

TECHNOLOGY AND OPERATIONAL INNOVATION

Innovation as a strategic leverage for Saipem



Due to changes in the global scenario on energy sources and increased exploitation costs, the Oil & Gas industry needs to focus on innovation in order to cope with near-future challenges. The new Innovation model at Saipem is the synthesis between the urgency to implement concrete solutions in the short term and the need to develop novel solutions reflecting the evolving macro-scenarios. Furthermore, the *digitalisation* option is being pursued extensively in both the outlined time-spans of innovation.

2017 Highlights	UN GC Principles	Sustainable Development Goals
People involved in R&D activities as full time equivalent 147		
Number of Joint Industry Projects since 2013 84		
Number of Technology Innovation Centres in 6 countries 8		

FACING TODAY'S CHALLENGES THROUGH INNOVATION

With regard to short term innovation Saipem's main targets are: (i) *Reducing costs and delivery times to market for O&G projects*, (ii) *Advancing further exploitation of Oil/Natural Gas*, (iii) *Pursuing diversification inside and outside the O&G market* and (iv) *Protecting the environment* ([Q detailed information on the development of innovative methodologies and solutions for the environmental protection can be found on page 36](#)).

(i) Reducing costs and delivery times to market

In terms of cost optimisation and process efficiency, the Company has adopted different strategies, for example:

Product innovation in the offshore business

Saipem is working on several innovative solutions that can be combined into new Subsea Field Architectures, making brownfield debottlenecking, stranded field exploitation

and even greenfield developments technically and economically viable. This is also true in deeper waters. Indeed, new technologies make it possible to move topside operations onto the seabed, heading towards the so-called *Subsea Processing*, *Long Tie-Back* solutions and *All Electric* fields, all resulting in an additional reduction in tubular and umbilical items installed subsea. A building block of those new architectures is the *Heat Traced Pipe-in-Pipe* technology for rigid J-Lay, for which Saipem completed the development and which extends the application of the most efficient active heating technology to larger diameter risers and flowlines, for even longer tie-back lines. In addition, Saipem is developing a new solution that consists in a subsea station that can heat up the fluid passing through the pipe locally, solving flow assurance problems during production; first tests on a prototype are under completion. The *Internal Plasma Welding* technology for carbon steel and clad sealines was successfully used on the Kashagan Pipeline Replacement Project in the Caspian

SAIPEM'S WAY OF COPING WITH SHORT AND MID-LONG TERM SCENARIOS

SHORT TERM	MID-LONG TERM
DRIVEN BY PROJECTS <ul style="list-style-type: none"> Increase efficiency Boost productivity Increase market coverage 	DRIVEN BY MACRO SCENARIOS <ul style="list-style-type: none"> Prepare for future challenges
DIGITAL TRANSFORMATION	
increase efficiency	offer new value propositions

A snapshot of sustainable innovations recently brought to the market are detailed below:

- For the Zohr project (Egypt), Saipem developed an extremely extended ROV (Remotely Operated Vehicle) tether (1.9 km) allowing touchdown monitoring during pipe laying with a ROV directly from the pipe layer, contributing, among others, to CO₂ emission reduction.
- For the Egina Project (Nigeria), a new method for prefabricating the Buoyancy Tank has been

implemented to reduce the risks of working in confined spaces.

- Increased operational safety during installation of FDS 2, the New Self Upending procedure for Buoyancy Tanks.
- New Saipem vessel Motion forecast systems linked to forecasting the weather increased pipe laying and topside module transportation safety (i.e. Shah Deniz and Ivar Aasen projects).

area. New and even faster welding and field joint coating techniques, as well as exotic and composite materials are under development to better withstand corrosion, fatigue, high pressure and high temperature applications. A step forward on this roadmap consists in using Plastic Lined Pipes in place of more expensive clad pipes; the new *Fusion Bonded Joint* technique enables the restoration of the continuity of the internal plastic liner during construction and installation of the water injection lines. Saipem is also active in developing solutions integrating the new disruptive *Thermoplastic Composite Pipe* products (jumpers, spools, flowlines and risers) in view of cost optimisation.

As an example, the *Zohr Accelerated Start-Up* project, successfully delivered offshore of Egypt, stands out for execution speed and quality of results provided. The achievements are also a result of the collaboration with a few industrial partners.

Examples of joint development milestones recently achieved in the subsea processing segment include:

- an agreement with Siemens aimed at qualifying and promoting an open standard Subsea Control System for Saipem's Subsea Bus architecture based on Siemens' Subsea DigiGrid;
- following the signing last year of a co-ownership and exclusive commercialisation agreement with Total and Veolia for the SPRINGS™ (Subsea Process and INjection Gear for Seawater) subsea water treatment technology, Saipem is now carrying out the activities for the industrialisation of the technology. SPRINGS™ is based on a nanofiltration-based sulphates removal unit from water designed for subsea use, thus allowing for an increase in the economics of oil recovery.

Process innovation through digitalisation

Digitalisation is the implementation and integration of digital technologies, connectivity and intelligence in

a wide range of devices and work processes enabling the collection and analysis of data in near-real time to improve performance. For EPC firms, the digitalisation focus is on management (project execution, new facilities design and optimisation of operations) and construction information modelling.

In this respect, in 2016, Saipem launched a new idea incubator and prototyping lab, *The Innovation Factory*, aimed at testing solutions to address the challenges of the sector through the adoption of new technologies and methodologies by changing the way Saipem works. Its key pillars are strategic themes defined by top management, a leaner approach, fast-prototyping, digital enablement, cross-industry open-innovation, enhancement of internal innovative thinkers, and constant collaboration with external stakeholders (universities, R&D centres, start-ups, etc.). A new digital collaborative and data-centric methodology for the entire project life-cycle management (xDIM™) was conceived to unlock the hidden value of company data. Its implementation comes through an integrated and multidimensional interface platform that stores and exchanges data and information with a Project Common Data Environment, and unifies it in different dimensions, based on the different activities and operations performed by all departments involved along the full life-cycle of the plant.

 *For further information on digitalisation and asset management please refer to page 21.*

(ii) Advancing further exploitation of Oil/Natural Gas

Although renewables are projected to grow quickly, gas and oil will still cover very important percentages of the energy demand in future decades and new solutions will be needed to make their production more sustainable,

SAIPEM'S STRATEGIES FOR COPING WITH BOTH SCENARIOS

TECHNOLOGY DEVELOPMENT

FIND INNOVATIVE SOLUTIONS TO IMPROVE OPERATIONAL PERFORMANCE AND REDUCE THE ENVIRONMENTAL IMPACT OF SAIPEM'S ACTIVITIES.

TRANSFORMATIVE INNOVATION

INNOVATE THE WAY SAIPEM OPERATES TO BOOST PRODUCTIVITY AND CHASE NEW VALUE PROPOSITIONS.

TECHNOLOGY INTELLIGENCE

SCOUT DISRUPTIVE TECHNOLOGIES, CHASE NEW VALUE PROPOSITIONS AND DISCOVER ADJACENT GROWTH OPPORTUNITIES.

as witnessed by Saipem's innovation efforts in Gas Monetisation and Heavy Oils upgrading.

As regards Natural Gas, efforts in the LNG (Liquefied Natural Gas) field are ongoing:

- the Company is working to define a proprietary small scale liquefaction and re-gasification of Natural Gas. This small scale product for LNG shows good promise for becoming a flexible tool to support sustainable mobility in the near future;
- with regard to Floating LNG, the Tandem Offloading floating system has been fully qualified together with Trelleborg, while the Moss Maritime subsidiary recently achieved pioneering experiences in the market of conversion of LNG Carriers to FLNG (Floating Liquefied Natural Gas) units and FSRU (Floating Storage Re-gasification Units).

A comprehensive programme dedicated to onshore pipelines is ongoing to improve and optimise several different aspects of the design and construction procedure (i.e. the adoption of geo-grids).

Implementation is continuing to keep the proprietary *Snamprogetti™ Urea* fertilizer production technology at the highest level of competitiveness. Ongoing activities include:

- improving resistance to corrosion and cost reduction through the development of novel construction materials (significant results achieved in the definition of an innovative alloy material);
- decreasing energy consumption and reducing the

environmental impact (*Urea Zero Emission*) through highly innovative solutions under development.

With respect to Oil, attention is particularly focused on the total conversion of the 'bottom of the barrel', both through gasification and full hydrotreatment via slurry technologies. In this area, in cooperation with the related technology licensors, Saipem boasts extensive know-how and very well-recognised industrial experience.

(iii) Pursuing diversification inside and outside the O&G market

Saipem innovation efforts are focused on *Renewables* to cope with a less carbon intensive scenario and on *Life of Field* technologies in the O&G business.

[Further information on Saipem's commitment to tackling climate change can be found on page 32.](#)

Renewables

Technology innovation in the onshore renewables field is mostly dedicated to concentrated solar, bio-refineries and geothermal.

In offshore renewables, Saipem has successfully installed the **first floating Wind Farm in the world, the Hywind Scotland Project for Statoil**, that required an innovative solution to lift, handle and install the gigantic, fully assembled, 6 MW wind turbine generators on floating spars anchored to the seabed. Several new solutions



Lee Sutterby, The Hywind Scotland Project, Norway

in the Offshore Floating Wind segment are currently under development, together with a novel concept for an *Offshore Floating Solar Park*, developed by Saipem's Norwegian subsidiary, Moss Maritime.

Life of Field technologies and Decommissioning

In this framework Saipem is aiming at vertical integration extending its scope from URF to subsea processing through the full life cycle of the field including decommissioning. The increased scope of work of seabed equipment and operations is leading subsea fields to a higher complexity and the consequent need to inspect, monitor, maintain and repair subsea facilities, to which Saipem innovative solutions can contribute. Subsea remote operation and intervention technologies are key to the success of installation and life of field services.

Saipem can count on all the subsea intervention technologies developed, like the Innovator ROV, the SiRCoS sealine repair system, the ultra-deep and ultra-shallow trenching systems and other subsea engineered systems.

Two newly launched *Innovator 2.0™* Heavy Work Class ROVs are currently operating onboard Normand Maximus, capable of deploying ROVs also in very harsh sea conditions.

Saipem's leading edge in subsea robotics is represented by the new *Hydrone* concept. Hydrone is a subsea platform composed of an advanced AUV (Autonomous Underwater Vehicle, Hydrone-S), a resident hybrid ROV/AUV (Hydrone-R) and a work class, temporary resident ROV (Hydrone-W). An accelerated development and industrialisation programme is in progress with the assessment and testing of the most advanced technologies as the subsea communication network, control automation, power management, remote manipulation, etc.

FACING MID-LONG TERM CHALLENGES THROUGH INNOVATION

The main targets, generally expected outside the 4-year plan, are (i) *guaranteeing full exploitation of Oil & Gas resources in future decades*, and (ii) *overall reduction of CO₂ emissions* (Q [more detailed information on the development of innovative solutions for the GHG emission reduction can be found on page 35](#)).

With reference to digitalisation, it is expected that the adoption of these kind of technologies will favour the rise of new value propositions both in the EPCI business model and in new service models.

(i) Guaranteeing full exploitation of Oil & Gas resources in future decades

In the field of Oil & Gas production, subsea processing shall concur in reducing costs by moving surface

operations and equipment to the seabed. Significant results have been achieved in terms of a full scale subsea factory, heading to the Subsea-to-Shore solution:

- Saipem completed a further phase of the joint development project with major oil companies on proprietary *Spoolsep* technology for the gravity separation of produced water from oil (under development);
- a study is currently underway with Petrobras on its Dense Phase CO₂ Separation *Hi-Sep™* technology. Otherwise, Natural Gas is the ideal source for driving the energy transition to a less carbon intensive energy production.

Several technology scouting options are under scrutiny to fully exploit the Gas resource in the long term: specific efforts are being made in the area of valorising Stranded/Associated/Flared Gas resources through a package of solutions that vary from new innovations in the LNG field, to compact (and possibly floating) GTL (Gas To Liquids) processes.

2015-2017 SAIPEM'S INNOVATION EFFORT

TECHNOLOGY INNOVATIONS

Accounted within the R&D budget, it includes activities with a higher innovative content and medium term target.

TECHNOLOGY APPLICATIONS

Activities developed in commercial or investment projects (i.e. offshore fleet).

€138 mln



EXTERNAL COLLABORATIVE EFFORTS

Increased effort in 'technology scouting' is planned to explore the breadth of opportunities offered by cross-industry cooperation. Creating alliances to be receptive to crossover technologies from aerospace and defence, automotive, IT, telecoms and biomedical, etc., is a key step.

Saipem has always displayed a cooperative attitude, leveraging on a broad network of technology suppliers, universities, research centres, university spin-offs, start-ups, commercial partners.