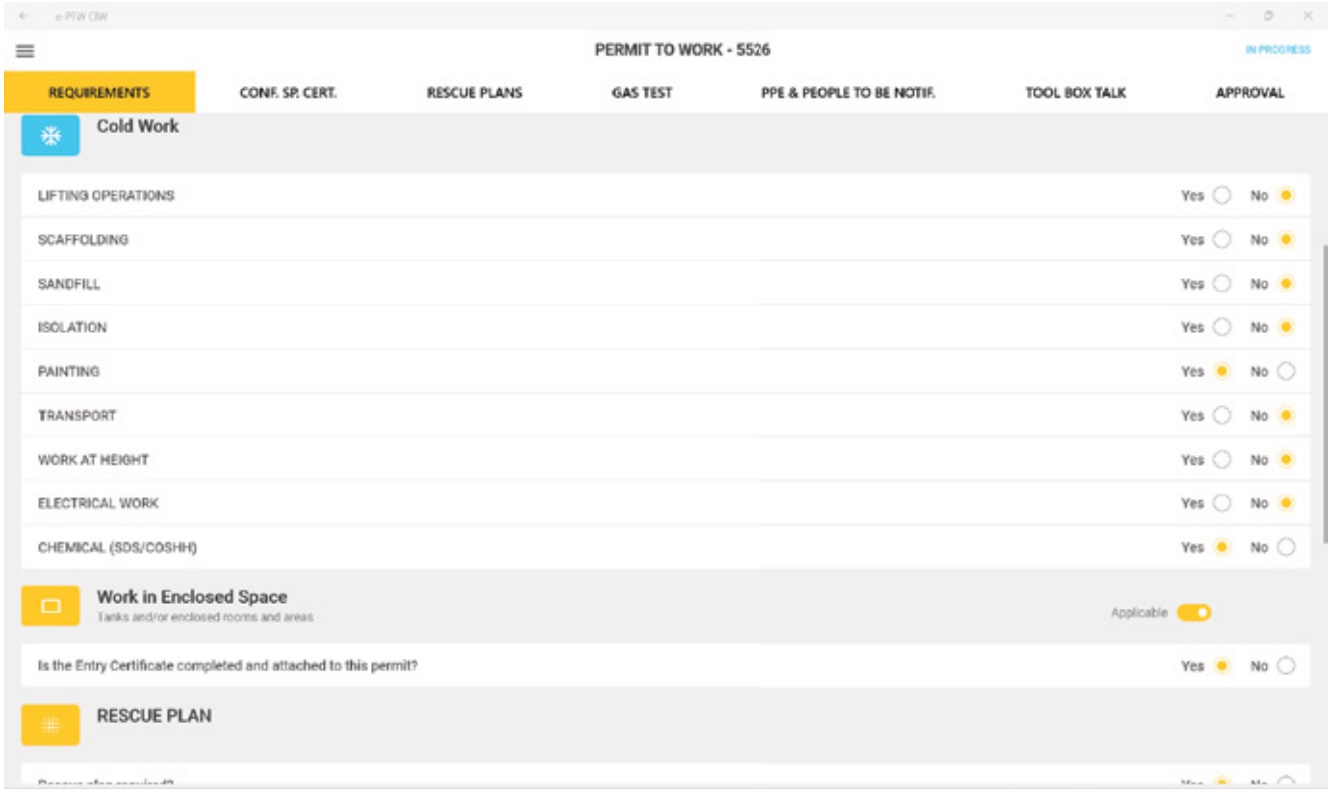
"The latest available technology has finally allowed the implementation of an electronic permit to work solution, able to overcome the existing process limitations

Before the implementation of an ePTW, Saipem management decided to implement the same PTW procedure, ensuring standardization of the relevant process and documentation across different vessels, sites, and projects, towards consistency and compliance with safety regulations, reducing the risk of human errors and incidents.

The Accenture Connected Industrial Worker Platform

To make the most of the new permit to work procedure, a digital solution was selected. In detail, the Accenture Connected Industrial Worker platform seemed to be





the best fit. It was created specifically to support workers in their daily operations, leveraging mobile devices to access relevant information and track the activities performed, even in industrial environments, where there are in place strict regulations (e.g., ATEX, use of DPI, other) and the availability of internet and intranet connection is not always granted.

To effectively translate the new PTW procedure into a new digital process, a multi-skilled and diverse team was involved starting from the design phase with the involvement of HSE functions, operations, and DIGITAL representatives. The solution is currently used at multiple sites for many major clients worldwide, to support their operations in many industrial sectors, such as manufacturing, energy, oil and gas, chemical, and others.

The solution combines a set of advanced technologies, such as a future-proof, fully responsive, and configurable front end for both laptops and mobile devices; an effective and flexible back-end document database technology; the ability to work offline, supporting the absence of internet connection, as it might happen on board operational vessels offshore; the ability to integrate with other systems, to ensure security access and potential ERP integration.

The ePTW implementation approach and modules

In line with similar implementations for other clients worldwide, the approach to bring the ePTW to life for Saipem has been following an agile methodology, through different iterations, to design an effective and modular user interface. The solution includes specific modules to cover end-to-end HSE processes (Permit to Work, Confined Space Certificates, and Isolation Certificates) plus dedicated modules to manage documentation and monitor ongoing activities. More in details:

- The Permit to Work (PTW) module allows the user to create, compile, and approve a PTW through a standardized and common process for all vessel fleet. Different tabs guide and help the worker compile the main information related to the job to be carried out, the safety measures that should be in place. Multiple operators can interact, contributing to the document (work location, signing the Tool Box Talk, inserting comments, uploading attachments). The approving phase is defined by sequential steps, each role is advised by specific notifications, and requirements are shown to the users. Moreover, the module includes the possibility to fill out an Audit on PTW activity.
- The Isolation Certificates (IC) module manages the complete mechanical and electrical isolation workflow. Isolation Authorities and technicians compile the main details related to the equipment to be isolated (equipment tag, isolation type, location on vessel, LOTO number) and collect required signatures to validate the form. The solution manages the IC workflow fully integrated with the PTW lifecycle.

- The Dashboard shows the sections of the vessel's decks, allowing the graphical visualization of the areas affected by the PTW. The PTW is linked to a specific area during its creation, which therefore appears colored (by a specific color code) to highlight the ongoing activities and the potential and critical interferences among them.
- The Document Library, accessible by all users, allows the digital archiving of all HSE documentation produced by the application related to PTW, Entry into Confined Space, Isolation Certificates, and Audit.

Starting from the first pilot vessel, in parallel with the current paper-based process, additional users' requirements have been collected and implemented to consolidate the solution, which has now rolled out on more than 20 vessels.

The ePTW rollout and collaboration features

In addition to the streamlined and standardized process mentioned above, the new solution is bringing real-time visibility into the permit status, allowing supervisors and stakeholders to monitor the progress of work activities remotely. This enhances safety by identifying potential conflicts in the same or adjacent areas through a map interface, enabling effective monitoring and prompt intervention in case of emergencies or non-compliance.

"In addition to the streamlined and standardized process, the new solution is bringing real-time visibility into the permit status, allowing supervisors and stakeholders to monitor the progress of work activities remotely

The multi-user platform improves collaboration and communication among permit holders, authorized personnel, and contractors. Notifications, alerts, and reminders can be automated, ensuring that all relevant

parties are informed of permit statuses and work activities.

All relevant data are also made available to effective dashboards, accessible both on board and at the headquarters, with the possibility to run analysis and extract useful reports. Insights into permit issuance trends, work activities, and safety performance can help organizations identify areas for improvement and implement targeted safety initiatives.

Finally, the solution creates a comprehensive audit trail, documenting all permit-related activities, including approvals, revisions, and closures. This audit trail can be invaluable for compliance audits, investigations into incidents, and continuous improvement efforts.

Conclusion

Safety of people, the environment, and assets is paramount within Saipem, and the use of new technologies has a fundamental role in further reducing risks. The implementation of the ePTW system on board Saipem units is one of the pillars of the Digitalization journey. The project required the involvement and collaboration of transversal resources belonging to different work families (from Digital to Safety, passing through Operations, IT: network/ architecture/infrastructure, procurement…) and is open to future connection and development (effective 3D visual, ERP connection, AI assistance).

Paolo Allara

Paolo Allara is Head of Digital Transformation in Saipem with 24 years experience in Energy sector.

Francesco Colletti

Francesco Colletti is a Saipem HSE Project Manager with over 12 years' experience in the Energy sector.

Natale Torchia

Natale Torchia is a Digital Project Manager with Saipem, with 18 years' experience in Energy sector.

Antonio Di Micco

Antonio is the Managing Director and Energy Lead, Italy, in Accenture, with over 20 years of experience in the Energy industry serving clients across Italy and EMEA.

Pietro Muzzio

Pietro is the Managing Director, Energy , in Accenture, with 18 years of experience in consulting services for Energy clients. He is a member of the ANIMP DIM (Digital & Innovation Management) section.

Transforming challenges into solutions.

The need for change has never been greater. In our industries, in the way we treat our planet, and in how we live.

To challenge the status quo we must be brave – it's having the courage to forge new answers. We're 35,000 inquisitive minds, on a quest to unlock solutions to critical challenges across energy and materials markets.

United by our mission to create a sustainable future as the world evolves to a cleaner planet. Our bold spirit drives us to lead the charge, our actions transform challenges into solutions, and our curiosity keeps us pushing, innovating, making the impossible... possible.

Because we understand the time for talk is over. Because the world needs new answers to old challenges. Because at Wood, we are future ready, now.

woodplc.com

wood.

A sustainable Methanol Initiative Coming true in Europe

Wood is fully supporting Perstorp, a global leader in specialty chemicals, for “Project Air”, the ground-breaking initiative to cut CO2 emissions by half a million tons, producing sustainable methanol feedstock as raw material for derivatives production

Francesco Croci, Principal Process Engineer
Wood

Figure 1 – Aerial view of existing Perstorp’s facilities at Stenungsund, Sweden

Perstorp, a global leading specialty chemicals producer, has historically based its production portfolio on conventional fossil-derived feedstocks as chemical building blocks and the methanol is one among the key raw materials. Methanol is nowadays identified as an essential feedstock to produce synthetic hydrocarbons, intermediates, and polymers. Its direct derivatives by market share are formaldehyde, methyl-tert-butyl ether (MTBE), acetic acid and dimethyl ether (DME). A number of daily products such as resins, adhesives, plastics, silicones and paints are derived from methanol [1] and used in several sectors embracing automotive, electronics, coatings, insulations and construction.

The carbon neutrality is nowadays a must for all the industry sectors and Project Air is an industrial initiative aimed to transform a variety of side and flue streams and hydrogen from electrolysis into sustainable methanol, thus reducing the carbon footprint of a wide portion of Perstorp’s specialty chemicals’ offering. The project is carried out by Perstorp in cooperation with Uniper and once completed it will cut carbon emissions up to half million tons yearly [2]. The importance of such initiative is internationally recognized: the European Innovation Fund – CINEA [3] supports the Project under an agreement funding 97 million euro, while the Swedish Energy Agency will contribute with approximately 30 million euro. Project Air is now in its FEED phase, developed by Perstorp’s engineering partner Wood and will target the final investment decision in 2025 to be in full scale operation in 2028.

“The project scope envisages the revamping of an existing partial oxidation plant and the greenfield design of a methanol unit, facing the true energy transition challenge

The new sustainable methanol plant will be built in an existing production site of Perstorp at Stenungsund, Sweden (**Figure 1**): the downstream section of the new

plant is a greenfield design, while the upstream part is a challenging brownfield revamping project. Perstorp and Uniper have as technology providers Johnson Matthey, Air Products and Chemicals Inc. and Sunfire, respectively licensing the methanol production process and the partial oxidation process of biogas to produce synthesis gas (syngas) and for the supply of electrolysers producing green hydrogen. According to the innovative process scheme of Project Air, 200,000 tons of methanol will be produced yearly by converting a variety of sustainable and green feedstocks.

The biogas from the network is fed as main feedstock stream to a gasifier together with oxygen and other organic residues recovered from the existing production plants in Stenungsund. The syngas produced by partial oxidation is then integrated with hydrogen carrying gaseous streams left over from the oxo-alcohol plants. Additional carbon feedstock, added to reach the target methanol capacity, is the captured carbon dioxide from an existing amine unit. The required hydrogen for the methanol production is sourced from external and nearby industrial facilities and from an electrolyser plant exploiting 30 MW of renewable electric power.

The produced methanol, according to the scheme described, is equivalent to the avoidance of greenhouse gases emissions of 500,000 tons per annum of carbon dioxide. The methanol will be exported to other production sites of Perstorp in Europe via ship transportation on small chemical tankers, therefore the project also includes the marine loading facilities, a 4 km pipeline connecting the storage tanks at site to the marine jetty. The project is completed by retrofitting the existing utilities and offsites, as well as the wastewater treatment plant which is upgraded to treat effluents from the entire site with the aim to recover the amount of water necessary for the electrolyser.

Wood is carrying out the Front-End Engineering Design (FEED) phase of the project in complete overlap with the development of the process design packages by the licensors of methanol and gasification areas, elevating the degree of completeness from an engineering standpoint. The final goal of the FEED is to reach a +/-10% cost estimate for Project Air. Such estimate will be used by Perstorp to secure the final investment decision in early 2025. In view of a fast execution of the next detailed engineering phase, the long lead items requisitions and tendering are developed to reach the status of ready for order. At FEED phase completion, Wood will prepare the technical tender documents for the EPCm phase.

Project Air is an exceptional example of energy transition project. In this paper two of the most challenging aspects of the FEED project execution are summarized: the former is a showcasing on the

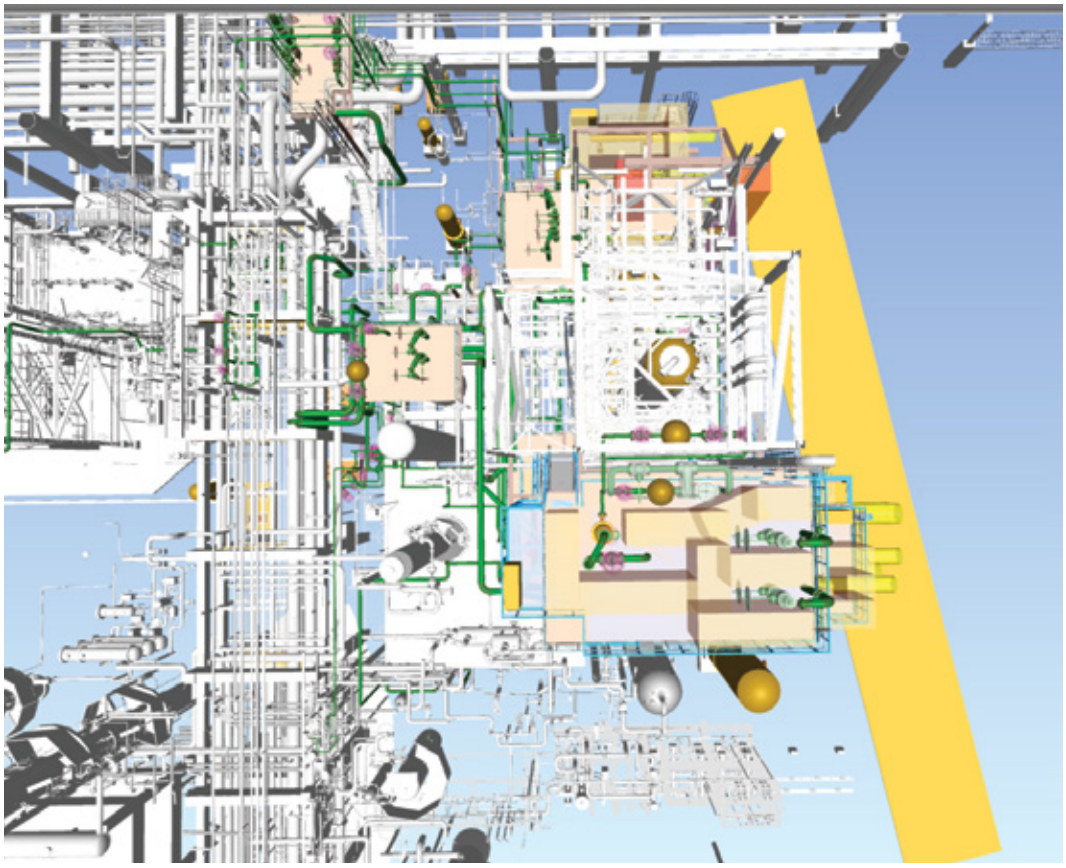


Figure 2 - Plot plan view from the 3D model developed for the gasification area of Project Air. Coloured adjacent structures are the newly added ones; white elements are existing

revamping of existing and conventional gasification plant to upgrade its design to cope with a low-carbon impact concept. The latter encompasses the greenfield design flexibility required by the sustainable methanol production to deal with the energy transition.

The revamping complexity of the existing gasification area

One of the main challenges of the project execution is dictated by the revamping of existing process facilities: the old concept relies on a conventional design having fossil fuels as feedstock. Project Air will shift to a mix of biogas and recycled hydrocarbons and another novelty is represented by the maximization of re-usage of by-products and tail streams from other production areas at Stenungsund.

The retrofit of existing facilities is approached by Wood following a consolidated methodology, leveraging its engineering expertise. The first step in revamping projects is the realisation of a field survey with the aim to determine the status of the existing installations compared to the documentation provided by the Customer. In addition to the traditional engineering techniques, a laser scan is performed. What is acquired with the laser scan is then compared with the 3D model to highlight any possible inconsistencies with the existing technical drawings. This methodology leads to a perfect knowledge of the actual conditions of the facilities in the field and does not allow any margin of uncertainty in the analyses and considerations of the subsequent phases.

The gasification area is composed by an existing gasifier designed to partial oxidate a feed stream of natural gas possibly integrated by hydrocarbon liquids such as propane and butanol. This gasifier is installed as a stand-by gasification equipment to a parallel train producing syngas further converted into other specialty chemicals. With Project Air, the gasifier will be revamped to process liquid hydrocarbon streams from other units, biogas from the national gas network and it will be connected to new equipment as required by the upstream feedstock feeding and preheating section and by the downstream syngas cooling. A group of equipment, not adequate for the new operating conditions, is also dismantled.

The existing gasifier is installed in a steel structure of about twenty meters high and requires to be close coupled via a transfer line to a new waste heat boiler to be allocated in the same structure. The plot plan detail is given in **Figure 2**, where the above-mentioned

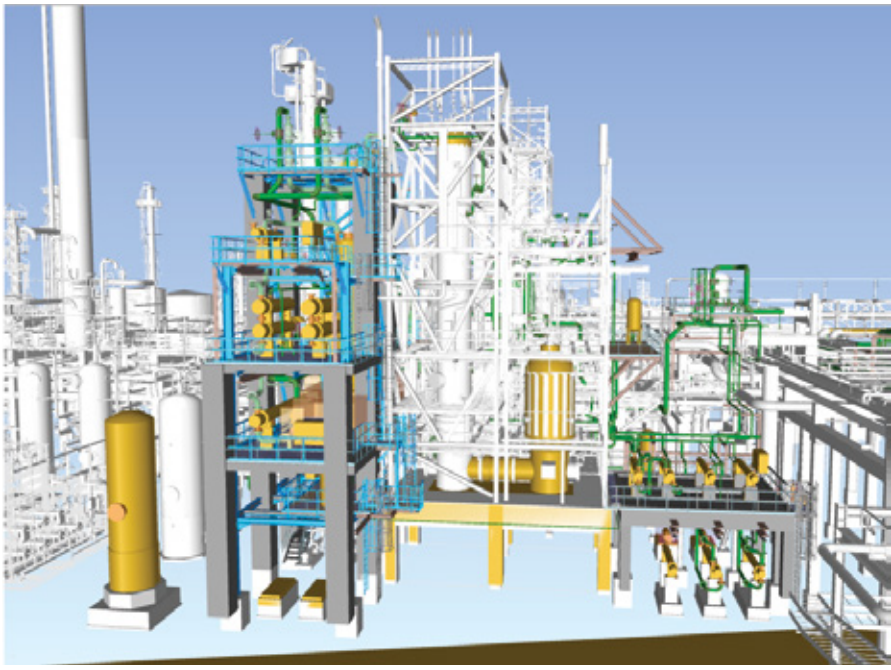


Figure 3 - Side view of new structures located adjacent to the existing gasifier

structure in white colour is positioned in a very congested area. Coloured adjacent structures are the newly added ones.

The structure is delimited on the west side by an old, decommissioned gasifier and a piperack, while on the east side an internal access road bounds the area. On the south side, the boiler water circulation pumps are installed, and other production facilities are located farther in the same direction. An interconnecting piperack runs to the north of the structure, with space constraining piping expansion loops. With such a limited space availability and the constraints of the existing concrete basements and foundations, a high revamping complexity has been addressed by Wood implementing a tailor-made strategy based on few key concepts.

"Wood is fully committed for the execution of the Frond-end Engineering and Design, leveraging its technological capabilities and engineering expertise

The revamping solutions has been carefully reviewed optimizing the new structures both in terms of their locations and heights. A key element is the segregation of process fluids, to avoid any possible incompatibility arising from shell and tube heat exchangers heating oxygen, biogas and liquid hydrocarbon streams. A newly added structure to the north side of the gasifier is designed to locate the liquid hydrocarbons and the biogas pre-heaters on the ground floor while on the top floor the oxygen pre-heating exchangers and the water coolers are installed (**Figure 3**). Such structure is limited in height due to the interference of an existing flare piping expansion loop.

The syngas cooling section is placed in a second new structure located to the south of the existing one,

satisfying the routing of two-phase flow lines. Another important aspect is represented by the verification of the existing foundations for the newly added loads.

"The methanol produced according to this scheme is equivalent to the avoidance of greenhouse gases emissions of 500,000 tons per annum of carbon dioxide

Constructability studies are carried out in parallel with the engineering development to optimize the procedures and the sequence of the construction activities. The tie-ins into the existing piping are identified and categorized. A large number of tie-ins are prioritized for the execution in the next factory turnaround. This reduces to the minimum the entity and the duration of the connection works to be carried out during the turnaround to be done before the Project Air start-up.

Flexibility in the design for the greenfield sustainable methanol plant

The methanol production unit of Project Air is based on a conventional process focused on the conversion of the syngas to methanol, which includes the following plant sections:

- Front-end syngas purification;
- Syngas compression;
- Converter and syngas circulation compressor;
- Hydrogen recovery;
- Crude methanol degassing and topping;
- Methanol refining to grade AA [4].

The conversion of the syngas to methanol can be represented as the sum of the following two reactions, resulting in a strongly exothermic process:

$$CO + 2H_2 \rightarrow CH_3OH \text{ (eq. 1)}$$

$$CO_2 + 3H_2 \rightarrow CH_3OH + H_2O \text{ (eq. 2)}$$

The ideal composition of the syngas for methanol production has a value of just over 2 of the following ratio:

$$Ratio = \frac{moles\ H_2 - moles\ CO_2}{moles\ CO + moles\ CO_2} \text{ (eq. 3)}$$

The ratio is obtained by dividing the difference between the moles of hydrogen and carbon dioxide by the sum of the moles of carbon dioxide and monoxide and therefore it describes the effect of carbon dioxide which consumes the hydrogen via the reverse water-gas shift reaction [5].

The syngas produced by the upstream gasification derives from the partial oxidation reactions of hydrocarbons that when applied to methane are:

$$CH_4 + \frac{1}{2} O_2 \leftrightarrow CO + 2H_2 \text{ (eq. 4)}$$

$$CO + \frac{1}{2} O2 \leftrightarrow CO_2 \text{ (eq. 5)}$$

$$H_2 + \frac{1}{2} O_2 \leftrightarrow H_2O \text{ (eq. 6)}$$

The partial oxidation reactions would be ideal for methanol production since the resulting ratio is equal

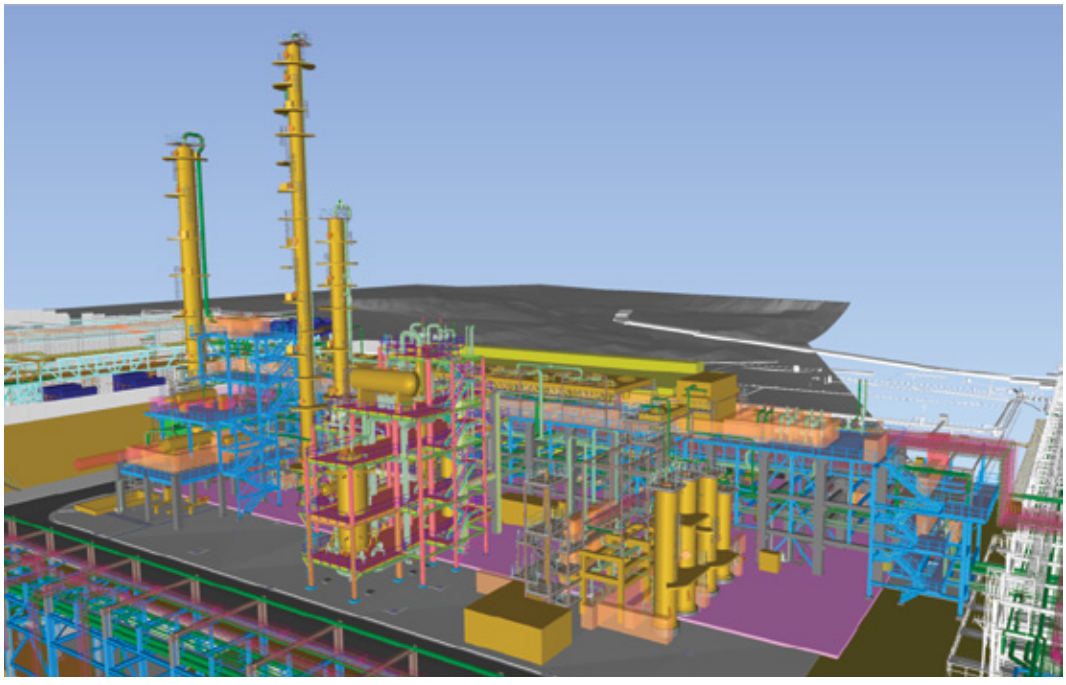


Figure 4 – 3D model developed for the Methanol Area: from right to left purification, reaction, and distillation sections

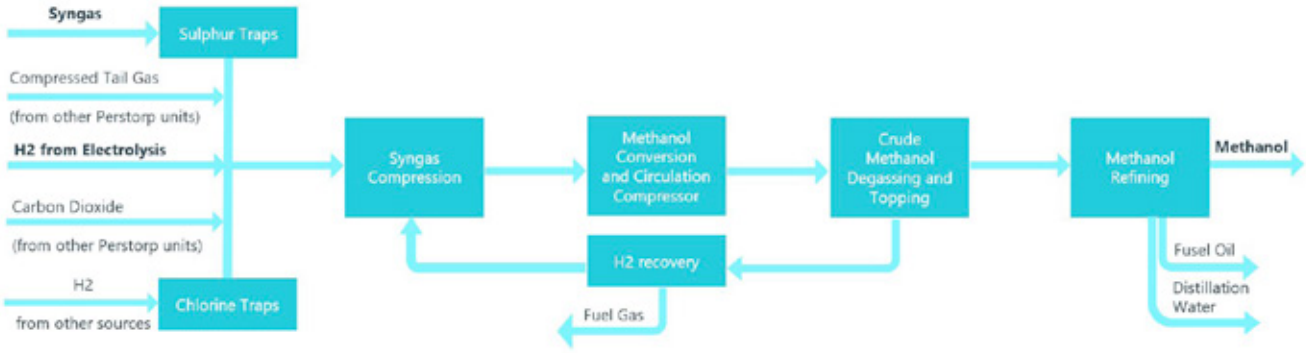


Figure 5 – Block Flow Diagram of the Methanol Area

to 2, however hydrogen and carbon monoxide are partially converted to fully oxidized products (carbon dioxide and water) leading to a lower ratio. The gap to reach the ideal value of 2, is closed in the front-end section of Project Air's methanol plant, by adding hydrogen rich streams to the syngas from gasification. According to the process scheme shown in **Figure 5**, the syngas produced in the gasification area first undergoes a front-end purification process removing the sulphur contaminants. Other hydrogen and carbon

"Wood is carrying out the Front-End Engineering Design (FEED) phase of the project in complete overlap with the development of the process design packages by the licensors of methanol and gasification areas

carrying gases are added and the resulting syngas composition is strictly controlled to have the optimal stoichiometric ratio to the conversion loop, to satisfy the methanol synthesis chemistry summarized above. Among such streams, the main one is the green hydrogen produced by the electrolysis unit. Its production relies on the availability of renewable electric power from the grid, and it will vary during the plant life: after the start-up, during the first operational life of the plant, the renewable electric power will be limited at 30 MW, while during the second and future period of operation, an increased availability of renewable electric power is expected and embedded in the design basis of Project Air.

A future scenario with a greater amount of green hydrogen will allow for an increased capability of the methanol plant to replace part of the syngas with externally supplied carbon dioxide from capture as primary carbon source. This upcoming operation will target a conversion of about 820 thousand tons yearly of captured carbon dioxide considering both the external and internal carbon dioxide streams, resulting in a ground-breaking process concept at the core of Project Air. Consequently, the increased amount of carbon dioxide converted will produce a greater amount of the water produced along with methanol according to equation no. 2 above. Hence, the distillation section, has been already designed to cope with this scenario.

Other minor streams are also recovered from other production plants in Perstorp's site and in the nearby industrial area, valorising them by the conversion to methanol instead of being used as fuel for steam generation. These internal streams from the surrounding specialty chemicals' plants include:

- a tail gas stream from a pressure swing adsorption for hydrogen separation and;
- a syngas purge stream.

They are both collected and mixed with a stream of carbon dioxide from a regenerator column in an existing amine unit. In such way, about 19 thousand tons per annum of carbon dioxide are converted into methanol rather than emitted to the atmosphere. For optimal stoichiometric ratio control of the resulting mixture of all the streams above, a further stream of external hydrogen is added.

Conclusion

Saving 500,000 tons per annum of carbon dioxide coming from methanol production, Project Air is overcoming a number of challenges dictated by revamping constraints and flexibility requirements and Wood is achieving the goal leveraging its engineering expertise and technological capabilities. Project Air stands as a true and ground-breaking sustainable methanol initiative, aimed at carbon neutrality, and deeply involved in the energy transition path forward. The paradigm of the transition towards a climate neutrality is directly embedded into its design, represented by the flexible handling of different carbon and hydrogen feedstocks, exploiting the synergies with existing surrounding plants and their side products.

References

[1] *Bozzano G., Manenti F. (2016). Efficient methanol synthesis: Perspectives, technologies and optimization strategies. Progress in Energy and Combustion Science 56, 71-105.*

[2] www.projectair.se *(Accessed March 18th, 2024)*

[3] *Project Air is Co-Funded by the European Union. Views and opinions expressed are however those of the author(s) only and do not necessarily reflect those of the European Union or the European Climate, Infrastructure and Environment Executive Agency (CINEA). Neither the European Union nor the granting authority can be held responsible for them.*

[4] *ASTM D1152-97 Standard Specification for Methanol (Methyl Alcohol).*

[5] *Wang, J., Anthony, R. G., & Akgerman, A. (2005). Mathematical simulations of the performance of trickle bed and slurry reactors for methanol synthesis. Computers & chemical engineering, 29(11-12), 2474-2484.*

Co-funded by the European Union
Emissions Trading System
Innovation Fund

Francesco Croci

Francesco Croci is the Principal Process Engineer with over a decade of experience in Engineering and Construction industry across the energy value chain, having worked for Wood for 5 years within the Projects - Process and Chemicals Business Group. He holds a master's degree with hons in Chemical Engineering. Francesco has worked for primary EPC contractors on the execution of different project phases ranging from feasibility studies, FEED and up to LSTK EPC for major international customers. His experience in process engineering design and optimization widens from world-scale LNG and natural gas processing projects to gasification and petrochemical initiatives including sustainable methanol. He is currently engaged for Wood in the role of process leader for Project Air.

SHAPING THE PRESENT FOR A SUSTAINABLE FUTURE

FORES INNOVATIVE SYNGAS PRODUCTION FOR DECARBONISED E-FUELS' VALUE CHAIN WITH CPO TECHNOLOGY INTRODUCES THE DAWN OF A NEW TOMORROW

FORES ENGINEERING

Syngas production for decarbonised e-fuels' value chain with CPO technology

The contribution of Fores Engineering in levelling up the maturity of a promising sustainable technology

Maria Auriemma, Process and Mechanical Discipline Manager
Fabio Nardone, Head of the Business Development
Fores Engineering

In the imperative for sustainable technologies across industries, the heavy logistic sector (aviation and marine) and the hard-to-abate industry stand as pivotal playgrounds for innovation and change from fossil fuels.

Differently from the light transportation sector, clearly addressed more easily by electrified technologies, the solution for the aviation and marine sectors requires a scalable and structured approach, possibly without heavy modification to the assets, but with innovations focusing on the fuel side.

Just focusing on the aviation sector, sustainable aviation fuels (SAF) are readily accessible, very similar to conventional fuels and thus a direct substitute that can be progressively integrated into conventional Jet A-1 fuel blends; SAF deliver substantially lower greenhouse gas emissions (typically around -80% vs Jet A-1) thanks to a specific production process which involves decarbonised hydrogen generation and CO_2 recovery and utilisation.

The chart in **Figure1** shows that more than 53% of CO_2 emission is expected to be abated by a growing implementation of SAF in upcoming decades, even in a positive scenario when new generation aircrafts (Technology) may contribute for a challenging 34% of abatement (1).

Nevertheless, the predominant SAF variant currently available, namely biofuels, encounters major challenges regarding availability, scalability, as well as concerns surrounding the sustainability of feedstock sources and supply chain limitations.

Power-to-liquid (PtL) synthetic fuel, derived from low-carbon hydrogen and CO_2, emerges as a promising solution for long-term utilization, however it has a significantly higher cost compared to other options, and it demands substantial investments in electrolysis and carbon capture technology

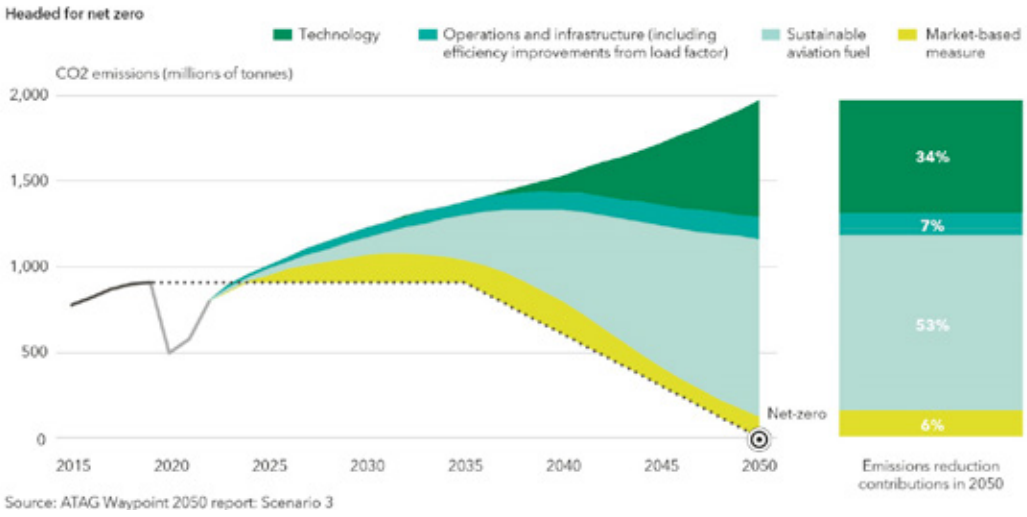


Figure 1 – Heading for Net Zero

development and deployment.

As the availability of bio-derived SAF is limited, since agricultural areas should be dedicated to food production, the main contribution to SAF/e-fuel production in the future will have to come from the production of synthetic fuels, which is processed in two-steps:

- the generation of synthesis gas, possibly from low-carbon feedstocks (like methane, waste gases, etc.) integrating also renewable hydrogen and captured CO_2;
- a fuel synthesis section, where synthesis gas is transformed into a synthetic liquid fuel, equivalent to traditional fossil fuels; Liquid methanol from methanol synthesis (2) and Liquid hydrocarbons from Fischer-Tropsch synthesis are the main options.

Currently, SAF production is energy and capital intensive and to support the required learning curve for the 2050 targets, it is necessary to invest in scaling up production technologies to industrial maturity that may leverage on largely available feedstocks with high efficiency and minimum CO_2 emission.

SCT-CPO: an innovative, scalable and low carbon emission process

The most utilized synthesis gas production processes are:

- Steam reforming (SR);
- Partial oxidation (Pox);
- Autothermal reforming (ATR).

In addition to the available listed technologies, "Short contact time catalytic partial oxidation" (SCT-CPO) represents the most innovative one, based on a very fast catalytic reaction that allows contact times between reagents (hydrocarbon, steam, air/oxygen) 10.000 – 50.000 times shorter than the ones of traditional catalytic processes for the production of hydrogen. The fast and selective chemistry of the process is confined inside a thin (<1 mm) solid–gas inter-phase zone surrounding the catalyst particles; here, the gas molecules spend a limited time (10-6 seconds) at temperatures variable between 600 – 1200° C, while avoiding the propagation of reactions into the gas phase, that has to remain at a "relatively low" temperature.

This condition favours the formation of primary reaction products (namely CO and H2) inhibiting chain reactions. Moreover, the very high catalytic surface temperatures inhibit its deactivation phenomena related to chemical poisoning effects. For these and other related reasons, this chemical process can be carried out in very small reactors having a very high flexibility towards reactant types and flow variations.

It has also been found that several hydrocarbon feedstocks, even containing sulphur and aromatic compounds, can be fed to a SCT-CPO reactor for producing synthesis gas.

A long-term R&D effort is driving towards the industrialization phase of a technology whose main advantages concern:

- Reduction of investment costs and energy consumption;
- Reduction of overall CO_2 production and possibility of an almost complete CO_2 capture for the generation of Blue Hydrogen;
- Flexibility towards feedstock composition & production capacity.

"In addition to the available technologies, 'Short contact time catalytic partial oxidation' (SCT-CPO) represents the most innovative one, based on a very fast catalytic reaction that allows contact times between reagents 10,000 – 50,000 times shorter than the ones of traditional catalytic processes for the production of hydrogen

"Several hydrocarbon feedstocks, even containing sulphur and aromatic compounds, can be fed to a SCT-CPO reactor for producing synthesis gas

Leveraging on multidisciplinary engineering capabilities and 30 years of experience in integrating technologies and systems in compact layout and robust design for offshore operations, Fores Engineering (Fores) has contributed to the industrial scale-up of the innovative CPO technology with 3 different plant references (designed, built and commissioned), each one addressing different challenges:

- Small dimensions with technical and operational simplicity;
- Possibility of modular construction of prefabricated and skid-mounted units;
- Specific tailor-made design solutions (Mega Syngascooler) on large industrial scale applications.

The first pilot plant with SCT-CPO technology for the production of hydrogen (Milazzo 2004/ 2005)

Fores has successfully accomplished the design and construction of a first pilot plant through a Lump Sum Turnkey (LSTK) contract, starting from a conceptual engineering developed by ENI (client & IP owner of the

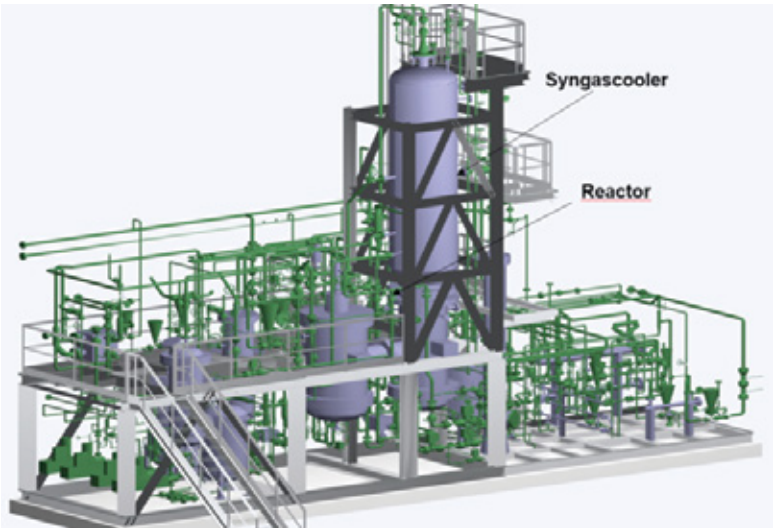


Figure 2 - 3D view of the first pilot plant operating the SCT-CPO technology built by Fores

process). The contract included basic engineering, detail engineering, modularisation, plant skid construction, assembly to the site, pre-commissioning and start-up assistance.

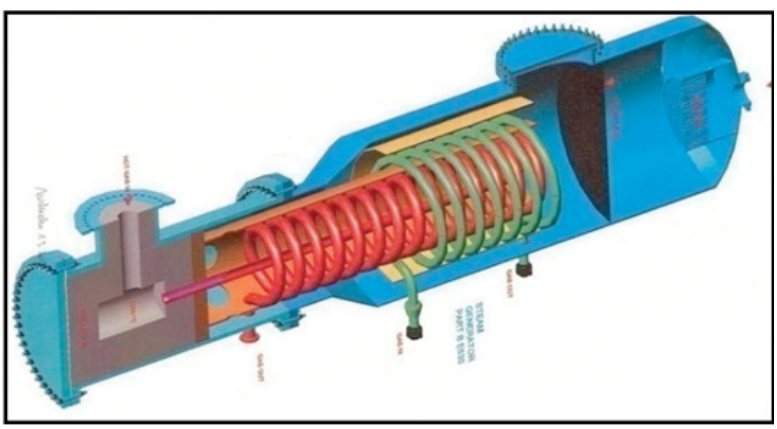
Despite the low detail level and the many uncertainties present in the conceptual engineering, the plant was designed and built in only 14 months.

The pilot plant illustrated in **Figure 2** consists of all the process and utilities units needed for the production of hydrogen from methane or other hydrocarbons:

- Compression of air and methane;
- Methane desulphurization;
- Reagents pre-heating;
- STC-CPO Reactor;
- Syngas cooler/steam generator;
- CO-shift;
- Hydrogen purification by PSA;
- Hydrogen compression.

Figure 3 - 3D view of the reactor-syngas cooling system

The project aimed to integrate the know-how and resources of the Client and the Contractor to achieve a higher synergy, while introducing innovative design solutions for the plant critical equipment engineering and manufacturing design. An example is relevant to the syngas cooling system, that needs to cool down the syngas out of the reactor from the typical high reaction temperature (800-1000°C) to about 300°C, prior the feed in the "water gas shift" process section.



The syngas cooler system developed by Fores, based on proprietary know-how and a preliminary thorough risk analysis, is specified as a coil-type heat exchanger and has demonstrated to be a better solution both from technical and economical point of view compared to the traditional shell&tube waste-heat boiler, as indicated in the original conceptual design. After several operating years, featured by 200+ start-ups and shut-downs, the solution has demonstrated to be an "intrinsically safe" gas cooling system with extraordinary performance regarding resistance to thermal gradients, process stability and feedstock flexibility.

The 3D view of the reactor-syngas cooling system is showed in **Figure 3**: the 3D model design was carried out by Fores to achieve the best synergy in terms of layout interoperability among the different plant' sections, overall process effectiveness, and easy transportability and maintenance.

Fores skid-based plant design demonstrated several advantages, in particular for the overall project timeline thanks to a concurrent engineering mode through, all the project execution phase and availing a fast track delivery.

As a matter of fact, the plant sections, manufactured in several different skids, have been pre-assembled at Fores site to carry out the factory acceptance test and then separated in standard modules for an easy transportation at the plant location for final test and operation (see **Figure 4**).

Second SCT-CPO plant with CPO technology for the production and distribution of hydrogen for Mobility ("Zero Regio" project – 2006/2008)

After the success of the first application, Fores engaged in a new and challenging case for the technological development in the "Zero Regio" project.

Although the capacity of this plant (50 Nm3/h) is 10 times lower with respect to the first plant (500 Nm3/h), the footprint of the solution is 25 times compressed to generate a sustainable solution for a small-scale hydrogen application. The plant was built to generate hydrogen "on site" at a multi-fuel distribution station, being the first Italian station also providing hydrogen among the fuel supplies for

Figure 4 – Preassembly of the skids at Fores site (Forli)

mobility. The project involved the construction of the entire section of the hydrogen production plant including the auxiliaries, featuring in particular:

- The SCT-CPO reactor and a quencher;
- The Water gas shift reactor;
- A PSA unit;
- Utilities;
- DCS and control room;
- Mechanical and instrumental interconnecting.

Fores has successfully accomplished the design and construction of this small-scale plant through a LSTK contract, starting from a basic engineering design developed by ENI.

The contract included the improvement of basic engineering and detail engineering design, modularisation and compression, the procurement and the plant skid construction and supervision to commissioning and start-up assistance.

The biggest challenge faced by Fores lied in the need of a high compression factor for a high-density modularised technological solution ensuring, at the same time, a proper access for all maintenance activities in line with reliable operation, consistently with Oil&Gas safety requirements.

The plant was built in Fores own workshops and started running in June 2008 at the multi-fuel station in Mantua (Italy) with a lead time of only 11 months from Notice to Proceed.

During its operations, the system confirmed the technology expectation and the EU sponsor of the project declared it suitable and approved for small-

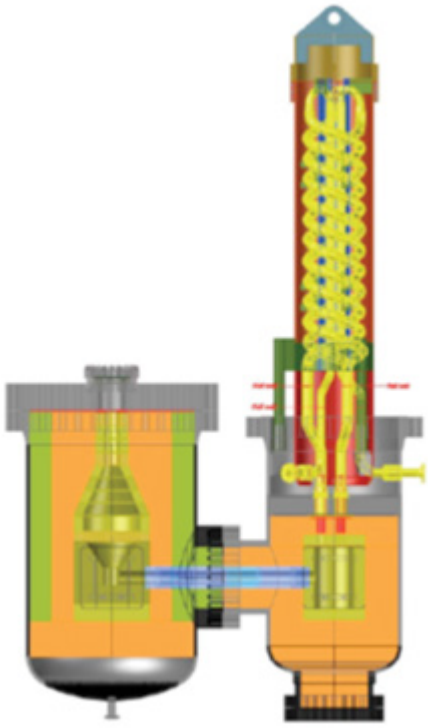


Figure 5 – SCT-CPO critical process package (Mixer-Reactor-syngas cooler)

3D model

Casing structures

Final completed assembly

Figure 6 – Taranto plant from 3D model to operational in refinery

scale production of hydrogen at fuel station for hydrogen vehicles.

Third plant with SCT-CPO technology a commercial scale demonstration plant

(Taranto refinery project – 2019/2021)

For any innovative technology the final and most challenging experience is the "scale up" to industrial maturity for commercial operation. Fores has successfully accomplished this step in an integrated plant-type solution provided for Taranto Refinery, with a production design of 10'000 Nmc/h of hydrogen.

Based on the positive experience of the syngas cooler proposed by Fores for the pilot plant in Milazzo, the Client entrusted Fores with the development of the best solution for syngas cooling and its complete design both from thermal and mechanical point of view.

Also in this case, Fores proposed a coil-type heat exchanger and carried out its complete design (from conceptual to detail engineering) with the objective of obtaining the best integration with the SCT-CPO reactor, which was based on the Client's IP.

The plant has been contracted on a LSTK basis, starting from a basic engineering developed by ENI. The activity involved the process and detail engineering, the complete engineering and construction of critical process package (Mixer-Reactor-syngas cooler, see **Figure 5**), module engineering and packaged unit construction, as well as assistance on the site during the assembly, plant operation and pre-commissioning phases (see **Figure 6**).

The Reactor-Syngas cooling process package is the core of SCT-CPO technology and was designed taking into account the experience in engineering and construction of the two previous projects (Milazzo, Zero Regio) and the operating experience of the Milazzo pilot plant.

Future Scale-up of the process for higher capacities and enabling design features

On the basis of engineering and operating experience in three CPO plants, in the past years Fores has also explored the scale-up potential of the CPO process and its adaption to various client's downstream applications in several engineering studies:

- a 15,000 Nm3/h unit to produce hydrogen for a 20 MW hydrogen Combined Cycle gas turbine power plant for an Italian power producer;
- a 10,000 Nm3/h unit for debottlenecking a steam reformer in a refinery;
- a 8,000 Nm3/h unit with temperature control and integrated CO-shift heat exchanger;
- a single stream 600,000 Nm3/h CPO unit for a mega-methanol plant for a Middle East client.

For the last on the list, a new single stream "mixer-reactor-syngas cooler" concept for a capacity of 600.000 Nm3/h has been developed. Such large gas

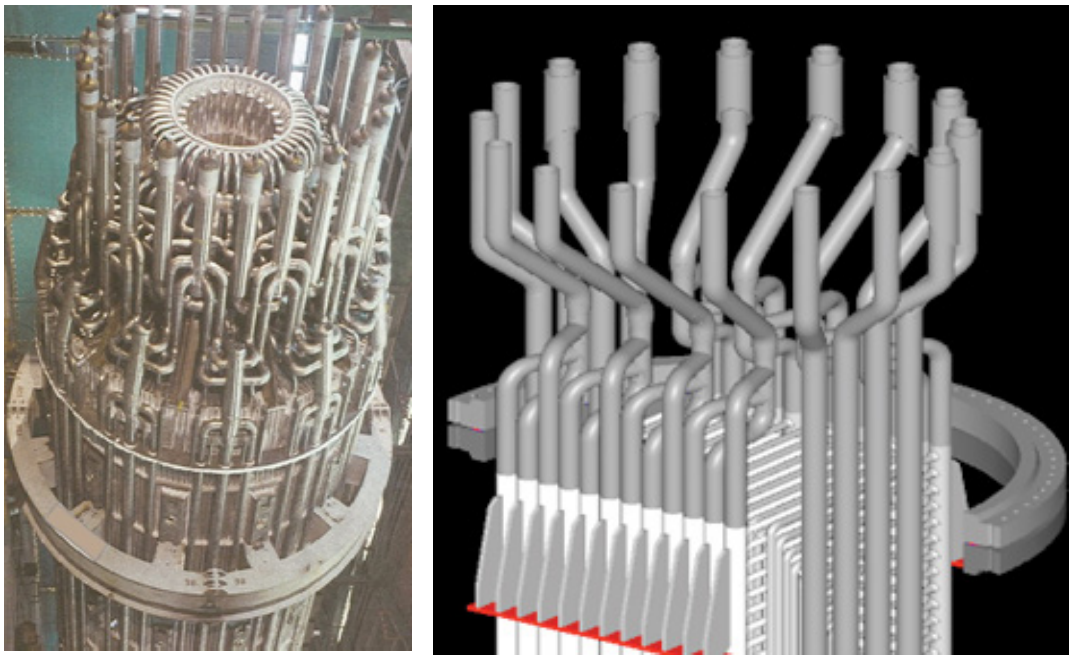


Figure 7 - Details of feedwater inlet and steam outlet headers: 7a) Tampa operated syngas cooler downstream coal gasification process (courtesy of J. Wilhelm, TecfinTRE-Engineering Excellence Library; 7b) Fores Mega Syngas cooler design downstream gas-fuelled CPO process

quantities exceed by far the scale-up limit of the existing syngas coolers and waste-heat boilers, which are based on a fired-tube design.

In order to win the challenge, Fores has developed an in-depth engineering analysis on the largest syngas cooler ever built: designed to cool down 400,000 m3/h "dirty syngas" from a Texaco coal gasifier in an IGCC power plant (one of the earlier application featured with CO_2 capture and Hydrogen ready gas Turbine). This "water tube" syngas cooler was successfully in operation for 12 years at Tampa Electric 'zero emission' hydrogen power station and confirmed the industrial maturity of the design.

For the natural gas-based mega-methanol project, Fores has developed a simplified design version with a capacity of 600,000 Nm3/h, maintaining the "water tube" principle and the proven mechanical design elements of the Tampa syngas cooler, and issuing a relevant patent application for this enabling feature to such large scale up design. The most challenging part in developing Mega Syngas coolers is the design of the headers for feedwater inlet and steam outlet (see **Figure 7**).

"On the basis of engineering and operating experience in three CPO plants, in recent years Fores Engineering has also explored the scale-up potential of the CPO process and its adaption to various client's downstream applications in several engineering studies

The right partner to design and execute a variety of industrial-scale applications on CPO technology: Fores Engineering

As illustrated in the above projects, Fores has given a significant contribution to the development and scale-up of CPO technology to industrial maturity. During these projects, Fores has gathered a significant engineering know-how, for the design of turnkey supply of CPO based syngas production plants of all sizes. Three operating references over the entire range of capacities from 50 to 10,000 Nm3/h indicate that CPO technology is a viable solution for synthesis gas production, ready to be integrated with downstream synthesis processes for the production of e-fuels and SAF. For small and medium production capacities under 10,000 Nm3/h, modularised preassembled and pre-commissioned CPO units represent by far the most cost effective solution.

Considering the entire capacity spectrum, the performed engineering studies confirm an interesting upscale potential to mega size units for large industrial applications, which offer economies of scale that may effectively contribute in the future to produce synthetic "low to zero emission" fuels at affordable prices.

Along with technological maturity, where Fores is ready to provide its engineering know how and

"Fores Engineering has given a significant contribution to the development and scale-up of CPO technology to industrial maturity, and is ready to integrate its engineering know-how with clients and partners in order to define competitive engineering packages

digitalisation platforms aiming to a continuous design and operational improvement, at industrial level there is a consistent value chain maturity to be developed to enable sustainable CAPex and OPex.
While for modular small-size application Fores is capable to serve as one-stop-shop for a turnkey delivery integrating Clients and Partners process IP, for large-size applications, Fores focus its value proposition in the engineering and construction of the critical part of the CPO process, along with all Digital and Safety systems design and delivery. Based on its durable experience in serving offshore clients and large contractors, Fores provides "tailor made solutions", not only on the equipment packages (modular or plant-based), but also on maintenance activities aiming to secure an overall lifecycle sustainability.

Literature

1) Air Transport Action Group, Waypoint 2050 Report, "A vision of net-zero aviation by mid-century", April 2023

2) Basini L., Mondelli N., Mondelli C., Furesi F, Impiantistica Italiana, N. 1, 2022

Maria Auriemma

Maria Auriemma is Process and Mechanical Discipline Manager in Fores since 2019, leading the design and engineering of several challenging projects in Petrochemical and Oil&Gas fields. She started her career as Process Engineer in ENI-Versalis and developed a solid technical background on the full engineering span (Feasibility study, Basic Design, FEED, EPC), further contributing to Energy Transition targets, including the solutions' maturity and scale up of Hydrogen related projects.

Fabio Nardone

Fabio Nardone is the Head of the Business Development in Fores, since 2019 leading business growth and diversification, with a special focus on innovative solutions for the Energy Transition & Digital Transformation. He has been working in the Energy industry for more than 15 years in companies with high technological content in a very competitive arena. During his professional career, he has built up a solid experience in technological innovation and international strategic and commercial partnerships management, which are a pivotal for his current mission.

Events in the Red Sea: impact on shipping contracts

The growing importance of Risk Allocation and War Risks clauses

Enrico Salvatico, Partner
Studio Legale Mordiglia
Head of the Section for Logistics, Transports and Shipping
ANIMP

The serious events affecting the Red Sea area are there for all to see and are being widely debated from geopolitical and macroeconomic perspectives. The purpose of this brief contribution is to examine what impact these events may have on maritime transportation contracts and on the rights and obligations of the parties.

In this regard, the first question that arises is whether the current situation results in the impossibility (total or partial, permanent or temporary) to perform the contract or only in the performance of the contract being more onerous or risky. The answer to this question can vary significantly depending on the applicable law. In addition, the remedies provided by statutory provisions may not correspond to the needs of the parties. The parties' negotiating autonomy may result in more flexible solutions through appropriate contractual arrangements.

Particularly noteworthy are the War Risk Clauses drafted by BIMCO, which are usually included in time charter and voyage charter contracts. The issue that these clauses intend to tackle arises from the fact that while it is mainly the ship and its crew that are exposed to war risks, the choices regarding the commercial use of the ship, and hence the performance of voyages that touch or pass through war-risk zones, are made by the charterer (at the time when the contract is concluded for voyage chartering, respectively during the execution of the contract for time chartering).

The definition of "war risks" of the BIMCO Clauses is

"The first question is whether the current situation results in the impossibility (total or partial, permanent or temporary) to perform the contract, or only in the performance of the contract being more onerous or risky

broad so as to include “war; act of war; civil war; hostilities; revolution; rebellion; civil commotion; warlike operations; laying of mines; acts of piracy; acts of terrorists; acts of hostility or malicious damage; blockade.”

“Particularly noteworthy are the War Risk Clauses drafted by BIMCO, which are usually included in time charter and voyage charter contracts

In time charter contracts – as is well known – the commercial use of the ship is not defined at the time of the conclusion of the contract: the ship is indeed at the charterer’s disposal for a certain period of time, during which he may from time to time order the performance of voyages according to his own commercial activity. The issue arises when the charterer requests the performance of a voyage that exposes the ship to war risks. In this respect, the fundamental principle enshrined in the War Risk Clause for Time Charters is that the shipowner is entitled to refuse to perform a voyage ordered by the charterer if such voyage exposes the ship to war risks; the determination of the existence of such risks is left to the “reasonable judgement” of the master or shipowner.

The shipowner may, however, agree to execute the charterer’s orders, even if this entails an exposition of the ship to war risks. In such cases, the additional costs will be borne by the charterer; these include, in particular, the war risk insurance premiums, i.e. the instrument by which the shipowner mitigates the risk to which he accepts to expose the ship and the crew. The economic consequences of the increased risk are thus reassigned to the party (charterer) who, through its commercial choices, generated such increased risk.

The clause also provides that the shipowner may comply with orders, directives and recommendations of governments and international organisations and with those of war risk insurers. Finally, if the risk materialises and if the shipowner invokes its right to refuse the charterer’s orders, the charterer must nominate an alternative port for discharge and, failing such nomination, the shipowner may discharge the cargo “at any safe port”.

In voyage charter contracts, where the itinerary of the voyage is contractually defined (albeit sometimes within a range), a war risk may occur during the period following the conclusion of the contract and preceding its execution. In such cases, the War Risk Clause for Voyage Chartering provides that if at any time before the commencement of loading, it appears that, “in the reasonable judgement” of the master or shipowner, the vessel and crew may be exposed to war risks, the shipowner may terminate the contract unless the charterer nominates any other safe port which lies within the contractual range for loading or discharging. Similarly, if loading, respectively performance of the voyage, have already commenced, the shipowner may require the charterer to nominate an alternative port, failing which it shall be entitled to disembark the cargo at “any safe port”.

The ship’s exposure to war risks may in some cases be avoided by taking a different route. If the extra distance of such alternative route exceeds 100 miles, the shipowner shall be entitled to charge an additional freight, calculated in accordance with the contractual freight.

The proper functioning of such clauses presupposes a

precise definition of the terms “war” and “war zone” and, subsequently, an assessment of the existence and seriousness of risk factors on a case-by-case basis.
If the war events result in the loss of or damage to the cargo, the carrier’s liability provisions and hence, in the vast majority of cases, those of the 1924 Brussels Convention (“Hague Rules”) will come into play. Article IV.2(e) of the Convention expressly provides for the carrier’s exemption from liability for loss or damage of cargo caused by an “act of war”. “Liberty clauses” in bills of lading regulate the possibility for the shipowner to follow a route other than the usual one; even in the absence of a specific contractual stipulation, it can still be considered that a change of route with a view to avoiding the risk of attack constitutes a “reasonable deviation” within the meaning of Article IV.4 of the Brussels Convention.
The overall definition of risk allocation is completed by insurance coverages. In this regard, it should be noted that, for both ships and cargo, “War Risks” are excluded from the insurance coverages, and it is therefore necessary to take out additional policies (e.g., through the forms Institute War and Strikes Clauses Hulls-Time, for ships, and Institute War Clauses Cargo, for cargo). We saw above how the related burden can be passed on by the shipowner to the charterer.
War Risks policies cover loss or physical damage to the insured property, but not the delay; detention is also covered, and is treated as loss if it exceeds a certain duration. Finally, the insurance coverage may be subject to the adoption by the insured party of specific security measures, such as those outlined in the BMP5 (Best Management Practices, relating to the Red Sea and Gulf of Aden) developed by BIMCO together with insurers and shipowners’ associations.

Enrico Salvatico

An expert in maritime and intermodal transport and insurance law, Enrico Salvatico deals, in particular, with logistics and disputes relating to charter parties, bills of lading and CMR, air transport, cruises and passenger transport. He has specialized in the field of Project Cargo shipments and provides services and assistance both to EPC Contractors and to international freight forwarders, in all phases of the project. He was appointed by the Minister of Justice as the Italian expert delegate to the next session of Working Group VI “Negotiable Cargo Documents” of the United Nations Commission on International Trade Law (UNCITRAL), which will be held in New York from 6 to 10 May 2024. In ANIMP Enrico is Head of the Logistics, Transport and Shipping Section.

ASCO FILTRI

a mott company

Asco Filtri, a mott company, is a market leader in **process purification and filtration** that designs, manufactures and services **highly engineered products** for the most severe applications, with the aim to deliver great solutions that tackle the most demanding engineering challenges.

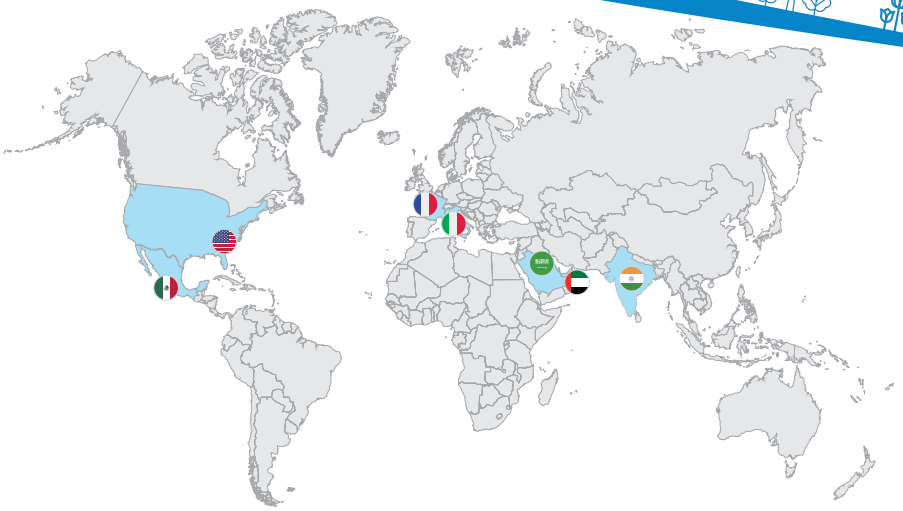
mott

MISSION CRITICAL PRECISION

Mott Corporation is a global leader filtration manufacturer of **sintered porous metal filters and fluid flow products** offering full service and custom designed products.
We combine design expertise providing **cutting-edge technology** for thousands of applications across the most diverse markets.
Our products are crafted with the highest reliability in the world, delivered with the best lead times to all our customers, at a great value.

ASCO Filtri S.p.A.
Headquarter:
Viale delle scienze, 8
20082 Binasco (MI) - ITALY
Phone: *(+39) 02 89 70 31*
Email: *ascoinfo@mottcorp.com*
Web: *www.ascofiltri.com*

MOTT Corporation
Headquarter:
75 Spring Ln
Farmington - CT 06032 - USA
Phone: *(+1) 860-747-6333*
Email: *info@mottcorp.com*
Web: *www.mottcorp.com*



ASCO Filtri UAE
Abu Dhabi, UAE

ASCO Filtri MEXICO
Mexico City, Mexico

ASCO Filtri FRANCE
Paris, France

ASCO Filtri INDIA
Pune, India

ASCO Filtri KSA
Al Jubail, Kingdom of Saudi Arabia

Asco Filtri S.p.A.
Viale delle Scienze, 8
20082 Binasco
Milano - ITALY

(+39) 02 897031
ascoinfo@mottcorp.com
www.ascofiltri.com

USA
UAE - MEXICO
FRANCE - INDIA
SAUDI ARABIA

Low Carbon Hydrogen generator by steam methane reforming

High-purity blue hydrogen with a very low carbon intensity can be produced from bio-methane or natural gas via the ASCO Filtri proven HRR-CO_2 technology

Francesco Romeo, Business Development Director
Fulvio Menini, CEO
ASCO Filtri S.p.A.

With the ASCO Filtri proven HRR-CO_2 technology, a readily available solution delivering high-purity, clean Low Carbon (blue) Hydrogen with a very low carbon intensity can be produced from bio-methane or natural gas by means of a high recuperative steam methane reforming and a carbon capture system based on Metal-Organic Frameworks (MOFs), a novel class of crystalline micro-structured materials known to have a super-high porosity, the highest known among adsorbents.

"The steam methane reformer and the carbon capture system based on Metal-Organic Frameworks (MOFs), a novel class of crystalline micro-structured materials known to have a super-high porosity

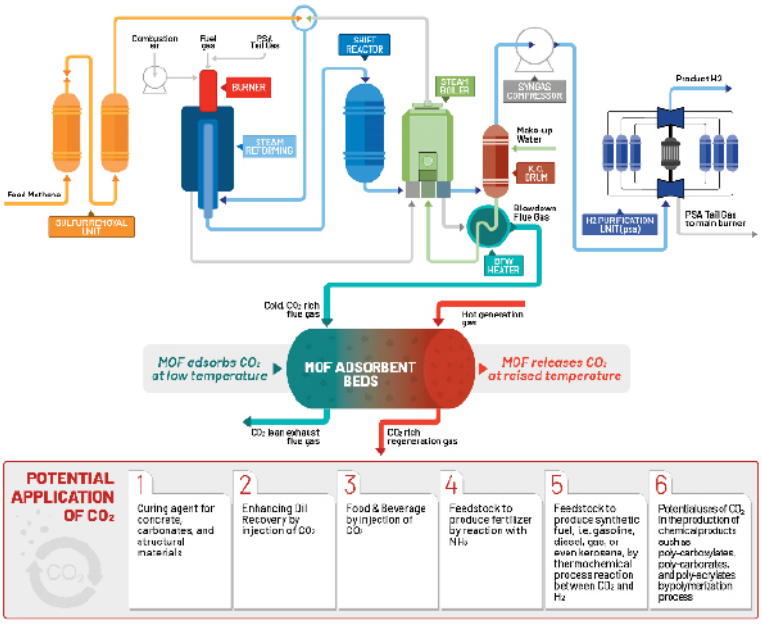
The High Recuperative Reformer Hydrogen Generator is designed to deliver high-purity hydrogen (typically 99.95% by vol.) by methane steam reforming combined with a PSA purification step. The Hydrogen Generator package consists of a high-energy efficiency steam reforming Fuel Processor, a Syngas Gas Compressor, and a Pressure Swing Adsorption (PSA) hydrogen purifier.

The Fuel processor produces syngas by methane reforming.The Syngas Compressor compresses the syngas from Fuel Processor before delivering it to the PSA unit.

The PSA purification system receives pressurized syngas and produces high-purity hydrogen.

The core of this unit is the Fuel Processor producing syngas by innovative and very compact reformer tube with lower pressure drop and significantly better heat transfer than other existing technologies.

Indeed, the reforming reactor is composed of multi-tubular fixed bed reactor tubes, which are closed at their top-end forcing the syngas to return and exit via an inner tube, centrally installed within the outer tube. Heat exchange occurs counter-currently between the reacting gas and the return gas, with the return gas that leaves the bottom of the reactor at a reduced temperature, prior to heat-up the feed



"The High Recuperative Reformer Hydrogen Generator is designed to deliver high-purity hydrogen by methane steam reforming combined with a PSA purification step. The package consists of a high-energy efficiency steam reforming Fuel Processor, a Syngas Gas Compressor, and a Pressure Swing Adsorption (PSA) hydrogen purifier

reforming gas (natural gas + process steam).

The main advantages of this technology are the following:

1. less firing;
2. lower number of tubes required;
3. smaller furnace plot.

The innovative reformer burner arrangement allows reaching a very low NOx emission below 60 ppm, having in addition the capability to burn H2-rich fuel gas, which allows to recover back to the burner the H2-rich PSA tail gas enhancing the Thermal Efficiency of the Steam Methane Reforming up to approximately 69% (LHV net H2/LHV feed + fuel) and providing one single CO2-emission by the flue gas blowdown header. Furthermore, the flame is not in direct contact with the reforming tubes, preventing any overheating of the tubes and preserving their lifetime.

ASCO HRR-CO_2 can achieve a very high CO_2 capture rate (90 % recovery), producing Clean Hydrogen with a very low carbon intensity. The carbon intensity range is expected to be at the very bottom of the carbon intensity range for commercial-scale hydrogen production and significantly better than other traditional technologies.

The Carbon Capture system is based on Metal-Organic Frameworks (MOFs), novel class of crystalline micro-structured materials known to have a super-high porosity, the highest known among adsorbents, which permits to reduce the energy consumption in the regeneration step to half compared to benchmark technology such as amine scrubbing (approx. 105 kJ/mol for amines vs. approx. 54 kJ/mol for MOFs).

Francesco Romeo

Francesco Romeo obtained a degree in Chemical Engineering from the Politecnico di Milano and has worked in ASCO Filtri since 2023 in the role of Business Development Director. He began his professional career as a process engineer and Project Leader at KTI Milan and in the SOL S.p.A. Group. Over the years, he has developed more than twenty years of experience in the production and purification of hydrogen, both from electrolytic cells and from the steam reforming of natural gas. Over the years, he has taken on various important roles, as project and product development manager and in the marketing and sales sectors at well-known international companies in the Oil & Gas and power generation sector, including PIETRO FIORENTINI and the SOFINTER Group , where he rose to the position of Vice President Sales Asia. In March 2023 he joined ASCO Filtri as head of the development of the new Group Division "Clean Energy" for the supply of turnkey package units for both green hydrogen from water electrolysis and low carbon hydrogen produced either from fossil fuels or from purification of hydrogen-rich synthesis gas.

Fulvio Menini

Fulvio Menini graduated in Mechanical Engineering from the Politecnico di Milano and is currently the CEO at ASCO Filtri. His professional career began in the technical field. Over the years, he has taken on several important marketing and sales roles at well-known international Oil&Gas companies, including the IMI plc Group, where he rose to the position of Global Sales Leader on the Board of Directors of IMI Critical Engineering Division. Since May 2022, following the acquisition of ASCO Filtri by the Mott Group, Menini has been appointed CEO of ASCO and President of Global Process Systems within the corporation.

A virtuous example of ESG integration at global and national levels

Gabbioneta Pumps and Termomeccanica Pompe, recently united under Trillium Pumps Italy, have embarked on their global parent company's ESG integration journey, recognizing its transformative power

Marco Tremolada, HSE Manager
Trillium Pumps Italy

In the current fast-paced business landscape, the importance of Environmental, Social, and Governance (ESG) principles has reached new heights. Although earlier considered peripheral factors, ESG aspects are now at the core of the strategies of progressive organizations worldwide. ESG considerations influence investment decisions, shape corporate policies, and drive regulatory changes, redefining responsible business practices.

At Trillium Flow Technologies (Trillium), we have embraced the multifaceted and challenging journey of ESG, recognizing its power to change our business practices and drive our future growth and success.

> **"Trillium Flow Technologies aims to become an industry leader in environmental improvement, betterment of people, and the communities in which we operate while holding ourselves to the highest ethical standards**

The group has embedded ESG in its mission statement and company values to sustainably, efficiently, and passionately assist customers in meeting today's ever-challenging world. It has also outlined its sustainability guiding principles, priorities, and actions in a dedicated Charter. This Sustainability Charter applies to all employees, contractors, products and services, joint ventures, and stakeholders under the Group's operational control.

Trillium is committed to achieving ambitious yet attainable ESG goals, and measures progress regularly. To ensure transparency and accountability, the company reports the results of its ESG initiatives using universally recognized reporting framework standards as a guide. Since 2020, Trillium has been using tracking metrics related to the Sustainability Accounting Standards Board (SASB) for Industrial Machinery and Goods and the Global Reporting Initiative (GRI) Standards. As of 2022, the company has institutionalized key ESG metrics into monthly reports and business reviews, using third party ESG software.

This reporting is an essential part of the review and continuous improvement process for the company's ESG policies.

Environment

Trillium continuously implements initiatives to ensure its operations are environmentally sound.

Trillium Pumps Italy's headquarters building project in Nova Milanese is particularly noteworthy. The building was designed and built according to LEED green standards and obtained the Gold Certification. The measures taken to reduce environmental impact include the use of local suppliers, the installation of a 200kW solar photovoltaic panels on the roof of the building to provide a baseline amount of energy for daily activities, the recovery of rainwater in a dedicated tank for gardening and toilets, and the use of LED lighting throughout the plant. In addition, charging stations have been set up for electric cars for both employee and company cars.

Furthermore, in 2020, Trillium formed a Global Green Team to lead its environmental and sustainable programs. Two years later, the Global Green Team created local green teams made up of volunteers at each site to help implement its initiatives, generate local ideas, and advance the corporate sustainability culture. For example, in 2023, the local Italian teams in Nova Milanese and La Spezia implemented Reduce, Reuse, Recycle (3R), initiatives to curb single-use plastic, waste, and energy consumption. In 2023, Trillium also held its first annual Global Green Day, which included activities centered around 3R while recognizing the significance of sustainability. Teams took part in an upcycling contest using otherwise discarded waste from their facility, challenging their creativity to make something new and functional from the waste. Employees also took part in Waste Walks, which invited them to look for opportunities for waste reduction or elimination. The Local Green Teams made sure to follow up on findings and act.

Social

Trillium strongly invests in the safety, health, and well-being of its employees.

The company has been working hard on developing a safety culture, promoting a Zero-Harm policy through Life-Saving Behaviors. As an example, some sites such as Nova Milanese and La Spezia in Italy, have implemented a Behavior Based Safety (BBS) protocol to enhance workplace safety and increase employee situational awareness through behavioral observations. Trillium also holds a Global Safety Day every year across all its worldwide operations. This day is dedicated to educational and interactive activities focused on safety.

In terms of health, many initiatives are organized as well. For instance, in 2023, in recognition of all its health efforts, Trillium's Nova Milanese plant received the "Workplace That Promotes Health" award from the Lombard Region WHP network. The Region's program, based on the World Health Organization Model, supports the adoption and diffusion of good eating habits and an active lifestyle, focusing on reducing the risk of chronic diseases and promoting work-life balance.

"To complete its social attention, Trillium has put into place a Diversity and Inclusion (D&I) policy. The company also gives back to the community by conducting charitable initiatives and getting involved with schools, offering apprenticeships, mentorships and/or facility tours to promote STEM career paths

Trillium is also dedicated to advancing employee well-being through programs focused on retaining and developing the talent needed to reach the company's business objectives. To achieve this, Trillium emphasizes cultural interaction, communication, training, and feedback. Digital platforms are crucial in all of this. For instance, Trillium has implemented a training e-portal to provide leadership and compliance training. The portal further includes over 6,000 courses and 35,000 books on functional and technical development, general business competencies, and overall well-being. Additionally, Trillium has incorporated its merit process into the existing HR online systems to better ensure consistency and cohesion. Moreover, the company has implemented in many countries flexible "smart" work arrangements to improve work-life balance.

To complete its social attention, Trillium has put into place a Diversity and Inclusion (D&I) policy. The company also gives back to the community by conducting charitable initiatives and getting involved with schools, offering apprenticeships, mentorships and/or facility tours to promote STEM (Science, Technology, Engineering and Mathematics) career paths.

"At Trillium, we take care of our employees, who then take care of our customers, who finally take care of our investors

At Nova Milanese, all these Social efforts have led to the plant's Social Accountability Certification, SA8000.

Governance

The third pillar of ESG, Governance, has been firmly embedded in Trillium's Integrated Management System. This system is certified according to ISO standards, which provide strict guidance on the group's Governance, assuring transparency and accountability mechanisms within the organization and alignment with stakeholder expectations.
In addition, Trillium is dedicated to conducting its business ethically. As an example of this commitment, in Italy, our Management Systems are not only ISO 9001, 14001, and 45001 certified but also comply with the local Law 231. The law, in line with European and International conventions, outlines the liability of a legal entity for crimes perpetrated in its interest or to its advantage.


SUPPORT FOR STEM
(SCIENCE,TECHNOLOGY,
ENGINEERING AND MATH) EDUCATION

ESG, an added value to customers

Thanks to its proactive and comprehensive ESG integration approach, the group is in a better position to maintain its competitiveness. Trillium works alongside its customers to provide products and services tailored to their needs, taking into consideration the entire supply chain framework. For instance, Trillium Pumps Italy already works within Corporate Value Chain Standards (Scope 3), which allows it to assess its entire value chain emissions and identify where to focus reduction activities.

Marco Tremolada

Marco Tremolada graduated from Politecnico di Milano in 1997 with a degree in mechanical engineering. He started his career at a pump manufacturer, where he worked for six years. Initially, he worked in Quality Assurance and Quality Control, and later as a Technical Sales Engineer for firefighting and engineered pumps. In 2004, he joined Trillium Pumps Italy (then known as Pompe Gabbioneta) as a Quality Manager, and later took on the role of HSE Manager, which became his sole focus. As HSE Manager, he is responsible for the company's Integrated Management System, which is certified under ISO 9001, 14001, and 45001. He also serves as the Prevention and Protection Service Manager (RSPP), QA lead auditor and internal trainer. Marco Tremolada is an expert in Behavioral Based Safety and is a member of the Italian Association for the Advancement of Radical Behavior Analysis (AARBA).

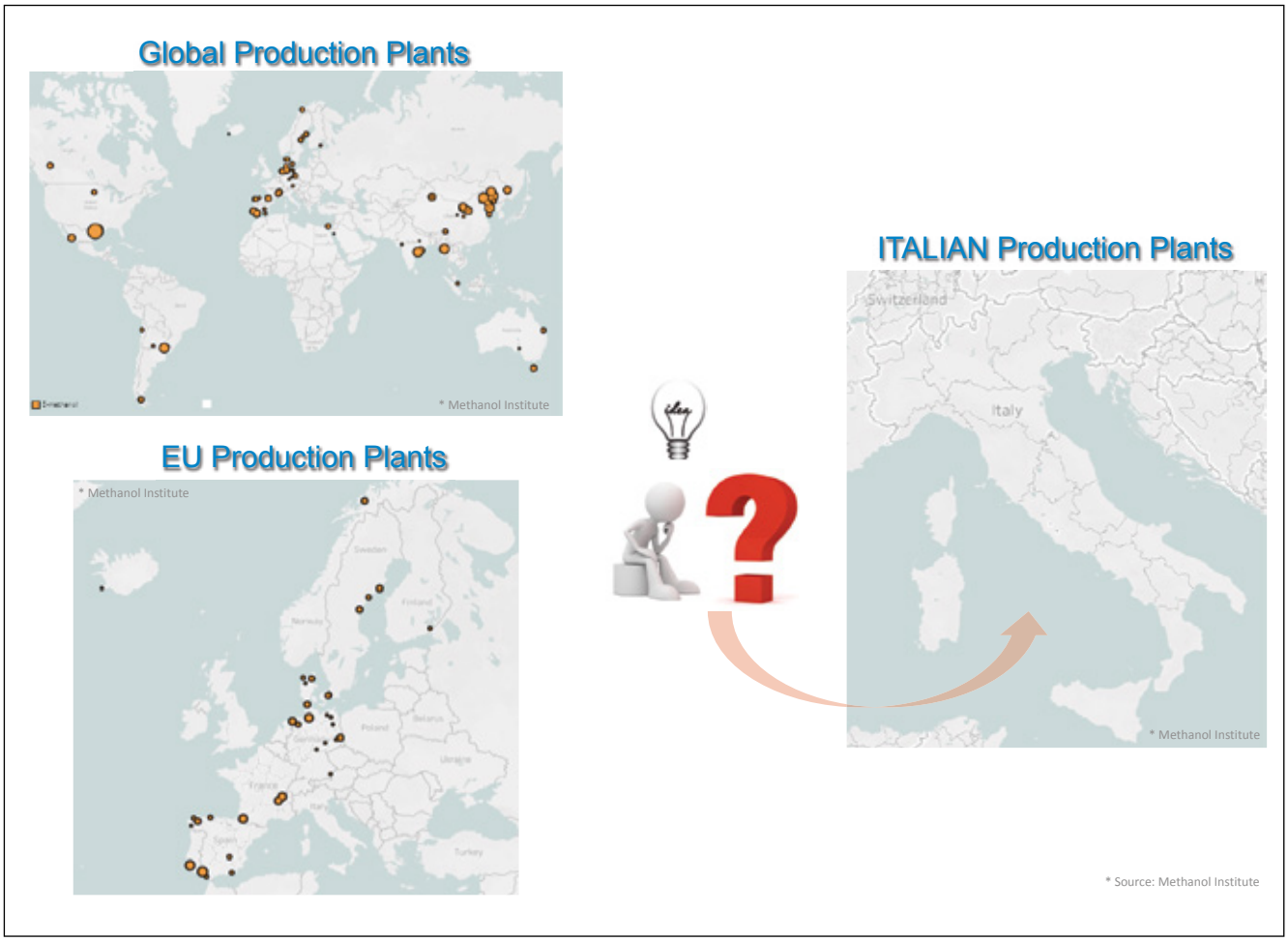


Figure 1 – Existing/under construction E-Methanol production plants in the World/Europe/Italy

Maritime industry facing a new business paradigm

Meeting the IMO and "FuelEU Maritime" initiatives to increase the demand for consistent use of renewable and low-carbon fuels to reduce the greenhouse gas emissions from the shipping sector

Alessandro Orsolino, Head of Technical Department
San Giorgio del Porto

Year after year, the climate emergency raises an alarm even louder and louder. It is clear that it is not the problem of others, but we must all, personally, strive to make in our private life our contribution, even a small one, to the survival of our planet: even the ocean is made up of drops.

But the greatest contribution to pushing the reversal of this dangerous trend must come from all sectors of industry, especially those that generate the greatest impact.

The global shipping industry, which realize the transport of the 90% of goods around the world, is responsible of only the 3 % of Greenhouse Gas (GHG) emissions around the world, but nevertheless it is increasing its efforts to develop alternative fuels in order to decrease its environmental impact, especially in terms of GHG release into the atmosphere.

To this end, IMO, the special agency of the United Nations, has adopted a series of mandatory international measures to improve the energy efficiency of ships, through the definition of a mandatory regulatory framework for designers and builders, as part of the decarbonisation strategy to reduce GHG emissions into the atmosphere through successive steps.

In parallel, EU Council has adopted new regulation, the so-called "FuelEU Maritime" initiative, to decarbonise the maritime sector through the development and usage of more renewable and low-carbon fuels, reducing its carbon footprint.

The main objective of the "FuelEU Maritime" initiative, as a key part of the EU's Fit for 55 package, is to increase the demand for consistent use of renewable and low-carbon fuels to reduce the greenhouse gas emissions from the shipping sector.

Both initiatives have set up a series of successive steps in terms of reducing GHG emissions for 2030 and 2050, to play a fundamental role in the achievement of necessary climate targets.

A new fuel for the maritime industry

For the Maritime industry the main targets can be resumed as follows:

- Acceleration to net zero;
- Availability and scalability of alternative fuels;
- New generation of ships powered by alternative fuels.

In respect to the first point, it must be clarified that the net zero target is really not year 2050, but 2040, where 90% of the GHG emission reduction has to be accomplished.

In making more complex the worldwide fleet conversion, we have to highlight that the Shipbuilding construction yards have already three years order book, so that before 2027 no action can be made. Only 13 years are left for taking effective actions which can be effective in 2040, highlighting consequently the pressing urgency of the measures to be taken.

"Climate emergency requires urgent actions to act energy transition in every sector: International guidelines and targets for Maritime industry are well defined by IMO and EU Council

With the scope to share some detailed information, we should note conventional fuel vessels will be ordered at least until 2030 (later it is unlikely, since depreciation will be too heavy on an economic life shorter than 20 years) and the current newbuild order book (GT – ABS source) is now 49% conventional while 51% is dual fuel, with dual fuel mix ratio at 68% Liquefied Natural gas (LNG), and 32% Methanol.

The fact LNG is the prevailing new standard for big vessels (passengers/containers) is given by pricing and availability of LNG, which has been developed with several "small scale initiatives" in the last decade.

LNG market remains relatively immature and will take more traction in maritime since:

- It burns more cleanly that any other fossil fuel;
- The newly introduced network of small size gas carriers is now/will be in the condition of efficiently refuel the current LNG fleet/new ships coming within 2030 currently ordered.

But we cannot forget that, even if LNG is a "cleaner" fuel than Diesel Oil, it is still a fossil fuel, with no negligible impact in terms of GHG emissions.

On the other hand, a new fuel for the sector, Methanol, and more precisely E-Methanol has been generating a lot of interest in recent months and is actually considered as the green fuel which will play a fundamental role in the Maritime Sector decarbonization.

Even if the impact of actual production costs of E-Methanol is still high as normally it happens for innovative solutions, the great evolution in the production technologies of this fuel, and the EU Emissions Trading System (EU ETS) based on 'cap and trade' system to reduce greenhouse gas emissions cost-effectively, will soon allow this e-fuel to play a leader role in the Shipping Industry in few years, as demonstrated by the increasing number of new ships orders, new plants for E-Methanol production and new Methanol ready engines and kits to retrofit existing ships in Europe and in the whole world.

Considering Italy, it must be said there is no precise common strategy in place for "methanol value chain" (**Figure 1**), which starts from:

- Green energy production;
- E methanol plants;
- Rail transportation to ports;
- Small size green methanol carriers to supply a bunker demand which will grow rapidly.

As opposite than for other energy sources, where the shore-based energy need is driving the energy supply chain construction, for methanol, the urgent need of the maritime industry of an alternative green fuel could be the catalyst for the next big wave of small-scale methanol networks granting production, distribution and plug and play bunkering services (**Figure 2**).

"Required necessary steps are the availability of E-fuels and e-fuel ready ships, namely in Italy the creation of a complete integrated E-Methanol cycle from production to maritime distribution

Demand is expected to grow rapidly, boosted not only from the current newbuild order book but more widely from the retrofit of the conventional fleet to methanol, which as of now appears the more convenient option to insure operational life to the worldwide fleet.

Methanol does not require the creation of a new logistic shore based logistic infrastructure. It will be required just adaption of the existing logistic storage utilized for despatching the conventional fuel.

Figure 2 – E-Methanol full supply chain for the Maritime Industry

The contribution of San Giorgio del Porto Company

San Giorgio del Porto is a 100-year-old company, based in Genoa and with operative yards in Marseille and Piombino, active in ship repair, ship retrofit and ship new building industry, and represent a global benchmark for repair, conversion, and construction of all types of ships.

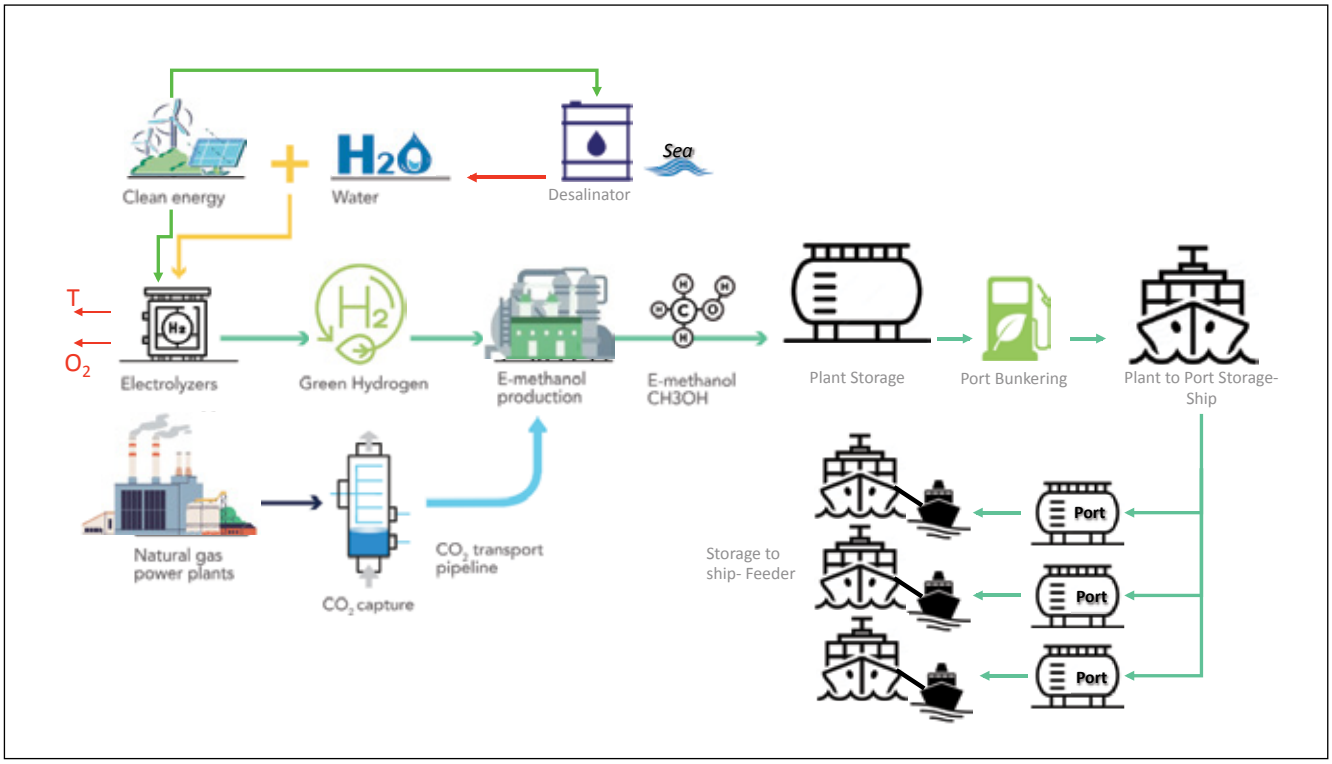
Based on this experience and with constant focus on the future development of the sector, San Giorgio del Porto decided to design and build the first of a possible series of ships dedicated to the coastal transport and port e-methanol refuelling activities, in order to give his own prompt contribution to the Italian supply chain of the E-Methanol in the maritime sector.

San Giorgio 116 ship project

The SG116 ship project is dedicated to the development of coastal transport and port methanol refueling activities for ships that will adopt this product in the future as a green alternative to fossil fuels in the maritime sector.

The construction of this new unit is part of a broader context of environmental sustainability that reflects the intention to actively contribute to the virtuous cycle of methanol, promoting a circular economy in the energy sector.

The unit will be used almost exclusively as a methanol tanker, taking the opportunity to be a pilot project for the installation of dual-fuel generators, i.e. capable of



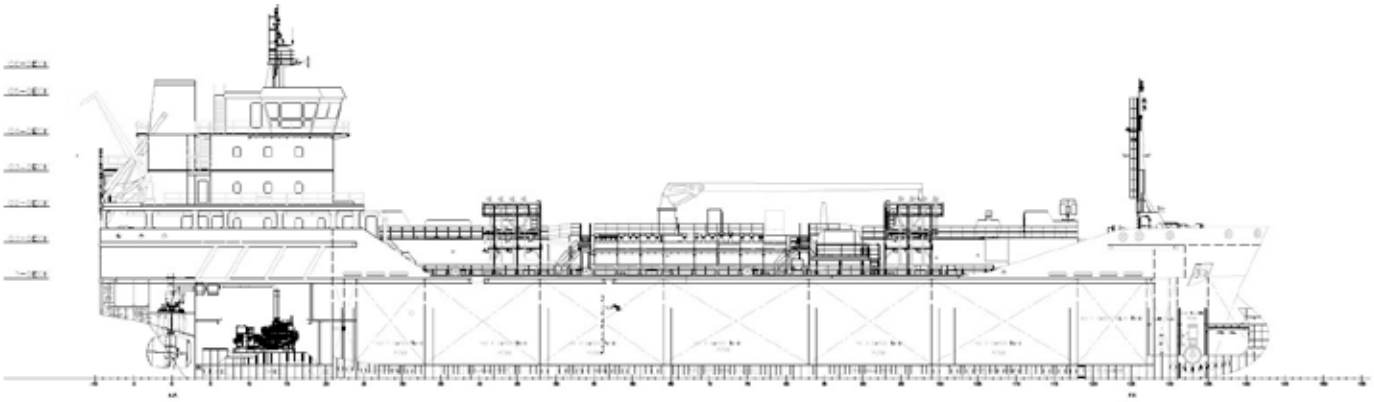


Figure 3 - SG116 METHANOL CARRIER - side view

running on both methanol and diesel.

The project will therefore lead the innovation of future ships that will operate using methanol as a fuel touching various Italian ports and will be able to be refueled thanks to a unit dedicated to this service.

The ship will be classified as a double-hulled IMO II Chemical Oil Tanker, i.e. capable of carrying products with flash points below 60°C, the main one being methanol.

Her design has the following main characteristics: length 91.30 m, width 16.0 m overall, with a construction height of 7.80 m for a capacity of 5,000 t of product (**Figure 3**).

The ship will fly the Italian/ EU flag, and is under construction at the PIM Shipyard (Piombino Industrie Marittime) under surveillance and classification by the RINA (Italian Naval Register) and can accommodate 13 crew members in unlimited international navigation with maximum speeds around 11.5 knots.

The SG116 stands out for its innovative design and the adoption of advanced technologies aimed at minimizing environmental impact.

The focal point of the project is a diesel-electric propulsion system powered by dual-fuel generators capable of running on both methanol and diesel. This configuration ensures operational flexibility and a significant reduction in CO_2 emissions (**Figure 4**).

E-Methanol offers a double advantage as a fuel:

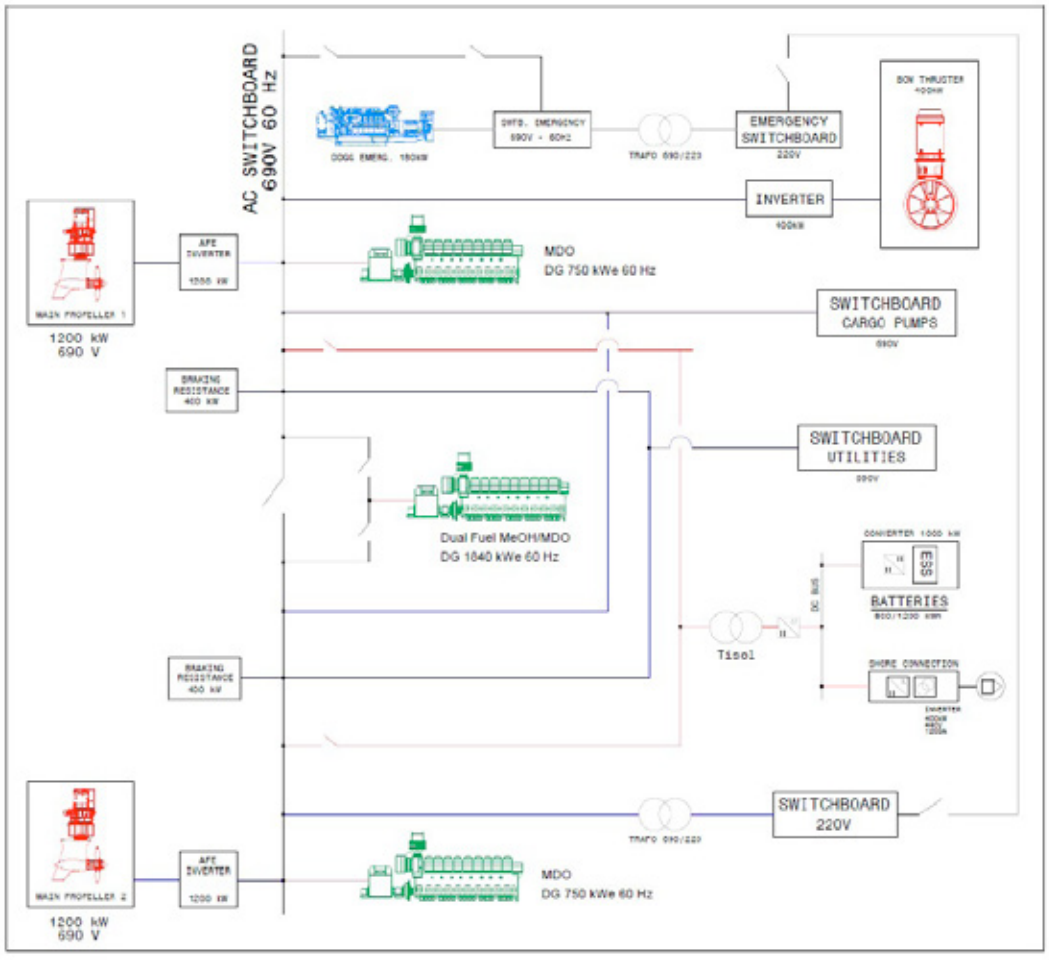


Figure 4 - SG116 METHANOL CARRIER - propulsion system philosophy

produced with green energy from biomass or through industrial CO_2 capture processes, it represents a total green solution, while its use in dual-fuel engines significantly reduces the ship's carbon footprint. The SG116, therefore, not only transports methanol but uses it as the cornerstone of its sustainability strategy.

The generators are complemented by a 1,200 kWh battery pack that allows port operations in all-electric mode.

The batteries can be recharged via shore connection or during navigation, performing alternating charge and discharge cycles with "peak shaving" functionality, optimizing the use of generators and further reducing fuel consumption and emissions.

Thanks to the contribution deriving from the power supply system through the combined use of "shore connection" and battery pack for port manoeuvres, the ship will be able to obtain 30% of its operational energy needs from the shore network, with a consequent reduction in CO_2 emissions of up to 35% compared to a similar ship traditionally not equipped with such systems.

The propulsion system consists of two azimuth thrusters, driven by electric motors of 1200 kW each, reflecting the need for optimized energy consumption and the DP1 dynamic positioning system.

"This should be the next energy revolution, in which the Italian ecosystem represented by Energy Operators, Construction Firms, Yards and Ship Operator should play a big role

This configuration offers excellent manoeuvrability, which is crucial for port operations, and allows the vessel to maintain an optimal transfer speed of 10-11 knots.

Azimuth thrusters are also known for their efficiency and reliability, making them an ideal choice for operations that require precision and control.

The electric motors are powered by three generators with a total installed power of 3340 kW, while the largest, a 1,840 kW MAN 175D, will be able to run on both methanol and Marine Diesel Oil. This generator, along with the batteries, represent the heart of the SG116 green approach, allowing the ship to use methanol as its primary fuel.

The dual-fuel capability provides unprecedented operational flexibility, allowing the vessel to easily adapt to changing fuel availability and evolving environmental regulations.

"San Giorgio del Porto S.p.A. company is already giving his real contribution to this target

The propulsion system of the SG116 represents a model for the future of sustainable shipping. With its combination of azimuth thrusters, dual-fuel generators, high-capacity batteries and readiness for renewable energy integration, the SG116 is not only a state-of-the-art vessel, but a manifesto of how technology can drive the industry towards a greener future. The challenge now is to expand the application of these innovative technologies, making them the standard in tomorrow's naval design.

Conclusions

Since EU yards are still in the game for building small size of highly technological vessels as the bunkering methanol vessel, the opportunity of creating a E-Methanol Value Chain based in Italy appears a great opportunity.

Italy is the third Country in the world for coastal infrastructures along the sea, the second manufacturing industry in EU, one of the most important world players in building and operating ship.

As it has been made for the decree n. 191 dated June 27th, 2022, which was providing state grants for construction of LNG small scale deposits (including acquisition of LNG bunkering vessels for coaster trade), EU provisions should be granted for construction of E-Methanol plants and acquisition of new ships for methanol related transportation and distribution.

Creation in Italy of a complete integrated E-Methanol cycle from production to maritime distribution has to be the next energy revolution in which the Italian ecosystem represented by Energy Operators, Construction Firms, Yards and Ship Operator should play a role.

Alessandro Orsolino

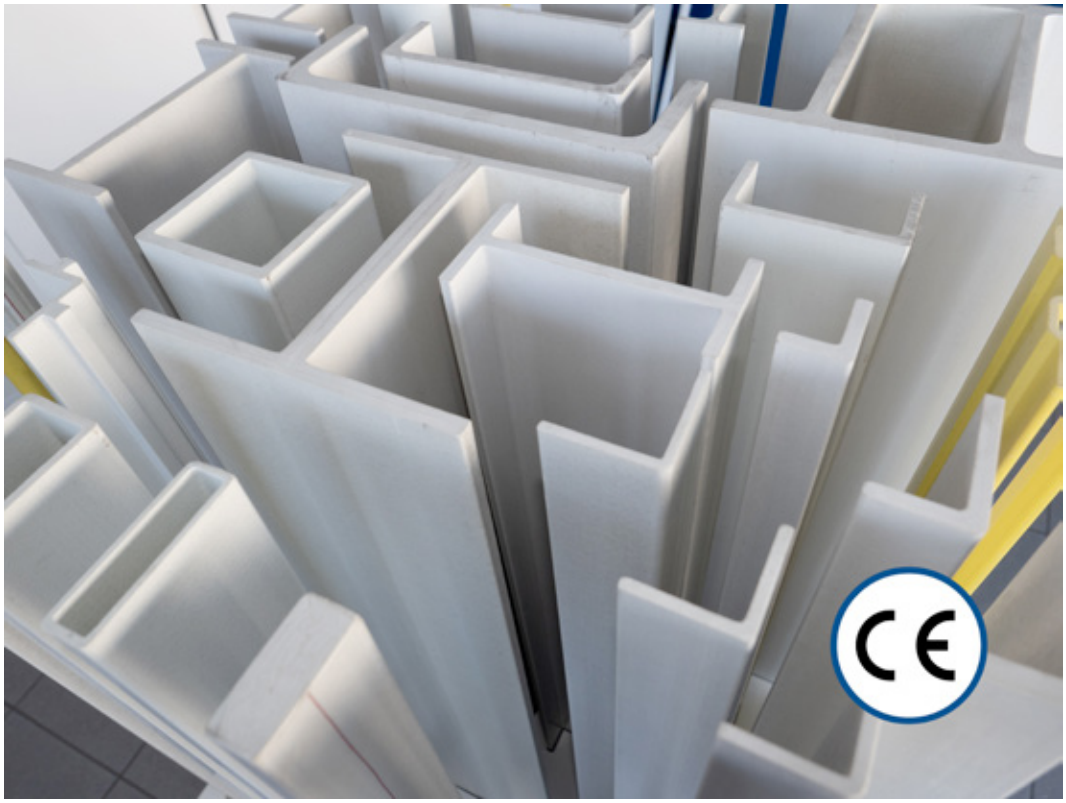
A naval engineer who graduated in 2005 from the University of Genoa, Engineering Department, Alessandro Orsolino worked firstly for Carnival corporate shipbuilding until 2011 as steel and paint surveyor, responsible for all steel structures for Cruise Vessels built in major Italian shipyards.

He then joined San Giorgio del Porto in 2011 as Ship Manager, and later as Project Engineer coordinating on board activities, subcontractors, work planning and internal resources for ships' repair and vessel refitting projects. Since 2019 he has been the Head of Technical Office. He coordinates the vessels' design activities on newbuilds, ships' repairs, retrofits and conversion projects.

FRP structures for Oil&Gas and renewable energies

Maximizing efficiency and safety in sectors like Oil&Gas and renewable energies, where reliable materials are crucial for creating safe, long-lasting structures in corrosive environments

Sara Macor, Sales Manager
M.M. S.r.l.



M.M.'s FRP profiles are CE-marked through ETA

In sectors such as Oil&Gas and renewable energies, reliable materials are required for the production of safe and durable structures capable of withstanding harsh environments. Since 1977, the italian company M.M. srl, based in Udine, near Venice, has emerged as pioneer in the production of FRP gratings and structures, offering customised, cutting-edge solutions tailored to the unique requirements of these industries.

FRP applications

FRP (Fiber Reinforced Polymers), also known as fibreglass, is a composite material consisting of thermosetting polyester resins and continuous glass fibres. The characteristics of this innovative material make it particularly suitable for various applications in the oil & gas and renewable energy sectors (solar, wind, water, geothermal, tidal).
M.M. produces a wide range of fibreglass products, including moulded gratings for floors and pultruded profiles CE-marked through ETA (European Technical Assessment) according to Regulation (EU) n. 305/2011 for construction products used for stairs, walkways, railings and fences. The company uses advanced technologies such as Resin Transfer Moulding (RTM) and pultrusion, guaranteeing high quality standards and compliance with the regulations of the sector. Its main production is completed by a series of complementary FRP accessories, such as rolled products, threaded bars and manhole covers.

FRP vs. steel

Fibreglass structures have several advantages compared to galvanised or stainless steel structures:

- Corrosion resistance, they withstand acidic or basic chemicals for a long time within a good temperature range, without paint or additional treatments;
- Mechanical strength which, in relation to the weight, is superior to that of steel;
- Electrical isolation, since they are made of a material that does not conduct electricity;
- Absence of earthing, since they are made of an insulating material;
- Radio-transparency, i.e. the ability not to interfere with the transmission of waves within a wide range of frequencies;
- Lightness, they are on average 75% lighter than steel structures, so they weigh down very little on the support structures and facilitate transport and installation operations;
- Resistance to atmospheric agents, they cannot be damaged or deformed by the elements, UV rays and temperature changes.

In addition to these technical qualities, they can be installed easily and quickly, because they are structures that are easy to handle manually, and they can also be worked on site and require no maintenance.

FRP structure

"M.M. meets the needs of safety and reliability with fiberglass/FRP (Fiber Reinforced Polymers) products for stairs, walkways, handrails, and fences, offering advanced solutions with advantages like corrosion resistance, lightness, and electrical insulation, outperforming steel in many aspects

M.M.'s FRP structures are innovative and reliable solutions for the requirements of the Oil&Gas and renewable energy sectors. Thanks to their strength and versatility, they are widely used for the construction of key infrastructures, capable of guaranteeing high performance and durability.

FRP for Oil&Gas

M.M.'s fibreglass gratings and structures can be used both in the oil and gas and in mineral extraction industry. M.M.'s products are resistant to corrosion, moisture, low temperatures and temperature changes, and they are suitable for applications in extreme climatic conditions.

M.M.'s range of products with high chemical resistance is ideal for application in chemically aggressive environments such as those typical of the metal production industry by electrolysis.

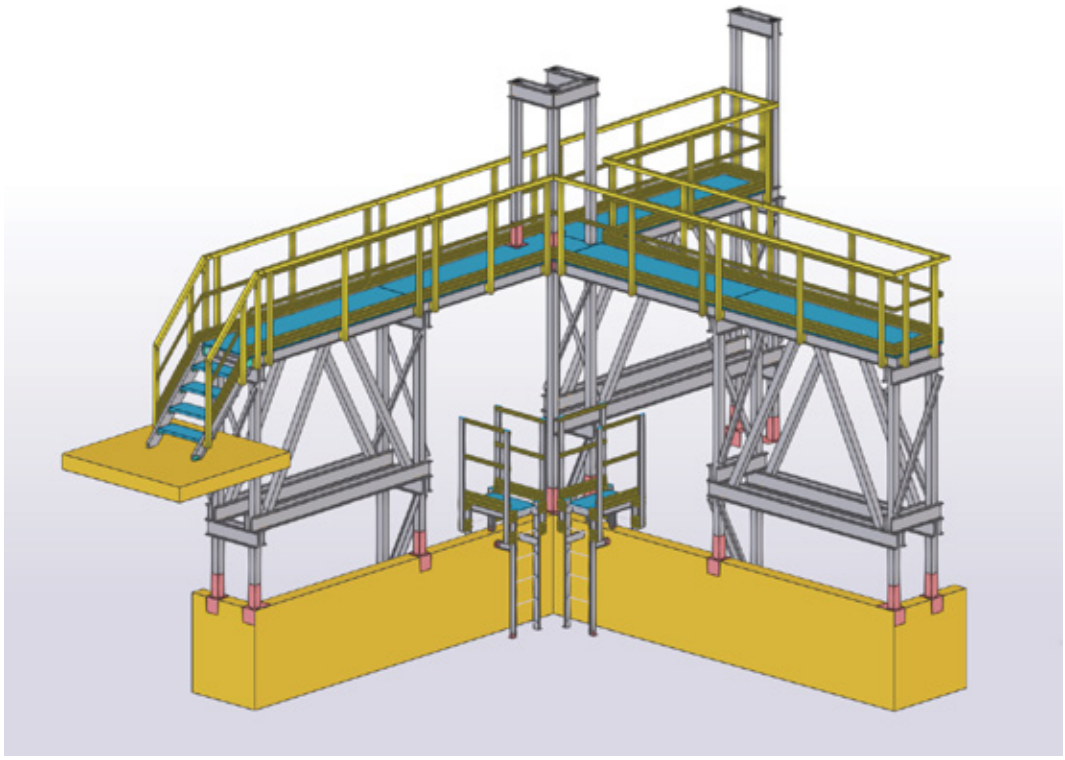
In fact, the electrolysis process involves the use of large tanks of acid solutions at high temperatures, which create environments in which galvanised steel cannot guarantee safe conditions for the operators, not even for a short time.

For the Portovesme Glencore Group plant, located in Portoscuso, in the Italian region of Sardinia, our customer, the installer Cosermo Española, was supplied with FRP structures customised in terms of resin and colour both to support the new acid ducts and to create walkways between the process tanks, replacing deteriorated steel beams.

In the Oil&Gas sector, M.M. has also delivered walkways and pedestrian areas in refineries. The customer Melones Oil Terminal Inc., a Panamanian hydrocarbon storage company, needed to install pipeline crossing systems complying with the regulations of the sector. Since these structures are exposed to an aggressive environment, due to the effect of seawater and salty air, and also due to the presence of hydrocarbons, the customer required a solution that was highly resistant to external agents and at the same time self-extinguishing.

FRP crossing of the tank containing pipelines

Moreover, the location of the terminal itself required a crossing system that was easy to install due to the lightness and adaptability of the components.
M.M., in partnership with Syncflow Corp., designed a crossing system for the tank containing the pipelines consisting of two stairways and a walkway.
The dimensioning conducted by M.M., taking into account Standard EN ISO 14122 - 1,2,3,4, made it possible to ensure a solution suited to the customer's needs, which primarily verified the resistance of FRP to the extreme corrosiveness of the environment compared to steel structures. A characteristic of M.M. gratings and profiles that allowed the final structure to be considered maintenance-free for more than 20 years.

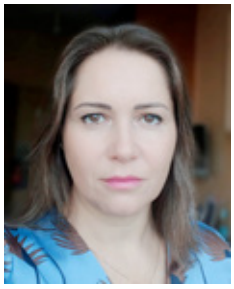


FRP structures for green hydrogen production plant

FRP structures for green hydrogen production plant

In the renewable energy source sector, M.M.'s achievements include the structures commissioned by the Belgian group John Cockerill for the green hydrogen production plant in Aspach (France), the first European hydrogen gigafactory. This ambitious project required the installation of safe and reliable structures to allow access to the control devices of the water treatment plant of a 1 GW hydrogen production plant. The solution proposed by M.M. involved an articulated system of walkways and stairs on load-bearing structures, designed to ensure maximum safety and functionality. The walkways were made of fibreglass gratings equipped with safety mesh, while the supporting structures were custom-designed to adapt to the specific needs of the site.

The project required the adaptation of the FRP structures to the concrete works, integration with the existing piping, and the construction of pipe supports. M.M.'s technical department designed special support plates to ensure the stability of the pillars on retaining walls, while gantry structures were built as pipe supports and for the passage of the operators.



Sara Macor

Sara Macor is the Sales Manager of M.M. Srl, an italian company that, since 1977 has been a reference player in the FRP gratings and structures market. Holding a degree in Civil Engineering, she joined M.M.'s sales department in 2013 and by 2017 was entrusted to implement a sales development process, as part of her role as head of the sales team. Her position entails overseeing the management and expansion of the M.M. sales network and supervising international activities, by coordinating with both internal and external resources.

CTA Group

TAD

raccortubi group ALCO

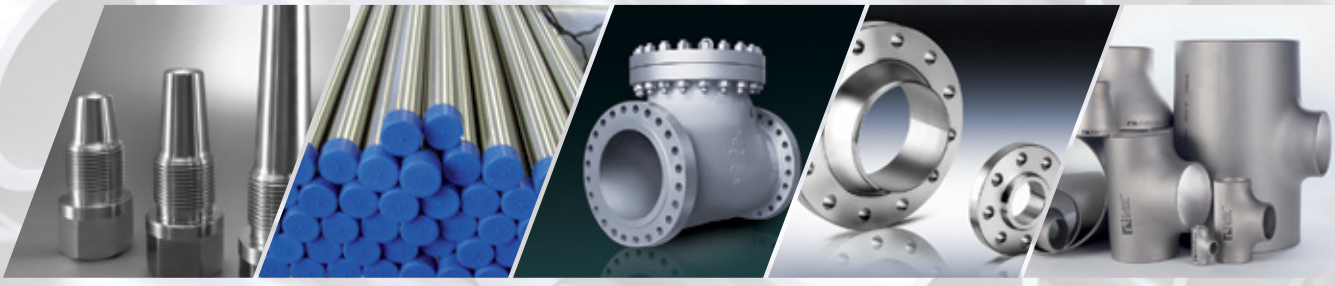
EITI

steel power

Since more than 60 years, CTA is present as qualified dealer on Chemical, Petrochemical, Refinery, Gas Processing, Power Generation and Nuclear and Renewable Energies markets with a wide range of products such as pipes, fittings, flanges, valves, bars, and profiles.

CTA offers a continuous and efficient presence thanks to additional and personalized services in Project Management, in order to fulfill all customer needs.

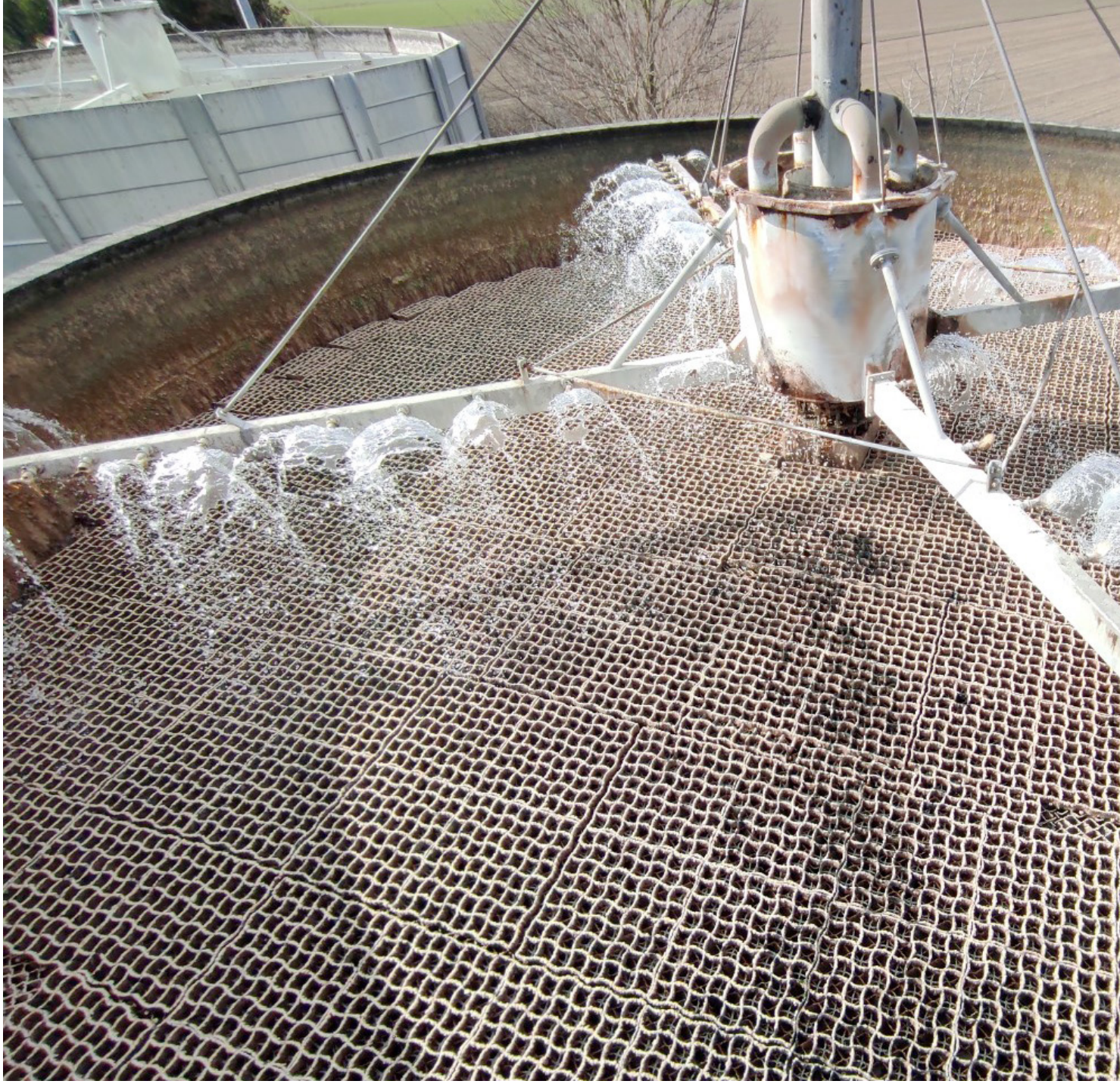
200.000 tons yearly handled worldwide.



CTA Paris - France
CTA Dubai - UAE
CTA IBERIA - Spain
CTA POLSKA - Katowice
CTA ASIA PACIFIC - Hong Kong
CTA CASPIAN SEA - Kazakhstan
E.I.T.I. - Italy
TAD Long Products - Italy
ALCO - France
RACCORTUBI Group - Italy

Head Office and Warehouse
CTA S.p.A.
Viale Lidice, 40
10095 Grugliasco (TO) - ITALY
Ph. +39 011 314 51 11
info@ctaspa.com

www.ctaspa.com



Trickling filters: high energy efficiency for wastewater treatment

One of the major challenges for ensuring safe and sustainable water supply

Antonio Ieraci, General Director
ENEXIO ITALY

Adequate treatment of wastewater is one of the major challenges for ensuring safe and sustainable water supply. Hence, it is essential that wastewater treatment plants are energy efficient. Trickling filters have been a valid solution for wastewater treatment for over a century and have benefited from continuous technological advancements. They are easy to manage, reliable, and energy-efficient, meeting the current treatment standards in many countries with short investment payback times.

The trickling filter is a treatment system where an active bacterial biofilm grows on the structured media fillings. Wastewater to be purified is allowed to percolate over these surfaces. The inlet wastewater is distributed over the upper surface of the filter using rotating distribution arms, which can be hydraulically or electrically operated.

"Trickling filters have been a valid solution for wastewater treatment for over a century and have benefited from continuous technological advancements

Oxygen is supplied to the system through ventilation openings at the bottom of the filter, allowing air to circulate freely. The support structure is typically composed of parallel beams placed on plastic feet or cement walls.

Advantages of trickling filters

These filters effectively treat wastewater to high standards while maintaining very low operational and maintenance costs, thanks to the following main advantages:

1. Simple and Reliable Process:

- Trickling filters operate as aerobic treatment system, where microorganisms grow on structured media made of robust plastic and biologically remove organic matter from wastewater. The attached biomass is harder to be washed away and it is more resistant to poisoning and process shocks.
- This simplicity contributes to lower operational complexity and maintenance requirements.

2. Lower energy consumption:

- Unlike more energy-intensive processes (e.g., activated sludge systems or membrane bioreactors), trickling filters are Energy Efficient because the oxygen demand is covered by natural convection (no need of forced ventilation or aeration) and depending on the geodetical conditions, pumps can be avoided by designing gravity, water feed.

"The trickling filter is a treatment system where an active bacterial biofilm grows on the structured media fillings

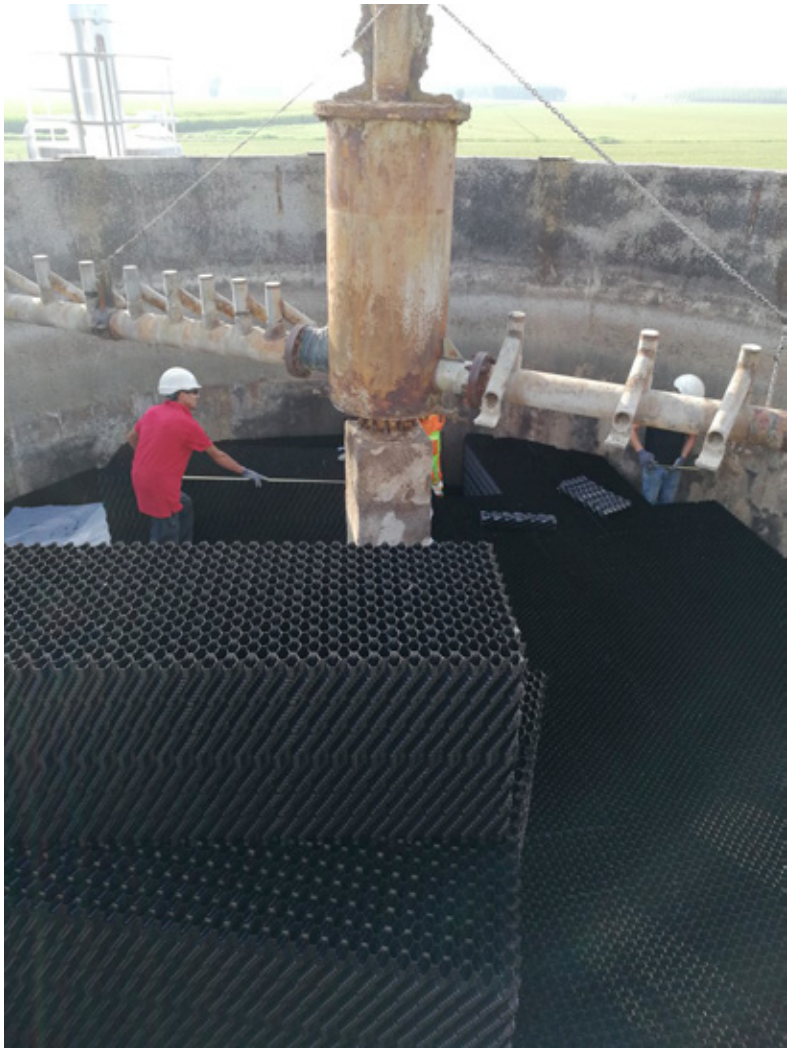
- They rely on natural air movement, reducing energy consumption. Moreover no sludge recirculation is necessary, thus further reducing pumping power.

3. Durable Components:

- The filter medium is durable and long-lasting.
- Maintenance costs related to replacing components are minimal.

4. Moderate Skill Level Needed:

- Managing and operating trickling filters requires a moderate level of technical expertise: there is no need for chemical reagents dosing and few mechanical components are used, they have direct and



open access and basically require just periodic check or cleaning.

- Operators can handle routine tasks without extensive training.

5. Low installation area requirements:

- Secondary sedimentation tanks can be kept smaller because the particulate matter discharged out of trickling filters is more dense and easier to be settled.
- The structured fill media can withstand high structural loads so the trickling filter can be developed in height instead of width, further reducing the required foot-print.

6. Cost-Effective Medium:

- The structured media made of robust plastic is relatively inexpensive.
- Replacement costs are low compared to more complex systems.

Recently, ENEXIO ITALY was awarded a contract to supply the structured fillings for a series of trickling filters used in the treatment of municipal wastewater in a large urban area in Peru. Municipal wastewater typically exhibits stable characteristics with relatively low concentrations of biodegradable organic substances and a good balance of nutrients. This is a typical application where trickling filters can be used not only for preliminary organic load removal but, if adequate space is available, also to achieve high purification yields and potentially nitrification and, in more advanced cases, even denitrification.

“Recently, ENEXIO ITALY was awarded a contract to supply the structured fillings for a series of trickling filters used in the treatment of municipal wastewater in a large urban area in Peru

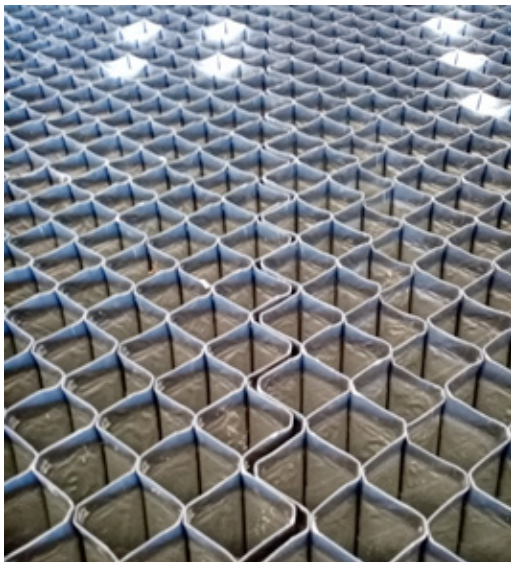
In this specific project, three identical trickling filters were required, dedicated solely to organic load removal, down below the local emission limits.

System Components

Following pretreatment involving screening and air flotation to remove larger suspended solids, fibers, and FOG (Fat, Oil, Grease)—all components that could affect the proper functioning of a trickling filter—the wastewater is collected in a common distribution well. Two dedicated booster pumps feed each trickling filter. A trickling filter is composed of a base support structure, containment walls, top distribution system and

most importantly the fill media.

- The base support structure plays a crucial role in maintaining the stability and functionality of the filler. Structural requirements must be calculated in order to withstand the weight of the media fouled by microorganisms and any additional loads. The base structure is not only essential for maintaining stability, but also for promoting efficient treatment and preventing blockages that could hinder wastewater flow or air circulation. Between the base support structure and the pavement, the underdrain collects the treated wastewater from the filter and it creates a plenum (an empty space below the media) that facilitates oxygen transfer throughout the trickling filter. A larger and open underdrain area promotes better air distribution.
- The containment structure could also be avoided if self-standing plastic structured media is installed but some water spillage could be observed in this case. This is why light walls are generally sufficient to safely contain all the water flow. Thicker concrete walls are needed when motor driver rotary distributors are used, as in this project.
- The top distribution system provides for uniform distribution of wastewater over the media. Rotary distributors can be hydraulically or mechanically driven as in this project. Modern electric drives provide the ability to control rotational speed, so that maintaining a relatively slow rotational speed and high flushing intensity several benefits can be achieved such as biofilm thickness control, macro fauna control, and increased wetting efficiency.
- ENEXIO ITALY's structured fillings, such as



BIOpack, are the heart of the system and they are specialized for different applications, like roughing applications for handling high concentrations of pollutants, total carbon removal treatment like in this project, nitrification even at very low concentrations. ENEXIO ITALY's expertise is available to clients for intelligent plant design and operation, selecting the most appropriate media for each application. Each channel type and size is designed to work at best in predetermined water hold up ranges, so that the full surface of the structured media is wetted by the percolating water but also that the water quantity does not flood the channels completely.

- Plastic media, available as cross-flow or vertical flutes, provide for better oxygen transfer, and are lighter than rock, so media can be deeper and the water and air flow is much better. Vertical-flow media are used in roughing and industrial applications: they are the least likely to plug and grant the best ventilation but redistribute wastewater only at module interface and develop smaller specific

surface. In this project, cross-flow media are used because pollutant concentrations are not so high and a larger developed surface is preferred.

Moreover, ENEXIO ITALY provides a reinforced top layer of structured filling in order to let operators walk on it. Sometimes clients prefer to install an additional FRP grating layer on top of the structured filling so to avoid any possibility to damage the channel entrance with any maintenance tools or personnel boots, but this is not mandatory.

The pedestrian-accessible top layer in the percolator filter design offers several advantages for inspections:
Ease of Access: By making the top layer pedestrian-accessible, maintenance personnel can easily reach the surface for routine inspections which simplifies visual checks, sampling and testing and any necessary adjustments.
Visual inspection: inspectors can visually assess the condition of the fillings, look for signs of clogging, and identify any irregularities. This direct access allows them to spot issues promptly and take corrective actions.
Cleaning and maintenance: if cleaning or maintenance is required, personnel can easily remove debris, clean channels or address any blockages.
In summary, the pedestrian-accessible top layer enhances the overall operability, efficiency, and reliability of the percolator filter system during inspections and maintenance activities.

System Design

In order to implement a robust design, the input parameters must be clearly fixed such as total wastewater flow to be treated, pollutants concentration, local temperature and other project specific needs. There are some fundamental subjects to keep in consideration when designing a trickling filter:

- The BOD loading rate:
  The Biochemical Oxygen Demand (BOD) loading rate in wastewater treatment represents the amount of organic matter (expressed as BOD) that enters a treatment system per unit of time per unit of volume. It quantifies the biodegradable organic load in the influent wastewater related to the volume available for treatment and it is normally expressed in kgBOD/m3/day.
  Higher BOD loading rates indicate greater organic pollution load entering the treatment system and require special materials and precautions. The treatment process aims to reduce this BOD load in the plant effluent in order to meet the local discharge standards.
  High BOD loading rates may lead to system overload, reduced treatment efficiency, and

increased risk of effluent violations. On the contrary low BOD loading rates are adopted for municipal wastewater treatment, which are much less concentrated than industrial wastewaters, in order to meet low effluent concentrations. Anyway, a too low BOD loading rate may indicate underutilization of treatment capacity.

Monitoring BOD loading rates helps operators assess the system's capacity and performance. It guides decisions related to process adjustments like water distribution, recirculation, aeration, and allows evaluation of overall treatment efficiency.

BOD loading rates vary based on influent characteristics, flow rates, and treatment plant design. Properly designed treatment systems balance BOD loading rates with available microbial activity according to the specific fill media characteristics.

In fact each channel type and size is suited for different organic loading ranges. Larger channels and vertical fluted channels are needed as BOD loading increases.

- The Hydraulic Loading Rate (HLR):

  The hydraulic loading rate refers to the volume of wastewater applied to a treatment system per unit of time per unit of horizontal area. It quantifies the flow rate of wastewater through a specific treatment component and it is normally expressed in m3/m2/hour.

  The HLR determines how much wastewater a treatment system handles and it affects the contact time between wastewater and treatment media (such as soil, filter beds, or biological reactors), as well as the washing force applied to the fill media.

  From an operational point of view, high HLR results in a smaller installation footprint and provides strong flushing force to remove the spoil film but may lead to inadequate treatment due to insufficient contact time, resulting in poor effluent quality.

  On the contrary, low HLR provides longer contact time for treatment and thus ensures higher treatment efficiency but it requires larger installation footprint.

  Treatment system designers consider HLR during system sizing and layout because while systems mut be able to accommodate fluctuations, balancing HLR with treatment efficiency is crucial.

- The flushing factor

  Generally, the higher the organic loading, the greater the flushing intensity required. Although many trickling filters have hydraulically driven distributors, some distributors are equipped with mechanical or other speed controls, as it is in this project. As a result, speed-control distributors now often allow normal operational speeds ranging from 4 to 10 minutes per revolution. More importantly, many speed-control distributors allow specifying a regular (daily or weekly) "flushing" speed that may slow the distributor to more than 60 minutes per revolution.

  Another design topic is determining the number of arms in the top distribution system: reducing it results in higher flow from each arm, thus increasing the local flushing force brought by the percolating water. This is useful because the oldest (and less active) portion of the biological film detaches from the media surface and is flushed to the bottom of the filter. Excessive biofilm thickness can impair oxygen transfer and limit overall treatment efficiency. This flushing procedure avoids the clogging phenomenon, which is accumulation of excess biomass or suspended solids on the filter media surface, resulting in loss of treatment and other problems.

  The specific flushing rate depends on the filter design, media type and organic loading.

In conclusion, ENEXIO ITALY successfully addressed the project requirements by implementing the following strategies:

1. Careful Internal Stratigraphy Design:

- ENEXIO ITALY meticulously designed the internal structure of the filter.
- Higher thickness of the foil media were

considered where operational loads were higher.
- The top layer was made pedestrian-accessible, allowing for periodic inspections.

2. Structured Filling Combination:
- ENEXIO ITALY proposed a combination of structured fillings.
- The selected fillings were cross-flow, ensuring uniform distribution of water, sludge removal and air circulation.

3. Optimal Support System and Filling Material:
- ENEXIO ITALY recommended the best match between the base support system and the filling material in contact with it, in order to avoid clogging and maximize oxygen transfer.

4. Top Rotating Distributor Configuration:
- ENEXIO ITALY advised on the optimal operating configuration for the top rotating distributor.
- This combination achieved both uniform feeding and effective cleaning force.

These measures collectively enhanced the expected performance and longevity of the trickling filters, ensuring efficient wastewater treatment.

Antonio Ieraci

After graduating in Computer Science and Technology - Digital Communications at the University of Milan, Antonio Ieraci obtained an Executive MBA Master at the MIP Business School of the Polytechnic of Milan. Winner of the AHK Italian-German Chamber of Commerce contest for the Best-case project “Efficiency made in Germany” relating to best practices on energy efficiency in the industrial and commercial fields. His work is focused on the search for innovative solutions in the sustainability field for the water treatment and heat exchange sectors. He is National Councilor of ANIMP and National President of Federmanger Youth, the association that represents all C-Level on Italian Industry. He is currently the General Director of ENEXIO ITALY.

Accessories for connecting flame-proof motors

Connection of “Ex- db” electric engines with “Ex- db” connection box to the power line using electrical connection accessories

Andrea Battauz, R&D Manager
Cortem Group

Increased safety electric motors or flameproof electric motors with increased safety connection box, which facilitate the connection of this equipment to the power line, have been on the market for many years. These very common motors are often chosen by many designers.
In this article we will delve into the connection of “Ex- db” electric motors with “Ex- db” connection box to the power line using electrical connection accessories, such as adapters, conduit sealing devices, cable glands and flexible tubes.

“Motors completely made in explosion-proof protection are still widely used and very present in plants. They are increasingly accompanied by increased safety ‘Ex- eb’ engines or ‘Ex- db’ engines, with an enclosure with ‘Ex- eb’ increased safety connection terminals

In this regard we will give some examples of system applications, remembering that the choice of these accessories, as is the case for cables, is the responsibility of the designer who must scrupulously apply what is foreseen by applicable edition of IEC/EN 60079-14 [1].

Connection to a plant with conduit system

In sites classified as at risk of the presence of explosive atmospheres, systems with metal protective tubes, commonly known as conduit system, are very common. Single insulated wires are usually laid inside these pipes, as in **Figure 1**.

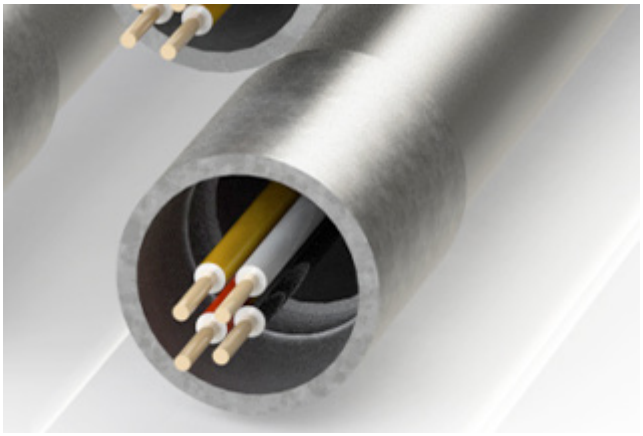


Figure 1 : Conduit tubes with single-core cables inside them

In **Figure 2**, we see the connection of a motor with flameproof connection box. To prevent a possible explosion inside the flameproof equipment from spreading to the system, a conduit sealing device was used [2]. Another important connecting element is the three-piece unions. This adapter can be used to give the right inclination to the sealing fittings, necessary for pouring and filling resin inside. Finally, the connection with the system in metal ducts is made with a flexible tube which, while maintaining high mechanical protection, allows the transmission of vibrations produced by the machine in operation to be reduced. It is a good rule to prevent any vibrations produced by the machine from being

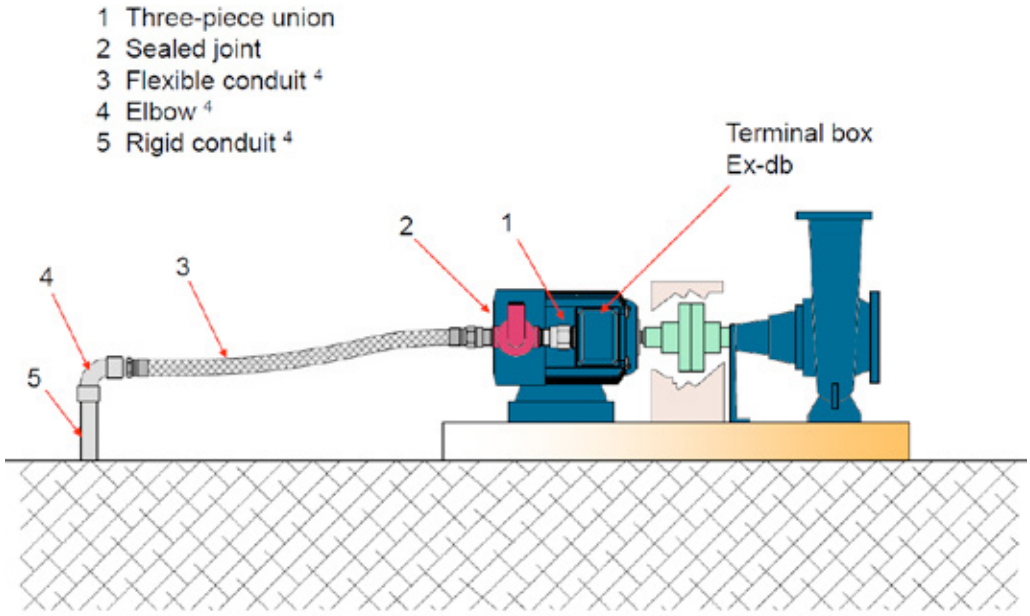


Figure 2 : Example of connection between a flameproof motor and a conduit system

transmitted to the pipes and boxes of the conduit system, therefore the connection to the machine must be carried out with flexible tubes with a metal core with mechanical characteristics equivalent to those of rigid tubes [3].

Connection to a cable system

If the system to which the machine is connected has visible cable laying, the entry into the connection box with cable glands must be made by applying the selection criterion of the latest edition of EN 60079-14. The main discriminant introduced by this selection criterion is the type of cable; in fact, the solid filling material [4] between the individual conductors of a multi-core cable must not allow the flame to pass in the event of an explosion and, at the same time, must deform without being crushed by the pressure action exerted by the cable gland rubber.

When a cable is not equipped with these characteristics, a barrier type cable gland must be used. In this device the installer, after eliminating sheaths, screens, and filler from the cable for a section, throws a two-component

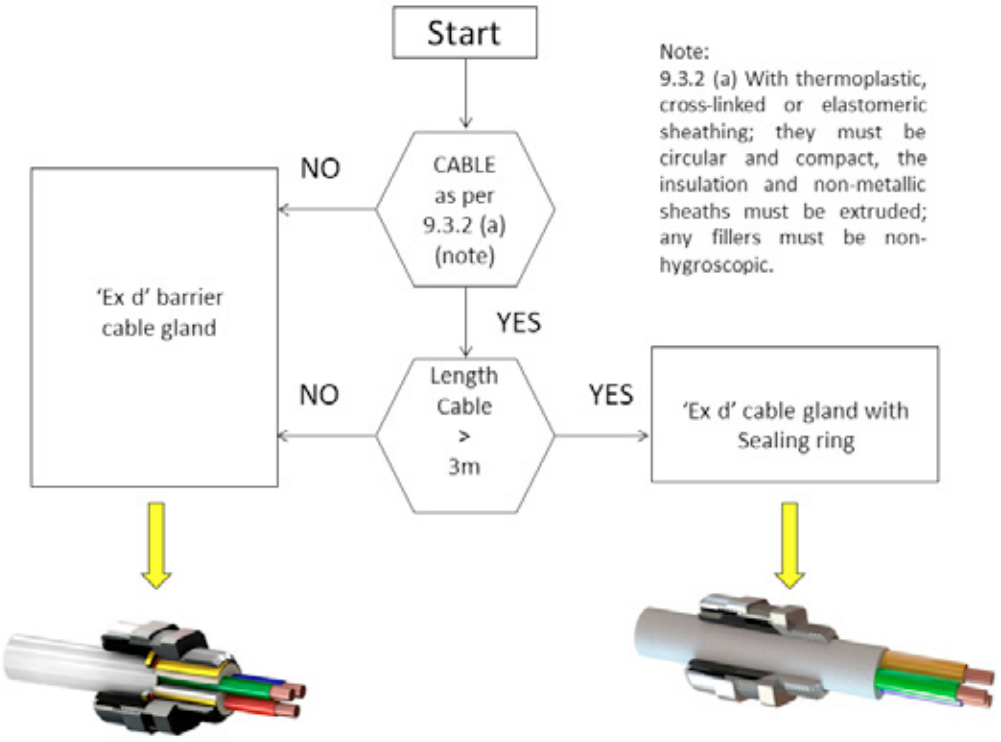


Figure 3 : Flow chart based on the EN 60079-14:2014-03 Standard[1]

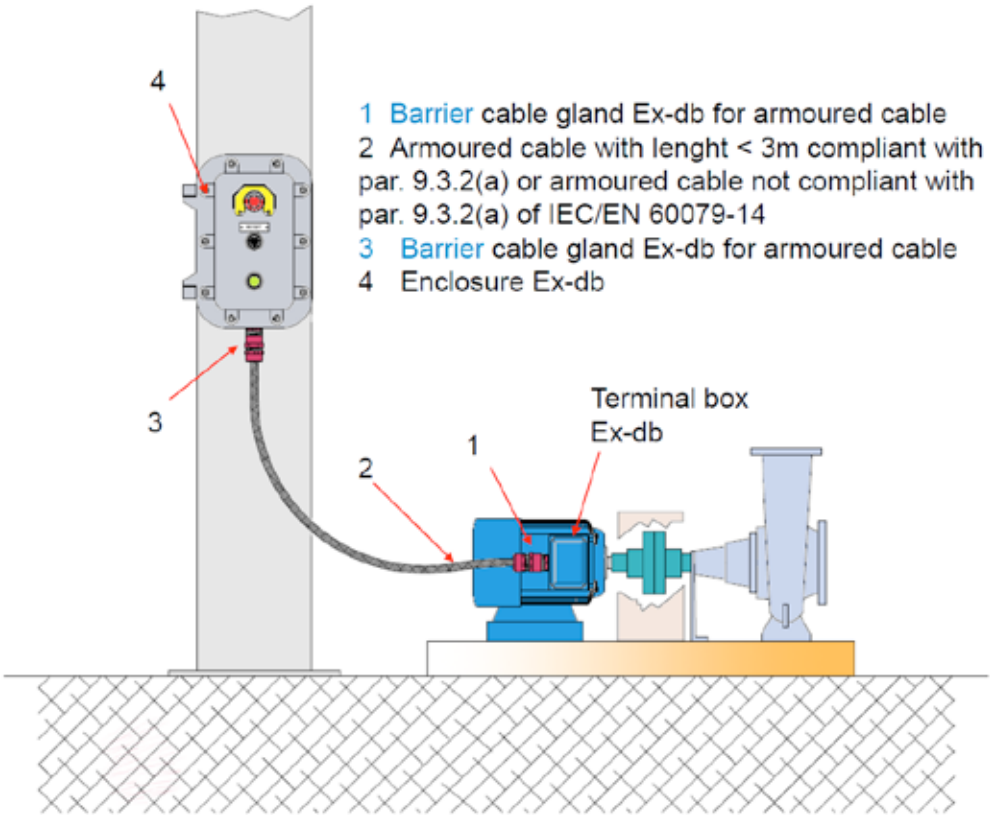


Figure 4 : Example of connection of a vibrating machine with barrier cable gland

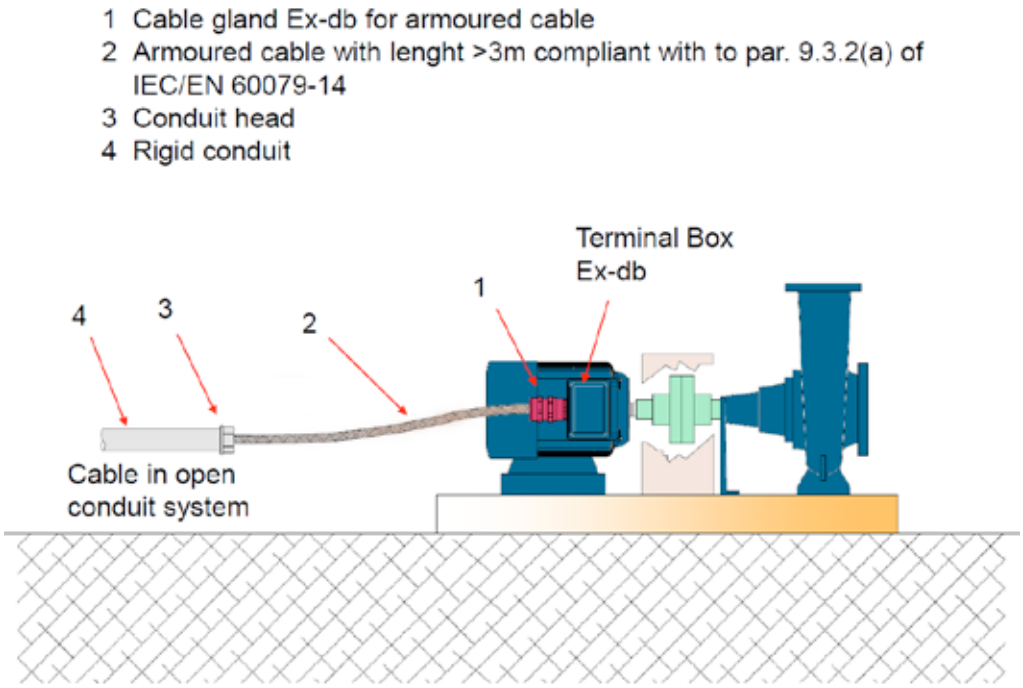


Figure 5 : Example of connection of a flameproof with cable gland with rubber

resin into a special bushing. This operation replaces the solid filler material between the individual single-core cables with resin, eliminating the gaps.

Figure 4 shows the connection of a vibrating machine using barrier cable glands. When, as in this case, the cable has a length of less than 3m or does not have a filling material as required by the standard, the use of the barrier cable gland is expected on both the motor and system sides. Armored cable is often chosen in sections where the cable is exposed for greater protection from mechanical risks.

However, if the cable is sufficiently long (>3m) and meets the requirements of the standard [5], a cable gland with gasket can be used. Also in this case, it is advisable to use an armored cable to increase the level of mechanical protection of the cable.

Figure 5 shows the connection: if, after a visible section, the cable continues in a metal protective tube, the cable is said to be laid in an open conduit system.

Conclusions

Motors completely made in flameproof protection are still widely used and very present in plants. They are more and more accompanied by increased safety “Ex-eb” motors or “Ex- db” motors, with an enclosure with “Ex- eb” connection box.

Notes and bibliography

1 - Par. 10.6.2

2 - The conduit sealing device the system into an equipment side, where Ex equipment and/or components are mounted, and a system side where line accessories consistent with EN 60079-14 and relevant national legislation are required.

3 - Extract of the CEI 64-2 standard, page 86 6.1.01 (8) now replaced by CEI EN 60079-14, in the latter there are no prescriptions in this regard. However, this excerpt still makes absolute common sense.

4 - CEI 31-108 Fig. 10.6-B

5 - EN 60079-14 9.3.2 (A) or better explained in the guide CEI 31-108 9.3.2 (A)

Andrea Battauz

After graduating in mechanical engineering, Andrea Battauz worked on the design of robotic machines and automation and, since 2004, he approached the ATEX Directive, and the design of equipment intended for explosive atmospheres. In 2008 he joined Cortem Group where he developed new explosion-proof products, specializing in signaling and lighting devices based on LED technology. He also carries out training activities on topics related to explosion protection. Since 2010 he has been a member of the national Italian committees CT 31 and SC 31J. Today he is the R&D Manager of Cortem Group.

CJ ICM LOGISTICS

www.cj-icm.com

PROGRESSIVE

Success of TC2 Group's collaboration with KT-Kinetics Technology for ENI's Casalborsetti project

Establishing one of the world's largest CO_2 storage sites and the largest in the Mediterranean

Gianluca Borraccino, CEO and Founder
TC2 Group

"Leveraging the vast capacity of the Ravenna CCS hub, ENI's Casalborsetti project in Ravenna, Italy targets decarbonizing hard-to-abate industries like cement factories and steel mills and establishing one of the world's largest CO_2 storage sites

In an era where environmental sustainability is paramount, industries worldwide are under increasing pressure to curb their carbon emissions. Refineries, despite their advancements in efficiency and technology, still contribute significantly to carbon emissions. However, emerging solutions such as carbon capture and storage (CCS) offer promising avenues for reducing carbon footprints in refinery operations. In this article, we delve into the significance of carbon capture for refineries and explore its implementation to achieve tangible emissions reductions.

Carbon Capture and Storage

Carbon Capture and Storage (CCS) is a crucial technology for combatting climate change by capturing and storing carbon dioxide (CO_2) emissions from industrial activities and power generation. It involves capturing CO_2 from large sources like power plants and industrial facilities, transporting it to secure geological formations, and storing it underground to prevent its release into the atmosphere. CCS technology consists of three main stages: capture, transport, and storage, each tailored to different industrial processes. While CCS offers significant potential for reducing CO_2 emissions, its widespread adoption faces challenges such as high costs, technological readiness, and regulatory frameworks. Nonetheless, ongoing research and international collaborations are advancing CCS technologies, making them key players in global climate change mitigation efforts. CCS technologies encompass various methods tailored to different industrial processes, including refineries.

Decarbonizing hard-to-abate sectors

"Hard-to-abate" sectors face challenges in reducing greenhouse gas emissions due to their heavy reliance on fossil fuels and carbon-intensive processes. Examples include cement, steel, chemicals, aviation, and shipping industries. Limited low-carbon technology options, energy-intensive processes, and fossil fuel dependence hinder decarbonization efforts. Solutions include enhancing energy efficiency, transitioning to renewables, utilizing carbon capture and storage (CCS), and exploring alternative processes.

Introducing TC2 Group

TC2 Group stands as a technical advisor and consultancy partner, specializing in Engineering, Procurement, and Construction (EPC) services. Committed to delivering efficient and innovative solutions, TC2 serves companies worldwide in managing their critical processes with excellence. With a history marked by innovation and a global perspective, TC2 continuously evolves to meet the dynamic needs of its clients. From Vendor Management to Engineering and Assurance Services, TC2 offers a comprehensive suite of offerings to support businesses in various industries We are entrusted by esteemed EPC clients such as Baker Hughes, KT, Tecnimont, Petrofac, Chiyoda, Technip Energies and also many Italian packagers to provide assistance in vendor management and engineering services.

Future outlook

Despite challenges, refineries are increasingly adopting carbon capture technologies due to advancements, environmental awareness, and supportive policies. This trend reflects a shift towards sustainability and resilience in the energy sector. By embracing carbon capture, refineries can reduce emissions and align with evolving regulations and societal expectations.

"TC2 Group's expertise in Vendor Management and Engineering Services pairs seamlessly with KT's innovative solutions, showcasing a commitment to excellence and sustainability in the global energy transition

ENI Casalborsetti project

In the energy hub of Ravenna, Italy, a significant initiative has been launched by Eni and Snam, leaders in energy and environmental management with collaboration of Maire Tecnimont (Kinetics technology) to construct a hub for Carbon Capture and Storage (CCS) in the depleted gas fields offshore Ravenna, with a potential storage capacity of 500 million tonnes of CO_2. This project addresses emissions reduction in 'hard-to-abate' sectors such as steel, cement, and chemicals, while fostering a national supply chain with advanced technology for decarbonization. The program's first phase, commencing in 2024, involves constructing a plant capable of capturing and storing 25 thousand tonnes of CO_2 annually. This CO_2 will be captured at Eni's natural gas treatment plant in Casalborsetti, then transported to the Porto Corsini Mare Ovest platform for injection into the exhausted gas field offshore Ravenna. Phase 2, anticipated in 2026, will scale up to 4 million tonnes annually, with

projections exceeding 16 million tonnes annually beyond 2030. This initiative stands as a pivotal milestone in Italy's commitment to sustainable energy practices, harnessing the potential of the Adriatic Sea's natural gas reserves.

Through these strategic partnerships and a shared commitment to innovation, Eni, Snam, and other key stakeholders are poised to redefine the future of energy production and consumption in Italy and beyond.

Overview of TC2 services to Maire Tecnimont and KT-Kinetics Technology for the ENI Casalborsetti project

TC2 Group takes pride in its proficiency, providing Vendor Management Services and Engineering Services to Maire Tecnimont and KT - Kinetics Technology.

TC2 Group Vendor Management service optimizes operations by reducing costs and lead times through supplier assessments, ensuring compliance, and managing delivery risks. Meanwhile, our Engineering Services provide customized solutions tailored to each client's needs, minimizing economic risks and maximizing project success.

For the ENI Casalborsetti project, TC2 Group provided integrated services throughout the component procurement process. We deployed a proficient team of experts, tasked with coordinating operational activities, overseeing and review suppliers' technical documentations and quality control procedures, managing delivery and logistic assurance activities generating detailed reports. Additionally, TC2 Group facilitated operational coordination for KT vendor management team, conducting over 25 technical specialists across various material suppliers. Our commitment to ensuring supply conformity involved deploying highly skilled inspectors well-versed in purchasing specifications and international standards.

Gianluca Borraccino

Gianluca is the CEO and Founder of TC2 Group, a technical advisor and consultancy partner, specializing in the fields of Engineering, Procurement, and Construction (EPC) offering Vendor Management, Engineering Services, and Assurance services across multiple industries. With a background in Project Management, Delivery Assurance, Inspection Engineering and Quality Management in the oil and gas industry, Gianluca brings valuable expertise to TC2.

Designed for the future.

Advanced Engineering Solutions Provider

Since 2013, we have been helping companies and supply chains to improve their business performance. We are a technical advisor partner specializing in consultancy services for Engineering, Procurement and Construction fields.

tc2 | Vendor Management Services

TC2 Vendor Management Services optimize supply chains through continuous improvement, cost reduction, and timely delivery.

tc2 | Engineering Services

TC2 Engineering Services provide specialized operational and technical-scientific consultancy.

tc2 | Global Register

TC2 assurance services, operating under the name Global Register, deliver high-quality Certification and Testing Services.

info@tc2services.com

www.tc2group.it

Via Pasubio 5, Dalmine, Bergamo 24044, Italy

+39 035 4517409

Join our LinkedIn pages to keep up to date with TC2 Group.

Digitalization with mobile technology and digital factory management

A case study and an Integrated survey with SLAM technology

Luigi Tornaghi, Sales manager and founding partner of 3Units
Enrico Trivini Bellini, Founding Partner at WESCAN and 3Units partner

A notable chemical plant in northern Italy, which covers an area of approximately 160,000 m^2, commissioned us to laser scan the plant with its consequent modelling. The problem, common to very old systems, is that the documentation in hand did not reflect the "as-is" conditions and represented an inadequate basis for the management/maintenance of the system which, as a consequence, can lead to safety problems or reworks which delay projects and increase costs. The scanning activities were performed with "mobile SLAM" technology which guarantees a reduction in time and costs compared to traditional methods.

Our solution

We have developed a workflow that allows us to obtain complete, accurate and reliable digitalisation of complex systems in less time. In approximately two days a complete survey was carried out with a mobile laser scanner, integrated with traditional support topography and geo referencing.

> "Developing a workflow that allows obtaining complete, accurate and reliable digitalisation of complex systems in less time

The introduction of mobile technology in an industrial environment has allowed the digitalisation of all structures, guaranteeing speed and accuracy. The survey activities involved a team of four operators.
Initially, a topographic polygon was laid out to cover the entire area, the apexes for georeferencing were drawn and the control points (specific points materialized on the ground or on elevated surfaces) necessary to improve and guarantee the required accuracy of the point cloud were measured.
An instrument equipped with a double LIDAR sensor (2 x 300,000 points/second and 100 m range) equipped with 4 full HD cameras (4x20 MPixel) was used for the mobile survey.

3Units

3Units is a sales and management company located in Canton Ticino (Switzerland), which collaborates with primary companies for plant engineering and laser scanning activities; operationally we are characterized by our extreme organizational flexibility, flexible working hours that can be adapted to the needs of the project, a reduction in time and costs which is reflected in the services and systems created.
Our staff is mainly composed of resources with more than twenty years of experience in the commercial and marketing sector, plant engineers, professionals in the maintenance engineering and software development fields. The sales department, in addition to being enriched by the significant collaboration with Hexagon AB, world leader in the supply of software for infrastructure engineering, is mainly involved in: plant engineering and 3D modelling, analysis engineering, laser scanning activities and BIM design, project management and project control activities, software and services for digital automation, digital twin, maintenance engineering and asset management software and services, software solutions and services for productivity activities, logistics and port services.
The Company is registered at the CC-TI Chamber of Commerce of the Canton Ticino, ATED ITC Ticino and ANIMP National association of industrial plant engineering.

The limited weight, less than 9 kg, and the particular ergonomics simplified the field work and allowed to always work in safety from the ground.
By using the mobile scanner in parallel with a colour point cloud, it is possible to obtain a virtual tour of high resolution photographic spherical images.
Once the field activities were completed, the post-processing phase was started for the creation of the final dataset; the data from the mobile laser scanner were processed by entering the coordinates of the control points previously acquired for the verification and correction of the final trajectory and then reprocessed to obtain the final point cloud.
The entire dataset, filtered, cleaned and coloured, was then published and made accessible on a web-based platform for consultation and measurement.

In the platform, the metric data of the point cloud are completed in high resolution spherical photographic images, giving full understanding and insight compared to a traditional point cloud.

Tagging

All the items and assets of interest were then geotagged within the platform, linking additional information such as ID, parameters and characteristics as well as attachments in different formats (text, images, audio, video or HTML) to the coordinates of the surveyed object, which can then be synchronized with maintenance management systems such as HXGN EAM for example.

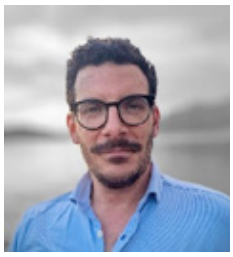
Modelling

Starting from the detailed dataset obtained, three-dimensional models of piping, equipment, pipe racks and all elements useful for a detailed understanding of the “As-Is” of the existing system were extracted.

The modelling performed in CADWorx® was fully supported by the detail and richness of information inherent of the point cloud. Point cloud modelling can also be managed with Hexagon SMART 3D®, Aveva E3D® and generally with the most common CAD platforms.

Luigi Tornaghi

Luigi Tornaghi, sales manager and founding partner of 3Units, Director of the Sales and Management Department, with over 25 years’ experience working with companies that provide software solutions to several business industries. Special current focus on sales and marketing of software and plant design solutions.



Enrico Trivini Bellini

Enrico Trivini Bellini, founding partner at WESCAN and 3Units partner for laser scanning and BIM modelling activities.

Solutions for Industrial Facilities

3Units was founded by a group of passionate and enthusiastic professionals who believe that their various different skills in the IT and three-dimensional plant design sectors can contribute to the creation of software solutions which stand out because of their quality, skill and innovation.

3Units is a sales and management company located in Canton Ticino (Switzerland), can develop projects with the major softwares on the market, while the laser scanning department also works with the new mobile laser scanner technology which allows to obtain high performance combined with a reduction in time compared to traditional technology.

3UNITS

3units.ch

At the forefront of the ball valve industry for over thirty years

Indra, a leader in the design and manufacture of ball and needle valves in various configurations as well as of tailor-made products

Emilio Renato Imbriani, Managing Director
Indra Srl

Indra Srl was established in 1987 in Milan. Today, it's a leading company in designing and manufacturing ball and needle valves in various configurations, including Floating and Trunnion ones. These valves, available in Single and Double Block and Bleed versions, cater to specific applications ranging from high-temperature to hydrogen cryogenics.

"Indra stands out from the crowd for its tailor-made products

The company's flagship products also include instrument manifolds built to the highest standards of quality, safety, and efficiency.
Its accurate production capacity, combined with efficient technical, logistics, and support services, ensures high-quality standards for an "all-italian-made" product.
Moreover, Indra stands out from the crowd for its tailor-made products.

Quality requirements

To maintain superior quality standards, Indra uses first-rate italian and european raw materials, mostly forged (bypassing China's or India's supply chains). Moreover, the company meticulously oversees every

production stage, from engineering to manufacturing, and conducts a comprehensive range of in-house tests.

Excellent quality is a must. Therefore, selecting raw materials is essential to ensure a high-performing product.

Indra's experience in understanding standard technical solutions, its innovative choices, and maximum versatility enables the development of customised solutions.

> **"Indra's experience in understanding standard technical solutions, its innovative choices, and maximum versatility enables the development of customised solutions**

A team of specialised technicians can analyse and engineer even the most complex requests, ensuring tailor-made products.

Today, the company boasts state-of-the-art machining centres complemented by a CMM machine overseeing production at every step.

Every product is tested in the company's testing rooms.

Fields of application

Over the years, these solutions have allowed Indra to establish its presence in various industry sectors, including oil and gas, petrochemicals, LNG, and hydrogen.

Indra enhances its product range by including additional materials and accessories, positioning the company as a trusted and preferred supplier for many businesses. It offers comprehensive packages containing a variety of complementary products.

Moreover, Indra's solutions are used as components in high-tech systems and machines. That's why the company needs to ensure the utmost quality level.

Indra's new challenges: LNG and hydrogen

As part of its commitment to ongoing improvement and in response to changing consumer preferences, Indra has expanded its product offerings to include LNG and hydrogen, two rapidly growing industries.

This regards cryogenic valves, in particular, selected for major LNG projects, such as *Arctic and Yamal.*

In-house tests ensure quality and reliable cryogenic valves.

Hydrogen is another rapidly growing sector for which Indra has recently acquired a few projects, including

"Minerbio Storage Field" and "Tavazzano Thermoelectric Plant".
Even in this case, hydrogen valves are tested in our laboratory, which has been recently expanded to fit a Hydro/Gas test bench that can test valves up to 15,000 PSI.
Indra is committed to consolidating its position in these markets and developing solutions and strategies to be qualified by end-users.

Certifications

To meet the requirements of clients and the market, Indra has obtained a considerable number of technical certifications, including API 598 / API 6D / API 602 / PED 97/23/CE.
Moreover, as an ISO 9001, 14001 and 45001-certified company, Indra is committed to protecting the environment by reducing its environmental impact, energy consumption, and waste production.
Therefore, certifications are essential to ensure product conformity to the standards in force in EU and non-EU countries.

The international role

Indra has an international outlook. That's why, over the years, the company has built a sales network in strategic areas through selected distributors.
Participating in important events in the oil and gas sector highlights Indra's determination to establish itself as a major player in the Italian and international markets.

Indra products

Ball valves

In the oil industry, safety plays a crucial role, a prerequisite for developing the ball valve range. In the "DBB" version, they replace the traditional "Christmas Tree", combining several functions in one valve body. Besides improving the system's efficiency, these valves reduce costs and installation and maintenance times.
All valves can come with various accessories, such as lock systems and electric signals, improving safety and efficiency.

"SIL4" Modular Interlocking Manifold for HIPPS systems

"SIL4" Modular Interlocking Manifold is an exclusive product featuring high safety, efficiency, and quality standards in HIPPS systems. It is designed specifically for instrument control systems.
"SIL4" Modular Manifold stands out for the following advantages:

- obligation to perform a sequence of operations that never overlap;
- cost reduction of high-pressure systems;
- line protected from overpressure;
- reduced pollutant emissions due to high-pressure lines.

The junction box containing the “SIL4” Modular Interlocking Manifold is made of stainless steel and polyester to protect all the components.

Tailor-made valves

Indra manufactures customised products. The “DBB” Twin valve, for example, is made from a single block of various materials, from the most common Aisi 316L to exotic ones. Its super compact size makes it easy to mount process variable control instrumentation (pressure transmitters, pressure switches, pressure gauges, etc.) in small spaces. Moreover, “DBB” Twin valves have one connection to the process and two separate output connections, each made in the “DBB” configuration. Separating the output lines makes controlling the process with one instrument while maintaining the other possible. “DBB” Twin valves can come with separate inputs for two independent pressure lines. They are available in two versions: ball and needle.

“DBB” Twin valves stand out for the following advantages:

- compact installations;
- reduced system construction costs;
- continuous monitoring of process pressure;
- selection of materials;
- diameter and rating of the inlet flange ½” to 6” - #150 / #2500;
- Api 10000 special versions.

Emilio Renato Imbriani

Emilio Renato Imbriani, the Managing Director of Indra Srl, a company born in 1987 and grown over the years; a company that has been able to build its role as a valve manufacturer, becoming a point of reference for leading companies in the sector in tackling and solving plant engineering and reliability problems of the supplied products, first in the italian market, and later internationally.

Indra has always been characterized by the desire to overcome the boundaries of its comfort zone, with a competitive approach, essential to respond promptly to the requests of increasingly complex markets. Indra’s strategy is to offer high quality products, customized and created specifically to meet the particular needs of the customers.

indra VALVES - ITALY

Ball Valves

Tailor Made Design

A complete range of Ball Valves – SB, SBB, DBB –
for the highest standard demand of installation

- Oil & Gas
- Petrochemical
- Off-Shore Platforms
- LNG
- Hydrogen
- Energy

www.indra.it

GARBARINO®

CENTRIFUGAL AND POSITIVE DISPLACEMENT PUMPS
FOR
MARINE-OFFSHORE-NAVY-INDUSTRY

Member of CISQ Federation
RINA
CERTIFIED MANAGEMENT SYSTEM
ISO 9001 - ISO 14001

www.pompegarbarino.com

Pompe Garbarino S.p.A. Via Marenco, 44 - 15011 Acqui Terme (AL) - Italy - Tel. +39 0144 388671 - info@pompegarbarino.it

ALDAI ASSOCIAZIONE LOMBARDA DIRIGENTI AZIENDE INDUSTRIALI

FEDERMANAGER

TUTELA, RAPPRESENTA E VALORIZZA I MANAGER

ALDAI-Federmanager è la maggiore organizzazione territoriale del sistema Federmanager, polo di competenze e punto di riferimento per i servizi ai manager oltre che partner integrante del sistema industriale. L'Associazione Lombarda Dirigenti Aziende Industriali rappresenta e tutela oltre 14.000 dirigenti industriali sul territorio.

SCOPRI I NOSTRI SERVIZI

Perché iscriversi ad ALDAI-Federmanager?

- per essere protagonista del futuro della rappresentanza della figura manageriale e del dibattito sul rinnovo del Contratto Dirigenti Industria anche grazie alla partecipazione a Commissioni e Gruppi di lavoro
- per rafforzare le azioni a tutela della categoria e l'impegno a difesa del potere d'acquisto delle pensioni
- per godere di un sistema integrato di servizi e consulenze professionali, per la sfera personale e familiare
- per sviluppare un network qualificato di manager, protagonisti della business community e della società
- per ricevere la Rivista mensile "Dirigenti Industria", l'house organ dedicato alla categoria manageriale, anche in formato digitale

Scopri di più su **www.aldai.it**
o contattaci a **organizzazione@aldai.it**

Facing engineering challenges in the Iraqi desert sands

Thanks to the commitment to locally owned and operated assets, CJ ICM carried out logistics and transportation activities as well as heavy lifting at site for JGC Corporation's Basrah Refinery Upgrading Project

Gerald Ziebermayr, Managing Director
CJ ICM Italia SRL

utilizes owned and operated assets.

Thanks to this commitment to owned and operated assets, Japan's leading engineering company, JGC Corporation, approached CJ ICM for its Basrah Refinery Upgrading Project. Although the economy of Iraq is dominated by the oil sector, with the country holding the fifth largest proven crude oil reserves, its refinery capacity has been deteriorating during the turbulent years of war and unrest, with the country being unable to even meet domestic demand for gasoline. The Basrah Refinery Upgrading Project, totaling approximately 4 billion USD and financed by a loan from the Japan International

"For the last 15 years CJ ICM, a leading freight forwarding and logistics provider, has continued to invest heavily in assets, equipment, terminals and other logistics facilities in Iraq for handling industrial projects

Cooperation Agency, includes the construction of a new fluid contact cracking unit, depressurization distillation unit, as well as a light oil desulfurization unit. The upgrade is destined to increase Iraq's production capacity of petroleum products, reduce consequently the supply-demand gap and the outflow of foreign currency, bring modern international environmental standards to the country and improve the refinery's impact on the environment. The project site itself is situated adjacent to the existing Basrah refinery, approximately 550 km Southeast of Baghdad. The project started in 2021 and is scheduled to end in 2025.

Iraq has suffered enormously from wars and public unrest. However, increased political stability since 2013 has helped greatly to improve living conditions of Iraqi citizens. Consequently, optimism is blowing through the country's now thriving industries. This is backed by a series of Government reforms and public investments supported by international donors and financial institutions that have opened up a new era of opportunities, accelerating the pace of economic diversification, sustainable development and local job creation.

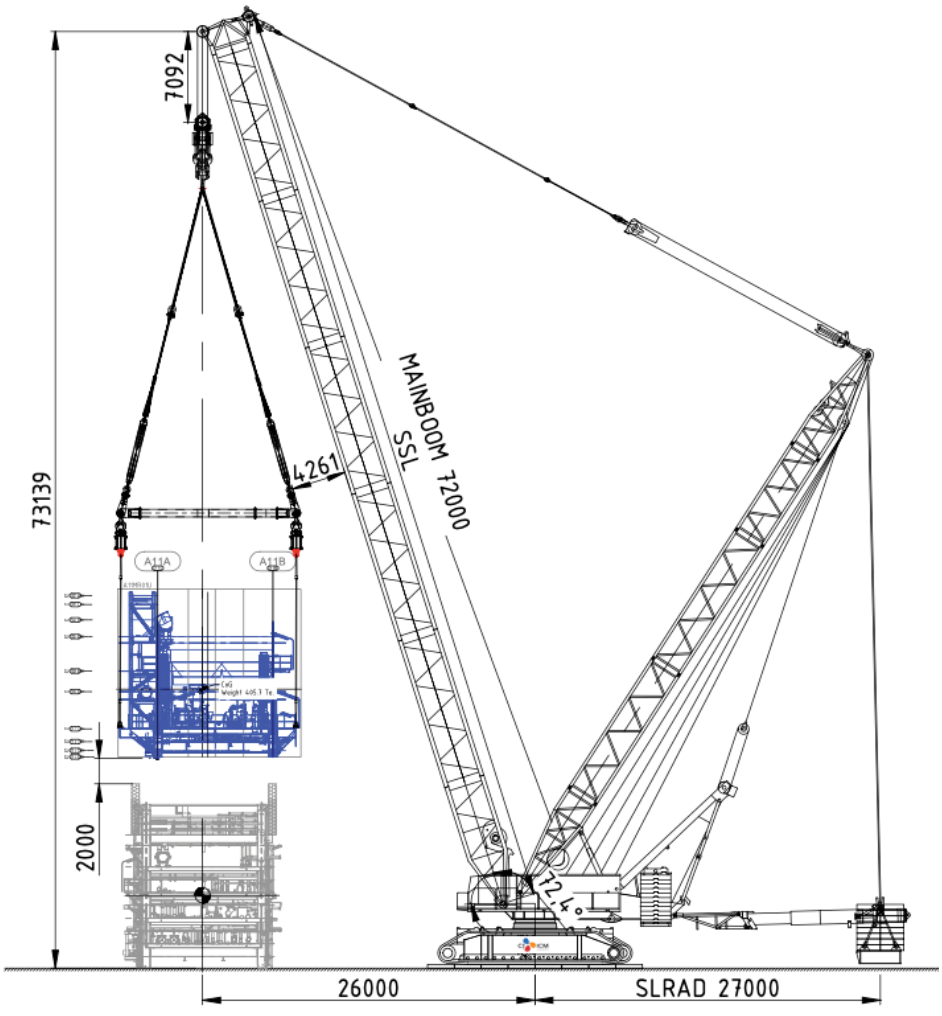
For the last 15 years CJ ICM, a leading freight forwarding and logistics provider, has continued to invest heavily in assets, equipment, terminals and other logistics facilities in Iraq for handling industrial projects. CJ ICM is now the largest local integrated logistics operator in the region that

CJ ICM's awarded scope for this project comprises logistics and transportation activities such as port handling, customs clearance and warehousing, as well as overall heavy lifting at site for final and mechanical installation. For this project alone CJ ICM mobilized a total of 480 SPMT axles, 502 modular axles, 205 prime movers, five crawler cranes with lifting capacity of up to 1,600 metric tons, as well as numerous other transportation and lifting equipment. Furthermore a total of 440 employees were deployed for this purpose, including engineers, crane operators, SPMT operators etc. In order to accommodate personnel and equipment at site, CJ ICM also constructed own temporary facilities. One of the major organizational challenges was the mobilization of the required equipment to Iraq itself. Thanks to its existing structure CJ ICM already had a significant presence in the country, but still hundreds of SPMT axles, modular trailers and cranes had to be brought into Iraq from around the world in due time.

"CJ ICM's awarded scope for this project comprises logistics and transportation activities such as port handling, customs clearance and warehousing, as well as overall heavy lifting at site for final and mechanical installation

Overall a grand total of 164,196 items weighing 153,570 metric tons with a volume of 1,036,569 cbm were shipped. To bring the cargo from Umm Qasr port to site, CJ ICM managed 8,535 container transports, 610 voyages with flatbeds, 471 with lowbeds and 240 hauls with modular trailers or SPMTs (self-propelled modular transporter). 200 pieces exceeded an item weight of 50 metric tons, with the heaviest 12 pieces ranging from 501 to 890 metric tons.

The 7 heaviest and most voluminous pieces transported from the port of Umm Qasr and then also installed at site were seven LPG bullets, each weighing up to 890 tons with 83 meters of length, 8.50 meters of width and 11 meters of height. For the transportation from port to site a total of 142 power lines had to be lifted or temporarily removed, other obstacles such as traffic signs or lights had to be dismantled and in order to guarantee maneuverability of the trailer with maximum



flexibility and to minimize the need of further civil works enroute, turntables were used over two independent sets of SPMTs of 48axle lines with four PPUs in 4-file open compound configuration. Furthermore grounding and installation at site proved to be particularly demanding due to the combination of cargo weight, ground conditions, limited space at site and the daunting environmental factors of Southern Iraq. Hereby the installation and pre-assembly of 99 heavy modules with unit dimensions up to 47.50 meters of length, 15.00 meters of width and 13.80 meters of height and weighing up to 672 tons each posed a series of unique challenges, each demanding careful consideration and strategic planning.

The installation of these heavy modules was divided into two categories. The first and relatively simple category comprised of modules which were to be installed without stacking, while the second category consisted of the stacking of lower and upper modules in two tiers at the final installation area, with module pairs reaching dimensions up to 28.30 meters of height and 821 tons of weight. These stacking operations required enormous precision, as the fabrication standards of the modules did not allow tilting of more than 2° and as the installation only allowed a 30 mm tolerance. Furthermore the single installation positions of the 99 heavy modules were to be found in different locations on site with varying distances. Applying a conventional stacking method would have required the employment of a heavy duty crawler crane at each of these locations. However, this method would have limited drastically the site construction progress, as the crane would have to be relocated each time for every single unit installation. Considering the time to dismantle and reassemble the crane for each lift this traditional method would have consumed too much time and would have had a negative impact on the project. In order to avoid these interruptions given the already demanding schedule, engineers from both CJ ICM and JGC developed a method using SPMT trailers and installing by jacking down the modules from the trailers directly onto their final foundations. In order to avoid relocating the crane for each lift, it was decided to stack the modules in a designated area of the job site and then move the two-tier stacked modules by SPMT trailers to their respective foundations. Needless to say, distance between the center of gravity of these stacked modules and the trailer increased significantly compared to moving just the lower or upper module singularly. Consequently one of the main targets of the engineers and operators was to carefully maintain the hydraulic stability of the SPMT trailers during the transport of the stacked modules from the stacking area to their foundations. It must be highlighted/It is pivotal/important to highlight that every module featured unique dimensions and weights together with a varying number of supporting beams, ranging from three to eight beams. Even if the modules were of identical size, the beam count differed in span length of the beams. As a consequence, the transportation process necessitated a tailored approach for each stacked module and for each haul from stacking area to foundation the SPMT axles had to be rearranged accordingly. This dynamic approach ensured that the trailers were adjusted to support the beams of each module accurately.

The installation and stacking procedure began with lifting the lower modules to above ground level using SPMT trailers. Once elevated to the maximum reach of the SPMTs, the modules were carefully positioned onto custom-designed stools. Subsequently, the trailer was lowered and released under the module. Cruciform steelworks were strategically placed over the trailer and again the SPMTs jacked up the modules to their maximum elevation. This cycle continued and gradually increased the modules clearance until sufficient space was achieved to assemble their legs.

"By leveraging innovative techniques and equipment, the construction teams were able to effectively overcome the unique challenges posed by the handling of these components in the unforgiving conditions of the Iraqi desert

Subsequently, lifting the upper modules from the top side with CJ ICM's 1,600 tons crawler crane at the designated stacking area also came with different challenges. The upper modules were lifted vertically from each lifting eye, differing from six to 16 lifting points per unit with two lifting eyes for each supporting beam. A load-spreading lifting frame between the module and the crane's hook was used. Due to varying dimensions and weights of the modules a standard single lifting frame with fixed dimensions could not have been utilized. This was overcome by building a customized lifting frame for this project, which could be configured prior to each lift by adjusting the length from 11.40 meters to 47.50 meters and the frame's width from 9.00 meters to 15.50 meters. This tailor made lifting frame alone weighed 240 tons.

As already mentioned, the modules could not be

tilted by more than 2° during lifting. Since each module had a different center of gravity and off-axis orientation in both the X and Y directions, hydraulic slings had to be strategically positioned atop the lifting frame to provide adjustable support to the Module's four corners, ensuring balanced lifting. Each hydraulic sling, or cylinder, was carefully calibrated to accommodate the specific weight distribution and dimensions of the respective module. Through precise calculation of the slings' stroke setup, engineers ensured optimal balance between the modular lifting frame and the load. Furthermore, to guarantee safety and compliance with tilt limits, rigorous testing procedures were implemented. Prior to lifting, all Modules underwent a comprehensive test lift to verify clearance from the ground within the prescribed tilting parameters.

Another challenging factor was installation tolerance. These massive modules had to be stacked within a 30 mm tolerance. This was mainly achieved thanks to the 90-degree axle movement capability of SPMT trailers. Furthermore tirfors were used from four corners for precise alignment. Although this direct installation approach with modular trailers was the optimum solution to save time and cost, not all modules were able to be installed by this method due to environmental obstacles hindering the movement of the loaded SPMTs at site. SPMT trailers could not access installation areas of 23 stacked modules, as the size of the modules exceeded the limits of the final turns to the installation areas. These modules had to be lifted from the top side by CJ ICM's 1600 tons crawler crane to get over the obstacles and placed on their foundations.

These methodical approaches applied by CJ ICM's engineers ensured the safe and efficient assembly and then installation of these heavy modules, minimizing potential disruptions and streamlining the construction process. By leveraging innovative techniques and equipment, the construction teams were able to effectively overcome the unique challenges posed by the handling of these components in the unforgiving conditions of the Iraqi desert.

Gerald Ziebermayr

As one of the founding directors of CJ ICM Italia SRL in 2016, Gerald Ziebermayr has been working as managing director for the company ever since. Nearly 20 years of management experience in logistics and industrial projects, a master's degree earned from the Vienna University of Economics and Business and the University of Trieste, as well as a Ph.D. from the University of Innsbruck give him the necessary insights to lead the Italian CJ ICM branch, which is highly specialized in project logistics and global heavy&special transports.

Advertisers

O.VE.S.T. S.r.l.

Advertising Agency
O.VE.S.T. s.r.l.
Tel. 02 5469174
ovest@ovest.it

INDUSTRIAL PLANTS

May 2024
Special issue of "Impiantistica Italiana", n. 3

Printer
Litotipografia S.M.
20032 Cormano (MI)