ENVIRONMENT

INDEX

SAIPEM TODAY

SAIPEM TODAY IS A WORLD LEADER IN THE GLOBAL SUPPLY OF ENGINEERING, PROCUREMENT, PROJECT MANAGEMENT, CONSTRUCTION AND DRILLING SERVICES WITH DISTINCTIVE CAPABILITIES IN THE DESIGN AND EXECUTION OF LARGE-SCALE OFFSHORE AND ONSHORE PROJECTS.

Saipem has a strong bias towards oil and gas frontiers, namely activities in harsh and remote areas, in deep waters as well as in extremely cold and hot environments, applying significant technological competences in many diverse fields such as gas monetization and heavy oil exploitation.

Saipem is organized in two Business Units: Engineering & Construction and Drilling.


SAIPEM
7000

SAIPEM ENGINEERING & CONSTRUCTION

FOLLOWING AN AGGRESSIVE GROWTH STRATEGY, WHICH INCLUDED IN THE LAST DECADE THE ACQUISITION OF MANY CONSTRUCTION, TECHNOLOGY AND ENGINEERING COMPANIES, MOST PROMINENTLY OF SNAMPROGETTI, BOUYGUES OFFSHORE, SOFRESID AND MOSS MARITIME, SAIPEM HAS BECOME ONE OF THE WORLD LARGEST AND MOST COMPLETE ENGINEERING AND CONSTRUCTION COMPANIES IN THE GLOBAL OIL AND GAS MARKETS, ONSHORE AND OFFSHORE.

Ever since its initial steps in the fifties as the construction division of Snam, the pipeline company of the Eni Group in Italy, Saipem has pursued a systematic growth strategy, based on the development of internal assets, expertise and skilled resources, as well as on the acquisition of other players with their own asset bases, such as Micoperi in late eighties, and many others.

In the last decade, Saipem has continued its growth by acquiring Bouygues Offshore and Sofresid in France, Moss Maritime in Norway, IDPE in India and Snamprogetti in Italy, and by carrying out a multibillion investment program into the expansion of its offshore construction and drilling fleets. Since the year 2000, Saipem's market capitalization has grown more than sixfold and its revenues tenfold.(*)

The organizational integration of this considerable asset base, namely the network of engineering centres, fabrication and support yards in several continents as well as the offshore construction fleet, has been completed gradually over the years - most recently with the creation of a unified Business Unit Engineering & Construction, an entity with over 30,000 employees (excluding corporate and BU Drilling staff) from over 100 nationalities, with over 60 permanent establishments and numerous project execution centres around the globe, and with yearly revenues exceeding 10 B €y; all held together by outstanding project management skills.

Through the involvement of our global EP(I)C hubs in Milan, Rome and Fano (Italy), Paris (France) and Chennai (India), which operate in connection with a growing number of medium size and smaller regional engineering and project execution centres employing altogether over 7,000 engineers, Saipem balances high project execution quality with a competitive cost and - most importantly - with a major emphasis on local know-how and content.

This well-integrated multicenter approach provides a consistent design and robust execution philosophy on all our projects worldwide. Top priority is provided throughout to all HSE and Quality aspects.

Saipem therefore offers a complete range of project definition and execution services, offshore and onshore, particularly for the complex "mega-projects" required by the market today: from feasibility and conceptual studies to complex integrated solutions combining design, engineering, procurement, field construction, fabrication and offshore installation; also revamps, upgradings, maintenance, decommissionings, reclamations and decontaminations.

Saipem today operates in virtually every world market, often in remote locations with harsh environmental conditions and challenging logistics, leveraging on its proven experience across the most significant product lines in the oil and gas production onshore, offshore, in deepwater; gas and oil transportation via offshore and onshore pipeline systems; midstream, refining, chemicals, power generation from fossil as well as from renewable sources; environmental industries, maritime works and infrastructure.

This new series, therefore, outlines Saipem's integrated references in engineering and construction markets offshore and onshore, according to individual business and technology lines.

(*) Until Dec. 31, 2010

SAIPEM: THE COMPLETE ENVIRONMENTAL SERVICES PROVIDER

FROM PREVENTION TO REMEDIATION:

- CARBON CAPTURE AND SEQUESTRATION
- SULPHUR AND H_2S MANAGEMENT
- APPLIED ECOLOGY
- SITE REMEDIATION AND ENVIRONMENTAL GEOLOGY
- DECOMMISSIONING AND WASTE MANAGEMENT
- ENVIRONMENTAL TREATMENT PLANTS

Environmental restoration of natural habitats with pipeline crossing

In addition to its many activities in the oil & gas, refining, petrochemicals and energy markets, several of Saipem's original constituent units have been active for many decades in a variety of environmental projects:

- The ecology division of Snamprogetti, which starting in the early 1980s designed and built numerous fluidized bed grate furnace incineration plants of municipal solid waste; rotating drum thermal conversion plants of industrial waste; treatment plants of waste waters from urban and industrial sources.

- Aquater designed and built water supply systems, combined with the planning and definition of new surface and groundwater sources: for example, during the 'nineties', a master plan for 6 regions of the Dominican Republic, covering 50% of their national territory. Furthermore, a variety of special projects, such as the design and execution of safety measures of large industrial, oil refining and petrochemical plants, as well as the management of hydrogeologically hazardous areas along a huge number of new pipeline tracks.

- Ambiente, then a division of the pipeline network owner and operator Snam, performed a large number of soil and water remediations, safety measures and clean-ups, particularly of toxic waste tanks, as well as the subsequent thermal destruction of contaminants in Ambiente's processing units. Furthermore, the management of major accidental oil spills both on the ship wrecks as well as in the surrounding sea and impacted shores; the design and implementation of gigantic discharge sites for millions of cubic metres of pyrite mine waste as well as the *in-situ* thermal destruction of chlorinated pitch via rotating drum technology; etc.

Over the last decade, the above units were gradually consolidated, first into Snamprogetti, then more recently into Saipem, together with all other Snamprogetti's activities and resources.

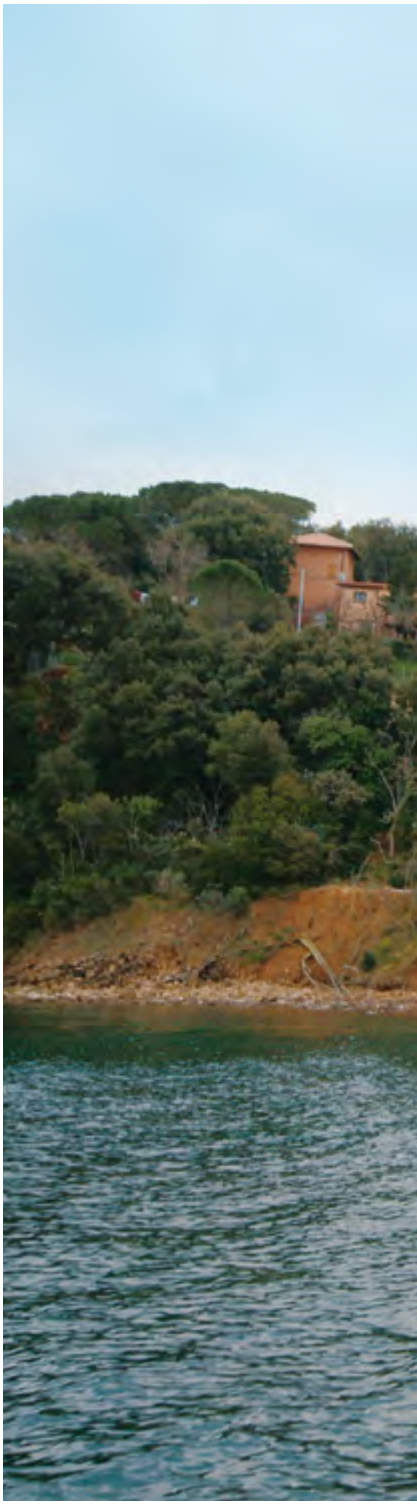
Today, the Environment centre of excellence consists of several hundred dedicated specialists, mostly graduates, covering all related engineering, project management, construction and other specialized disciplines, all fully integrated into Saipem's worldwide organization and relying on - where appropriate - Saipem's global network and resources.

ENVIRONMENT

EXPERIENCE HIGHLIGHTS

- Environmental characterization of more than 400 contaminated sites, through thousands of boreholes and piezometres, in order to evaluate soil and groundwater quality.
- Design and execution of more than 300 projects to remediate or contain contaminated soil and polluted groundwater.
- Design and execution of more than a dozen large industrial plants to treat process streams and polluted groundwater from petrochemical sites.
- Design and execution of numerous large industrial plants to treat urban and industrial waste, associated with water reuse units.
- Design and construction of the first Ensolvex plant commercial application, an original and proprietary *ex sito* remediation technology by solvent extraction.
- Management of more than 1.5 million tons of industrial waste through dumping, thermal treatment or recycling.
- Performance of more than 100 social and environmental impact studies.
- Initiated new R&D and design development projects to abate pollutants, today under enhanced scrutinity: e.g. CO_2, sulphur, heavy metals.

Remediation and restoration of the pyrite export marine terminal site in Terrarossa, Italy.



The Terrarossa site was used as a marine terminal for pyrite export from mines close by in the Gavorrano area, since 1900.
The site remediation work was carried out during the 2007-2009 timeframe for Syndial.
Over 6,000 t of pyrite and other contaminants were removed and processed, together with the performance of numerous restoration works.

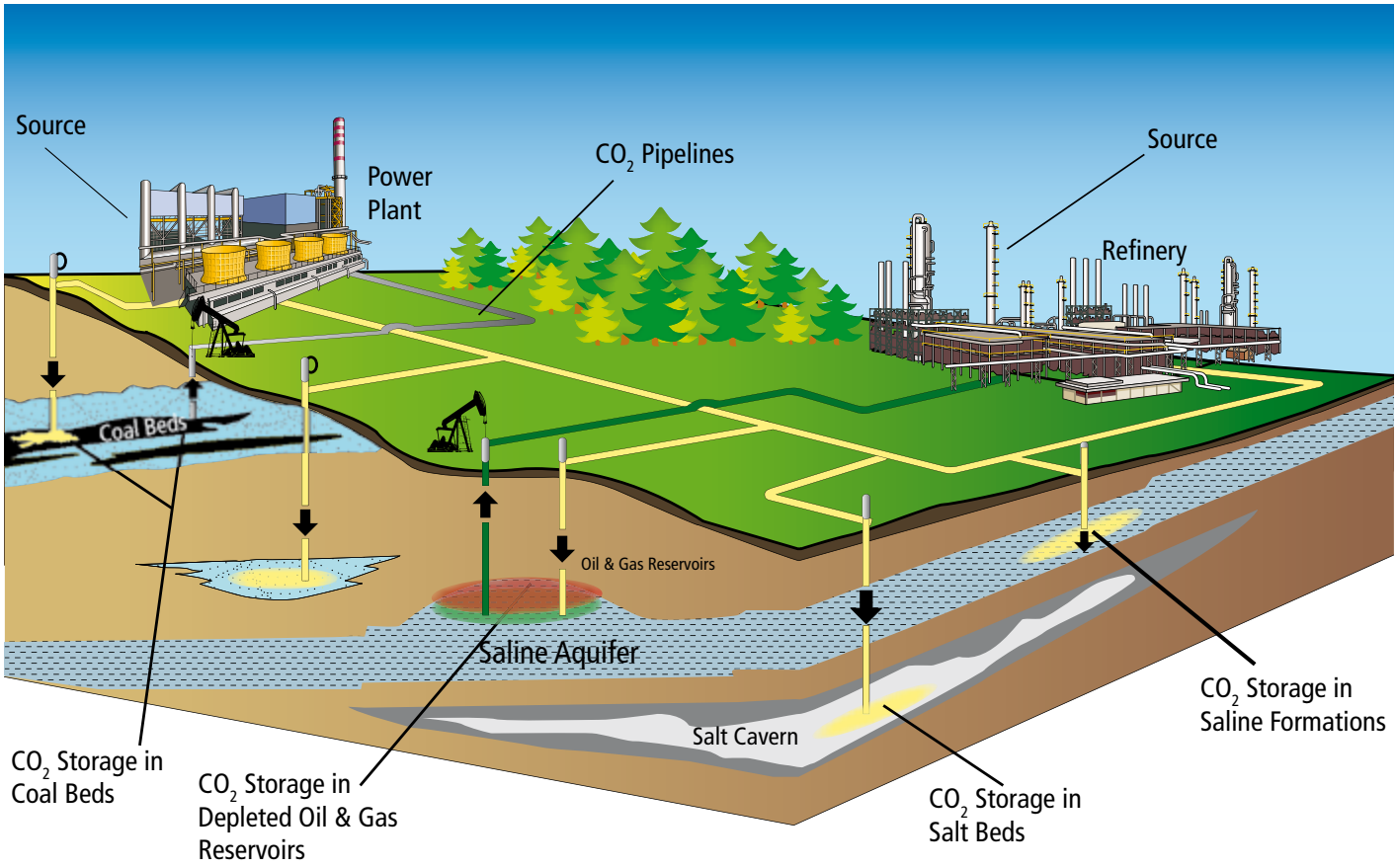
CARBON CAPTURE AND SEQUESTRATION

In order to reduce the emissions of greenhouse gases, the CCS - Carbon Capture and Sequestration - chain of technologies is under development and/or demonstration at several initiatives worldwide.

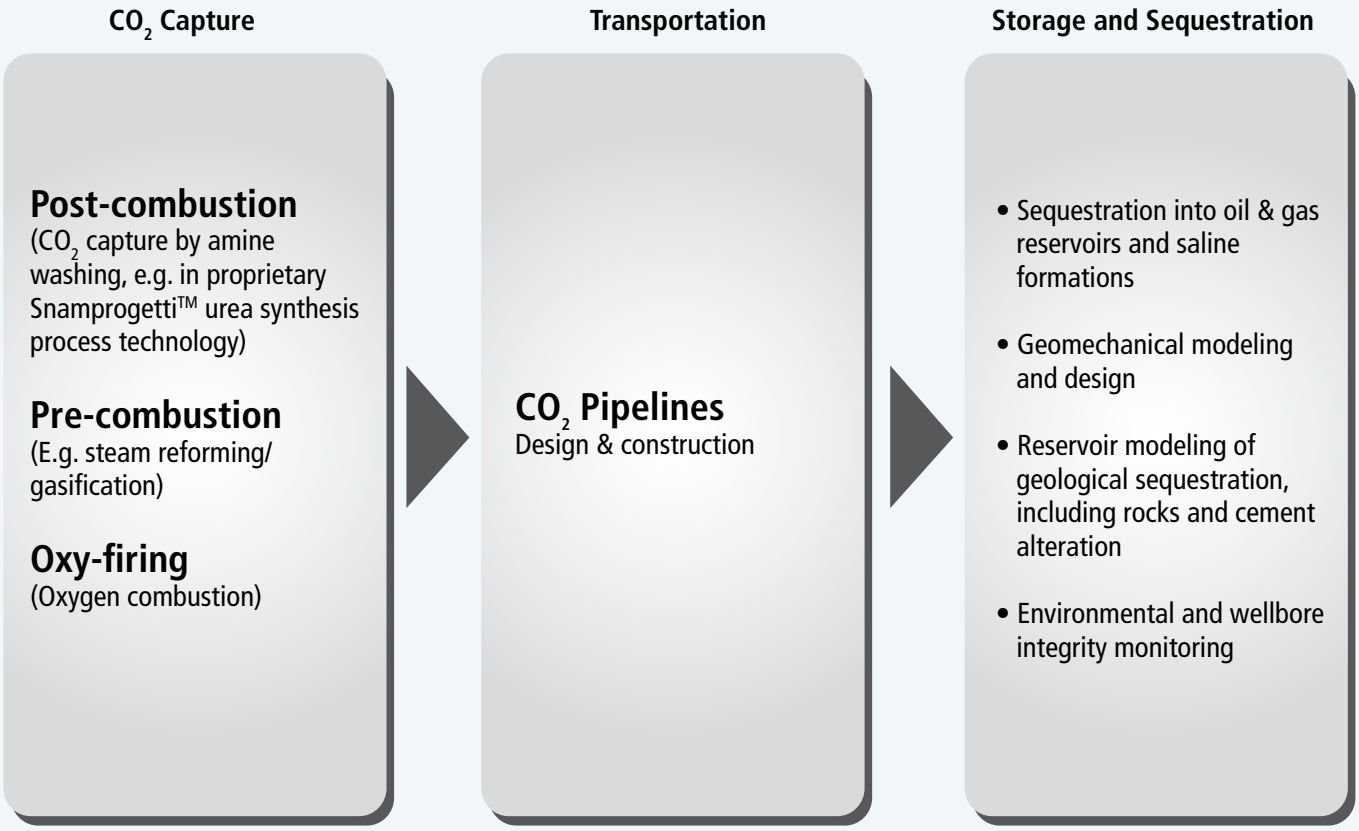
Using this approach, the CO_2 produced by the fossil fuel combustion in a coal- or gas-fired power plant is captured, compressed, transported and subsequently sequestered, typically either in exploited oil and gas reservoirs to enhance oil and gas production, or in saline formations and depleted oil and gas reservoirs.

In addition to the participation in the Eni/Enel and Total demonstration projects, Saipem also has predating substantial know-how and experience with related technologies in all individual process steps in the CO_2 capture, transportation and storage chain.

The references quoted herein therefore originate also from many individual applications generally related to the CCS scheme.



Source: Alberta Geological Institute


CO_2 Capture
Post-combustion
(CO_2 capture by amine washing, e.g. in proprietary Snamprogetti™ urea synthesis process technology)
Pre-combustion
(E.g. steam reforming/ gasification)
Oxy-firing
(Oxygen combustion)
Transportation
CO_2 Pipelines
Design & construction
Storage and Sequestration
• Sequestration into oil & gas reservoirs and saline formations
• Geomechanical modeling and design
• Reservoir modeling of geological sequestration, including rocks and cement alteration
• Environmental and wellbore integrity monitoring

CARBON CAPTURE AND SEQUESTRATION DIRECT AND RELATED PROJECT REFERENCES

LOCATION	CLIENT	PROJECT
Algeria, Arzew	Sonatrach	Natural gas sweetening with activated MDEA
UAE, Shah	Abu Dhabi Gas Development Company Ltd.	Gas treatment NGL recovery plant producing 4,400 t/d NGL. CO_2 H_2S removal system using DGA washing (Fluor technology)
Qatar, Mesaieed	Qatar Fertilizer Company	Ammonia - Urea complex 2 x 3,850 t/d including MDEA washing (BASF technology) on the reformer effluent
Pakistan, Daharki	Engro Chemical Company	Ammonia - Urea complex 2 x 3,850 t/d including 340 t/d CO_2 recovery unit from reformer furnace flue gas using MHI technology. It includes MDEA washing (BASF technology) on the reformer effluent
Italy	Enel Ingegneria & Innovazione S.p.A.	ZEPT. Analysis of basic field data. Modeling of coupled wellbore-reservoir flow during the injection of CO_2 in a saline aquifer in the Adriatic offshore
Central Asia	Eni S.p.A.	H_2S injection into sour reservoirs. Coupled wellbore-reservoir flow modeling of sour and acid gas mixtures. Modeling of near-wellbore effects including hydrodynamical, thermal and geochemical processes. Geochemical alteration of reservoir and cap-rock formations
Italy, Brindisi	Eni/Enel	Pilot dense-phase CO_2 transport loop
Italy	Eni S.p.A.	GHG phase 2. Evaluation of the effects of CO_2 impurities on injection performances and the alteration of reservoir and cap-rock formations
UAE, Ruwais	Gasco	Wet gas fractionation plant, acid gas enrichment with Flexisorb solvent (ExxonMobil) gas clean-up (Worley Parsons), part of the NGL-3 complex

CO_2 CAPTURED OR INJECTION CAPACITY	SCOPE OF WORK	ON STREAM
992 t/d CO_2	EPC	Under Exec.
9,000 t/d H_2S 5,100 t/d CO_2	EPC	Under Exec.
2 x 2,600 t/d	EPC	Under Exec.
2,600 t/d from syn-gas, 340 t/d from flue gas	EPC (utilities and interface for the MHI column)	Under Exec.
1 $MtCO_2$/y for 10 years	E	2011
	E	2011
55 m^3/h	E	2011
8,000 t/y for 3 years	E	2010
Acid gas enrichment 28 t/d H_2S 30 t/d CO_2	EPC	2010

CARBON CAPTURE AND SEQUESTRATION DIRECT AND RELATED PROJECT REFERENCES

LOCATION	CLIENT	PROJECT
Italy, Gela	Eni R&M	CO_2 biofixation and abatement plant from gaseous effluents by microalgae

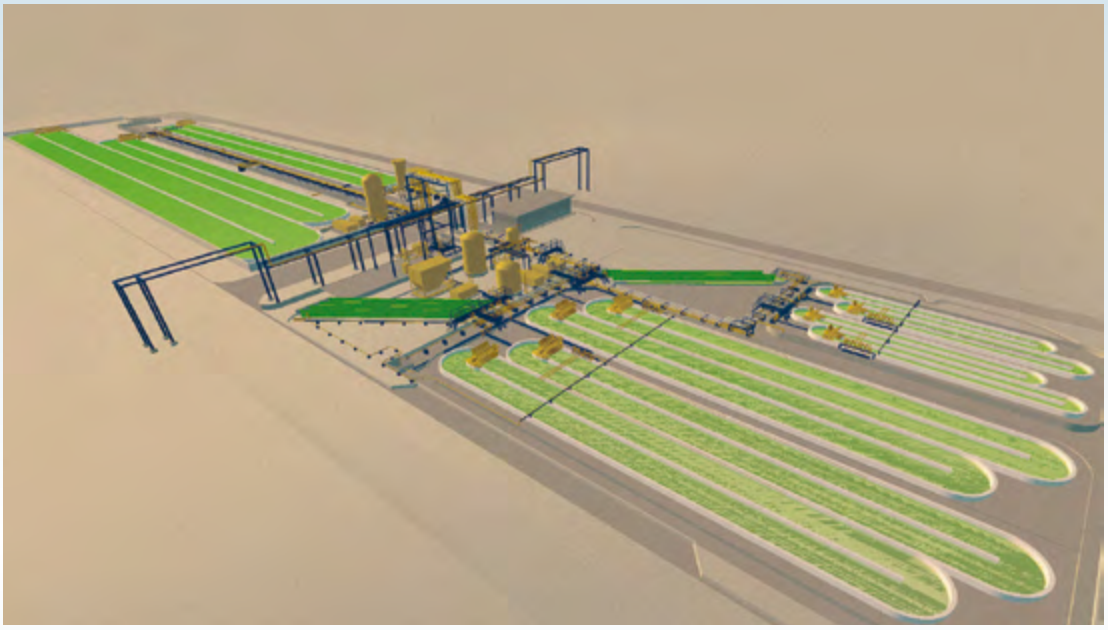
ENI R&M CO_2 BIOFIXATION PLANT GELA (ITALY)

This new process patented by to Eni aims to clean CO_2 from refinery fumes using selected strains of microalgae. The produced biomass can be converted into biofuel and/or other energy vectors, such as bio-methane and electricity.
A pilot plant at the Gela refinery consisting of photo bioreactors and open tanks has been in operation since 2007.
A subsequent demo unit covering an area of one hectare has been built in 2009.

Contract: EPC.
Completed in 2010.

Pilot plant

CO_2 CAPTURED OR INJECTION CAPACITY	SCOPE OF WORK	ON STREAM
Pilot 25 kg/h	EPC	2010



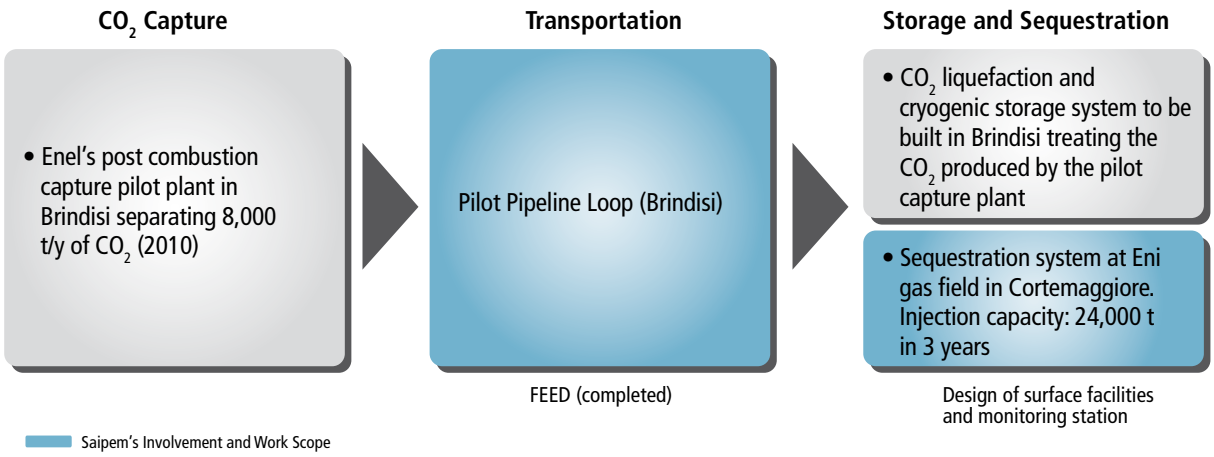
Demo plant

CARBON CAPTURE AND SEQUESTRATION DIRECT AND RELATED PROJECT REFERENCES

LOCATION	CLIENT	PROJECT
Italy	Eni S.p.A.	GHG phase 2. Modeling the injection of CO_2 in an exploited sour gas reservoir. Modeling of geochemical alteration of reservoir formation, cap-rock and cement sheats
Italy, Cortemaggiore	Eni S.p.A.	Environmental impact study, well modeling and automatic monitoring of depleted natural gas well to be used for CO_2 storage and injection
Italy, Cortemaggiore	Eni S.p.A.	Surface facilities for CO_2 storage and injection pilot project

ENI/ENEL INTEGRATED PILOT PROJECT BRINDISI AND CORTEMAGGIORE (ITALY)

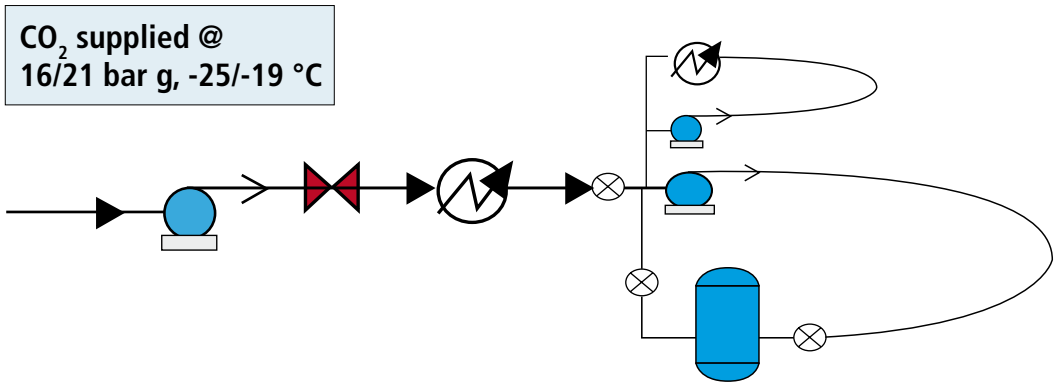
Saipem is an integral part of the development and project activities of the Enel and Eni Strategic Cooperation Agreement (signed on October 21, 2008) to design and build the first integrated CCS pilot project in Italy.
Within the simulated pilot scheme of the full CCS chain, Saipem has developed a FEED for the pilot pipeline loop to be built at the Enel power plant in Brindisi to validate the design models, to optimize operating procedures and to study corrosion problems. Saipem has also contributed with the design and execution of sections of the sequestration system at Cortemaggiore gas field.



CO_2 CAPTURED OR INJECTION CAPACITY	SCOPE OF WORK	ON STREAM
	E	2009
8,000 t/y	E	2009
	EPC	2008

PILOT PIPELINE LOOP – SIMPLIFIED PROCESS SCHEME

A pilot CO_2 dense phase transport loop to gain experience on high pressure CO_2 transport systems, testing different CO_2 stream compositions, investigating friction and thermodynamic properties, CO_2 stream behaviour during flow variations, upsets, shutdown, slinky effect, etc.



CARBON CAPTURE AND SEQUESTRATION DIRECT AND RELATED PROJECT REFERENCES

LOCATION	CLIENT	PROJECT
France, Lacq	Total E&P	Integrated demonstration CO_2 capture project

TOTAL E&P INTEGRATED DEMONSTRATION PROJECT LACQ (FRANCE)

The Sofresid unit of Saipem supplied in 2008 basic and detailed engineering studies and technical assistance for the procurement of compressors, dehydration units and selection of subcontractors, for the demonstration project at Lacq in Southern France.
The project consisted of CO_2 recovery from an oxygen fired boiler and injection in a depleted gas field located 27 km away.

Contract: EP services (2008).

CO_2 CAPTURED OR INJECTION CAPACITY	SCOPE OF WORK	ON STREAM
30 MW boiler unit	EP	2008

CARBON CAPTURE AND SEQUESTRATION DIRECT AND RELATED PROJECT REFERENCES

LOCATION	CLIENT	PROJECT
Italy	Eni E&P	GHG phase 1 - Modeling the pilot injection of CO_2 in an exploited gas reservoir. Modeling of geochemical alteration of reservoir formation, cap-rock and cement sheats
Saudi Arabia, Hawiyah	Saudi Aramco	Natural gas treatment and compression facilities producing 3,366 mmscfd of clean compressed gas. CO_2 removal using DGA washing
Italy	Eni E&P	H_2S management in E&P operations. Modeling of near wellbore processes during sour gas injection in an oil reservoir. Modeling of gas diffusion through the cap-rock and alteration of mineralogical assemblage
Central Asia	Eni S.p.A.	H_2S management in E&P operations. Development of an EOS module to model the geological disposal of sour/acid mixtures in geological formation up to HP/HT conditions. Modeling of near wellbore processes and cap-rock alteration
Italy, Sannazzaro	Eni R&M	260 MW Integrated Gasification Combined Cycle. MDEA washing using Dow technology
Libya, Mellitah	Western Libya Gas	Natural gas treatment and compression facilities treating 765 mmscfd with MDEA
Oman, Sur	OMIFCO	Carbonate washing (Giammarco-Vetrocoke technology) on the reformer syn-gas effluent, part of 2 x 2,530 m/td Ammonia - Urea complex
Venezuela, José	Fertinitro C.E.C.	Carbonate washing (Giammarco-Vetrocoke technology) on the reformer syn-gas effluent, part of 2 x 2,200 m/td Ammonia - Urea complex
Argentina, Bahia Blanca	Profertil S.A.	MDEA washing (BASF technology) on the reformer effluent, part of the 3,250 t/d Ammonia - Urea complex
Italy, Priolo	ISAB Energy	512 MW Integrated Gasification Combined Cycle. MDEA washing using Dow technology
Malaysia, Tok Arun	Petronas	NGL recovery and fractionation project
Italy, Sarroch	Sarlux	550 MW Integrated Gasification Combined Cycle. CO_2 washing with Selexol technology by UOP

CO_2 CAPTURED OR INJECTION CAPACITY	SCOPE OF WORK	ON STREAM
8,000 t/y for 3 years	E	2007
2 x 860 t/d CO_2	EPC	2007
NA	E	2006
	E	2006
78 t/d	EPC	2006
3 x 2,209 t/d CO_2, 3 x 152 t/d H_2S	EPC	2005
2 x 2,100 t/d	EPC	2005
2 x 2,200 t/d	EPC	2001
2,400 t/d	EPC	2000
320 t/d CO_2 (in addition to 192 t/d H_2S)	EPC	2000
	EPC	2000
142 t/d CO_2 (in addition to 182 t/d H_2S)	EPC	1999

APPLIED ECOLOGY

- ENVIRONMENTAL AND SOCIAL FEASIBILITY STUDY
- ENVIRONMENTAL, SOCIAL AND HEALTH IMPACT ASSESSMENT (ESHIA)
- ENVIRONMENTAL AND SOCIAL GEO-DATABASE
- ENVIRONMENTAL AND SOCIAL STUDY TO PERMITS
- SUPPORT TO CUSTOMER DURING PERMITTING PROCEDURE (PUBLIC AND GOVERNMENT AUTHORITY COMMITTING)
- LIFE CYCLE ANALYSIS ECOLOGICAL AND NATURAL RISK ANALYSIS, ECOSYSTEM SERVICES
- ENVIRONMENTAL AND SOCIAL MONITORING

Characterization of the environmental and social context for new investments: identification of the criticalities and the issuance of all the data needed to ensure new project sustainability during the implementation and operation phases.

- Environmental and Social Feasibility Studies (FFS, SFS)
- Environmental Social and Health Impact Assessments (ESHIA)
- Environmental and social geo-databases
- Sustainability and biodiversity planning
- Life cycle assessment and carbon footprint
- Design and implementation of mitigations and environmental, landscape and social compensations
- Design and implementation of environmental, landscape and social monitoring
- Design and development of remote data acquisition systems for environmental monitoring
- Environmental permitting
- Agricultural and forest development projects for production and re-use of biomasses and vegetable oils for food and energy

APPLIED ECOLOGY PROJECT REFERENCES

LOCATION	CLIENT
Italy, Gela	Greenstream B.V. - Gela Branch
Italy, Gela	Syndial S.p.A.
Italy	Eni E&P
Kenya	Eni Kenya
Ghana	Eni Ghana
Italian Regions	Snam Rete Gas
Congo	Eni E&P - Eni Congo
Italian Regions	Snam Rete Gas
Angola	Eni Angola - Sonangol - Angola Ministry of Agriculture
Congo	Eni Congo - Congo Ministry of Agriculture
Italy, Pieve Vergonte	Syndial S.p.A.
Australia	GLNG OPL (Santos Pty Ltd. & Petronas Australia Pty Ltd.)
Italy, Ripalta	Stogit S.p.A.
Italy, Bordolano	Stogit S.p.A.
Congo, M'Boundi Area	Eni E&P - Eni Congo
Transboundary	Eni E&P
Nigeria	Eni E&P - NAOC Ltd.
Italy	Eni E&P

PROJECT	SCOPE OF WORK	ON STREAM
Management plan and 10 years of environmental monitoring inside a protected area affected by gas pipeline implementation project	E	Under Exec.
EIA for 2 polluted groundwater treatment plants in Sicily and Sardinia, 4 gas storage plants in deep geological formation (over pressure operations) in North Italy, 1 pilot plant for CO_2 injection in deep geological formation in North Italy, 1 photovoltaic power plant in Sicily	E	Under Exec.
EIA for oil mining exploration and development projects; feasibility studies; field surveys; impact assessment; mitigation measures development: environmental monitoring plan	E	Under Exec.
2D and 3D offshore seismic prospection in block L21, L23 and L24 (Lamu District)	E	Under Exec.
Geophysical, geothecnical, meteoceanographic surveys in offshore areas and geophysical, geotechnical survey in onshore areas	E	Under Exec.
Gas pipeline network construction	E	Under Exec.
Tar sands pilot treatment plant in M'Boundi oil field	E	Under Exec.
Gas pipeline network construction	E	Under Exec.
Food and biofuel - Feasibility Front End Engineering Design	E	Under Exec.
Food and biofuel - Feasibility Front End Engineering Design	E	Under Exec.
Site remediation and treatment plant project of decommissioned plant area in Site of National Interest (SNI) - Pieve Vergonte	E	2013
GLNG pipeline project 420 x 42'' km length will transport Coal Seam Gas (CSG) to the LNG plant from existing and future fields in the Roma, Fairview and Arcadia Valley area	E	2012
Ripalta gas storage plant in deep geological formation: over pressure operations Pmax=1.10Pi and new treatment plant	E	2012
Upgrading of treatment and compression gas plants	E	2012
EIA for M'Boundi full field development project; Djeno power plant and connecting pipeline. Feasibility study and ESIA for tar sands mining for road construction project	E	2012
Business intelligence in Australia, Indonesia, Qatar, Iraq, Libya, Uganda, Togo, Ghana, Ivory Coast, Gabon, Venezuela, Polonia, Kuwait, Turkmenistan	E	2012
15 PEIA and EIA for Brass upstream project (flowstations and oil & gas pipeline), swamp area flare down and further oil development project. Offshore EIA and ESHIA for OML 116 and OML 119 projects	E	2011
Feasibility study of biomass plant in Val D'Agri and Sardinia - Biomass supply and analysis of social and environmental sustainability criteria	E	2011

APPLIED ECOLOGY
PROJECT REFERENCES

LOCATION	CLIENT
Italy, Mantova	Stogit S.p.A.
Congo	Eni E&P - Eni Congo
Italy, Massafra	Enipower
Algeria	Sonatrach
Italy, Settala	Stogit S.p.A.
Congo	Eni E&P - Eni Congo
Italy, Sergnano	Stogit S.p.A.
Italy, Sabbioncello	Stogit S.p.A.
Algeria	Sonatrach
Italy	Eni E&P
Angola	Eni Angola - Sonangol - Angola Ministry of Agriculture
Italy, Minerbio	Stogit S.p.A.
Libya, Mellitah	Eni E&P
Angola	Eni E&P - Eni Angola
Turkey	Eni E&P
Indonesia, Natuna Island	Eni E&P
Italy, Ticino Reserve	Eni E&P
Italy, Falconara	API - Nova Energia S.r.l.
Nigeria	Eni E&P - NAOC Ltd.

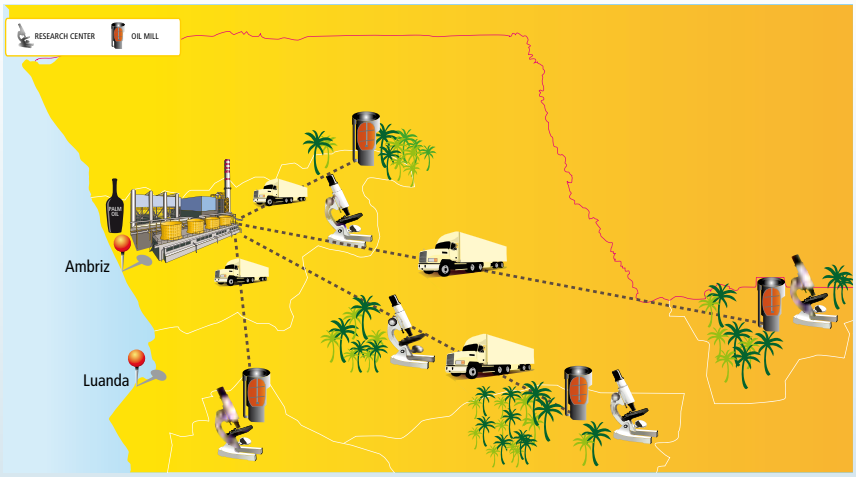
PROJECT	SCOPE OF WORK	ON STREAM
Groundwater treatment plant in IES refinery	E	2011
Tar sands mining in Djonga area	E	2011
Taranto power plant - Massafra electrical substation relocation	E	2011
GK3 - 48" HRM to El Kala and Skikda 265 + 85 km API 5L X70 gas pipeline from Mechtatine to El Kala and Skikda	E	2010
Settala gas storage plant, new compressor turbine unit	E	2010
Environmental quality and sensitivity of tar sands exploration permit to locate exploration drilling and mining activities	E	2010
Gas storage plant in deep geological formation: over pressure operations Pmax=1.05Pi (carried out according to Italian law)	E	2010
3D seismic survey (acquisition) of Sabbioncello gas storage permit	E	2010
GNL-3Z - Etude d'impact environnemental et socio-economique - Project GNL-3Z HSEIA	E	2010
Environmental monitoring of an effluent of Ticino river due to a consequence of an oil spill	E	2010
Food and biofuel - Feasibility study	E	2010
3D seismic survey (acquisition) of Minerbio gas storage permit	E	2009
LNG plant - Mellitah preliminary EIA	E	2009
Preliminary EIA Angola block 15 West hub well heads, FPSO and sealine installation	E	2009
TSB - Turkish Straits Bypass: environmental and social impact assessments	E	2008
Implementation of geographical information system	E	2008
Environmental feasibility study for piping removal	E	2008
Environmental impact assessment for the LNG project	E	2008
Niger delta biomass exploitation centre - Design and construction of a biodigester for Eichornia Crassipes	E	2008

LOCATION	CLIENT
Nigeria	Eni E&P - NAOC Ltd.
Tunisia, Nabeul	Eni E&P
Congo	Eni Congo - Congo Ministry of Agriculture
Italy, Brindisi	Enipower
Kazakhstan, Astana and Borogoye areas	Agip Kazakhstan North Caspian Operating Company
Nigeria	Eni E&P - NAOC Ltd.

ENI ANGOLA – SONANGOL – ANGOLA MINISTRY OF AGRICULTURE FOOD AND BIOFUEL PROJECT (ANGOLA)

The large-scale cultivation of oil crops like oil palm (primarily for food destination and secondarily for biodiesel) could offer an opportunity to reorganize and develop the national agricultural sector.
The selection of the areas and of the development models proposed for each country meets the internal social and environmental sustainability criteria.

Food and biofuel project (Angola)



Feasibility study data (2009-2010)
Capacity: 20,000 t/y
(1st phase "food oil")
and 250,000 t/y
(2nd phase "biofuels")
Front End Engineering Design - Under execution for 1,000 ha in Cuanza Norte Province

PROJECT	SCOPE OF WORK	ON STREAM
Green River project technical assistance	E	2008
Technical coordination and EIA report for Maâmoura field development project	E	2007
Food and biofuel from palm oil project - Feasibility study	E	2007
Environmental monitoring of marine area	E	2006
Technical and financial supervision and management for realization of 5 social projects	E	2004
Akri-Oguta development project - Concept selection phase - Preliminary EIA	E	2004

ENI CONGO TAR SANDS MINING (CONGO)

The project deals with tar sands mining and optimization of the route reaching the delivery point. Include characterization of social and environmental components in order to better address project solutions, assess the relevant criticalities and impacts and suggest restoration and mitigation measures.
The mining area is located in the Kouilou watershed and is known "Lac Kitina" (100 km NE from Pointe Noire).

SITE REMEDIATION AND ENVIRONMENTAL GEOLOGY

Promoting the use of sustainable practices during implementation of remedial action activities.

Design and execution of protection, conservation, remediaton, and rehabilitation projects, assessment of soil, sediment and groundwater quality.

These projects typically include site assessments, health and environmental risk analysis, groundwater modeling, design and execution of containment measures or remediation technologies.

The activities include the design and installation of sheet pile walls, cement-bentonite slurry walls, capping systems, hydraulics barriers and the planning/application of soil and groundwater remediation using different technologies, such as biological, chemical-physical and thermal approaches.

A growing concern today is the site restoration to the original conditions prior to the new project implementation, related to difficulties due to local laws and regulations.

Other projects include hydrogeological studies for aquifer protection, deep aquifers monitoring, geotechnical characterization, landslides, etc.

SITE ASSESSMENT PROJECT REFERENCES

LOCATION	CLIENT	PROJECT
Italy, National Priority Sites Assemini, Brindisi, Cengio, Crotone, Gela, Manfredonia, Mantova, Pieve Vergonte, Porto Marghera, Porto Torres, Priolo, Sarroch, Taranto, Val Basento	Eni E&P Eni R&M EniMed EniPower Polimeri Europa/Versalis Raffineria di Gela Snam Rete Gas Stogit S.p.A. Syndial S.p.A.	Site assessment, groundwater modeling, risk analysis, groundwater and aquifer system monitoring, hydrogeological and geotechnical studies

KEY FACTORS	SCOPE OF WORK	ON STREAM
- Thousands of exploratory boreholes - Thousands of groundwater monitoring wells - Thousands of chemical soil and groundwater analyses - Thousands of aquifer and unsaturated soil field tests - Tens of GIS/dB - Tens of groundwater modeling - Tens of risk analysis - Deep piezometres drilling (500 m bgl) for groundwater-multiaquifer monitoring system - Forensic geochemistry	EPC	1990 - Under Exec.

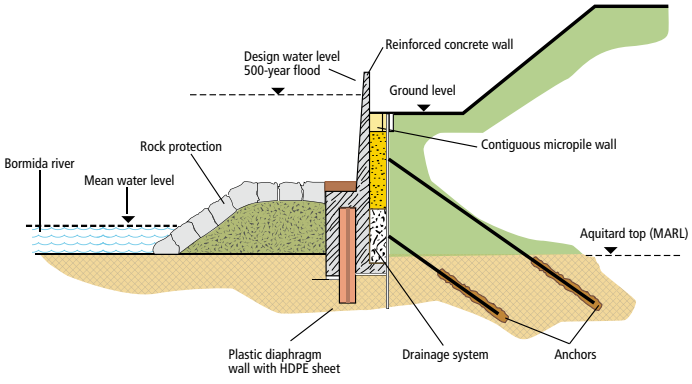
CONTAINMENT SYSTEMS PROJECT REFERENCES

LOCATION	CLIENT	PROJECT
Italy, Gela	ISAF S.p.A.	Phosphogypsum with natural radioactivity landfill containment and capping 5 MW photovoltaic power plant construction
Italy, Porto Marghera	Syndial S.p.A.	Physical containment system (cement-bentonite slurry wall)
Italy, Cengio	Syndial S.p.A.	Physical containment system (cement-bentonite slurry wall)

SYNDIAL S.P.A. PHYSICAL BARRIERS CENGIO (ITALY)

Design and construction of physical barriers as a safety measure for containment and drainage of ground and surface water to protect the site of national interest. The plastic diaphragms have a length of 4.8 km and reach a depth of 20 m. The environmental activities included the demolition of old structures and buildings, contaminated soil removal, treatment and dumping, for a total of 800,000 m³ over an area of 50 ha.

Contract: EPC.
Completed in 2009.



KEY FACTORS	SCOPE OF WORK	ON STREAM
Physical containment system Length 3.5 km (max. depth 21 m) n. 29 wells (30 m depth bgl) Pumping and treatment leachate Physical containment system	EPC	Under Exec.
Physical containment system Length 1.2 km 15 m max. depth bgl	EPC	2010
Physical containment system Length 4.8 km 20 m max. depth bgl	EPC	2009

ISAF S.P.A.
PHOSPHOGYPSUM PERMANENT CONTAINMENT SYSTEMS (CAPPING AND PLASTIC COMPOSITE DIAPHRAGM) – 5 MW PHOTOVOLTAIC POWER PLANT CONSTRUCTION
GELA (ITALY)

Capping design and construction of 36 ha landfill, with composite layers to protect the site of national interest. Design and construction of 5 MW photovoltaic power plant. Environmental radiological monitoring and control procedures for the protection of workers and environment according to national and international legislation on NORM/TENORM.

Contract: EPC. Under construction.

CONTAINMENT SYSTEMS PROJECT REFERENCES

LOCATION	CLIENT	PROJECT
Italy, Porto Torres	Syndial S.p.A.	Hydraulic containment & LNAPL recovery systems, groundwater treatment plant
Italy, Sarroch	Polimeri Europa	Hydraulic containment and LNAPL recovery systems
Italy, Priolo	Syndial S.p.A.	Physical containment system (sheet piles wall) and groundwater treatment plant
Italy, Priolo	Syndial S.p.A.	Physical containment system (reinforced concrete wall)
Italy, Porto Marghera	Syndial S.p.A.	Physical containment system (cement-bentonite slurry wall), capping and hydraulic control
Italy, Porto Marghera	Syndial S.p.A.	Pump and treat system
Italy, S. Giuseppe di Cairo	Syndial S.p.A.	Physical containment system (reinforced concrete wall and cement-bentonite slurry wall)

KEY FACTORS	SCOPE OF WORK	ON STREAM
Hydraulic containment system Length 4.7 km 64 wells (30 m depth bgl) Pumping rate 180 m^3/h LNAPL recovery: Dual-Pumping wells Oil skimming systems	EPC	2008
Hydraulic containment system Length 1.7 km n. 63 wells (58 m depth bgl) Pumping rate 73 m^3/h	EPC	2007
Physical containment system Length 5,500 m 13-18 m depth bgl	EPC	2007
Physical containment system Length 500 m 17 m depth bgl	EPC	2007
Physical containment system Length 3.5 km (max. depth 21 m) 6 - 22 m depth bgl	EPC	2005
Horizontal directional drilling to ground water drainage (max. depth 12 m)	EPC	2005
Physical containment system Length 400 m 15-20 m depth bgl	EPC	2004

SITE REMEDIATION PROJECT REFERENCES

LOCATION	CLIENT	PROJECT
Nigeria	NAOC Ltd.	Feasibility study in-situ/on-site remediation technologies
Nigeria	NAOC Ltd.	On-site thermal desorption plant design (direct/indirect thermal unit)
Italy	Eni R&M	Incorporating sustainable practices into site remediation
Italy, Fornovo di Taro	Eni R&M	Soil and groundwater remediation - Dismissed special oil refinery
Italy, Bari	Eni S.p.A.	Soil and groundwater remediation - Oil refinery
Italy, Assemini	Syndial S.p.A	Minciaredda landfill - Feasibility study in-situ thermal desorption
Italy, Villoresi	Eni E&P	Groundwater remediation - In Well Stripping (IWS-GCW) system
Italy, Cremona	Tamoil	Oil spill - Soil and groundwater remediation - Residential area behind oil refinery
Italy, Lunetta	Eni S.p.A.	Groundwater remediation - In Well Stripping (IWS-GCW) System

KEY FACTORS	SCOPE OF WORK	ON STREAM
Remediation type: In-Situ/On-Site Technology/Process: all technologies Contaminated media (soil/groundwater): soil/waste water Treated contaminants: organic pollutants: TPH, BTEX	FEED	Under Exec.
Remediation type: On-Site Technology/Process: thermal desorption Contaminated media (soil/groundwater): soil/waste water Treated contaminants: organic pollutants: TPH, BTEX	FEED	Under Exec.
Remediation type: All Type Contaminated media (soil/groundwater): soil and groundwater elaboration for green remediation software	FEED	Under Exec.
Remediation type: In-Situ/On-Site Technology/Process: air sparging, soil vapor extraction, pump & treat Contaminated media (soil/groundwater): soil and groundwater Treated contaminants: organic pollutants: TPH, BTEX, MTBE Inorganic pollutants: heavy metals	FEED	Under Exec.
Remediation type: On-Site Technology/process: pump & treat, oil recovery Contaminated media (soil/groundwater): groundwater Treated contaminants: organic pollutants: TPH, BTEX, MTBE	EPC	Under Exec.
Remediation type: In-Situ/On-Site Technology/process: In-Situ/On-Site thermal desorption, MPE Contaminated media (soil/groundwater): soil Treated contaminants: organic pollutants: TPH, BTEX, PAH, chlorinated compounds, PCDD/PCDF Inorganic pollutants: heavy metals	EPC	Under Exec.
Remediation type: In-Situ Technology/process: In Well Stripping - groundwater circulation well Contaminated media (soil/groundwater): groundwater Treated contaminants: organic pollutants: TPH, BTEX, MTBE	EPC	Under Exec.
Remediation type: In-Situ/On-Site Technology/Process: multi phase extraction, pump & treat, soil vapor extraction, oil recovery Contaminated media (soil/groundwater): soil and groundwater Treated contaminants: organic pollutants: TPH, BTEX, MTBE	EPC	Under Exec.
Remediation type: In-Situ Technology/process: In Well Stripping - groundwater circulation well Contaminated media (soil/groundwater): groundwater Treated contaminants: organic pollutants: TPH, BTEX, MTBE	EPC	Under Exec.

SITE REMEDIATION PROJECT REFERENCES

LOCATION	CLIENT	PROJECT
Italy	Eni S.p.A.	Remediation of gas station - PMC activities
Italy, Milazzo	Milazzo Refinery (RAM)	Contaminated soil removal
Italy, Crotone	Syndial S.p.A.	Interim remedial action on NORM landfill
Italy	Eni R&M	Oil-Refinery decommissiong and remediation
Italy	Eni R&M	Service station decommissioning and remedation
Italy, Brindisi	Enipower	Soil remediation project - Phytoremediation of heavy metal-contaminated soil (on-site treatment)
Kazakhstan, Ust-Kamenogorsk	UKER	UST Kamenogorsk design of pump & treat system
Colombia	Ecopetrol	Sludge treatment & oil recovery - Conceptual design
Italy	Eni R&M	RAGE - Feasibility study on-site thermal desorption & stabilization plant
Italy, Passirano	Eni R&M	Groundwater and saturated soil remediation - In-Situ chemical oxidation
Italy, Voghera	Eni R&M	Soil remediation - In-Situ thermal desorption treatment plant
Italy, Secchia	Eni R&M	Soil remediation by soil washing treatment plant

KEY FACTORS	SCOPE OF WORK	ON STREAM
Activities related to Eni S.p.A. Div. R&M - Retail - Italian Sites Remediation type typically used: In-Situ/On-Site/Off-Site Technology/Process: air sparging/soil vapor extraction/dig & dump/ ISCO/ISTD/P&T/ORC technology Contaminated media (soil/groundwater): soil and groundwater Typically treated contaminants: organic pollutants: TPH, BTEX, MTBE	EPC	Under Exec.
Design and implementation of sheet pile wall and soil removal	EPC	Under Exec.
Excavation and temporary cover installation operated on the shore line. Evaluation of radioactive exposure levels in handling, storage and transportation activities	EPC	Under Exec.
n. 15 sites located in Italy with on-going remediation projects	E	Under Exec.
Over than 600 sites with on-going remediation project	E	Under Exec.
80,000 t of excavated soils 24,000 t of treated soils at on-site plant	EPC	Under Exec.
Pump & treat system drilling of exploratory wells, groundwater modeling and groundwater treatment system design. Pumping rata about 1,400 m^3/d	E	Under Exec.
Remediation type: In-Situ/On-Site Technology/Process: TPE Contaminated media (soil/groundwater): soil Treated contaminants: organic pollutants: TPH, BTEX	FEED	2012
Remediation type: On-Site Technology/process: thermal desorption, stabilization Contaminated media (soil/groundwater): soil Treated contaminants: organic pollutants: TPH, BTEX, MTBE Inorganic pollutants: heavy metals	FEED	2012
Remediation type: In-Situ Technology/process: In-Situ chemical oxidation Contaminated media (soil/groundwater): saturated soil/waste water Treated contaminants: organic pollutants: TPH, BTEX, MTBE, LNAPL	EPC	2012
Remediation type: In-Situ Technology/process: In-Situ thermal desorption Contaminated media (soil/groundwater): soil Treated contaminants: organic pollutants: TPH, BTEX	EPC	2012
Remediation type: On-Site Technology/process: soil washing Contaminated media (soil/groundwater): soil Treated contaminants: organic pollutants: TPH, BTEX	EPC	2010

SITE REMEDIATION PROJECT REFERENCES

LOCATION	CLIENT	PROJECT
Italy, Ravenna	Eni R&D	In-Situ Chemical Oxidation (ISCO) pilot-plant
Italy, Secchia	Eni R&M	Soil and groundwater remediation project - Excavation and Soil-Washing SW (for contaminated soil treatment) - Pump & treat (for contaminated groundwater treatment)
Italy, Quiliano	Eni R&M	Soil and groundwater remediation project - Excavation, Soil-Washing (SW) and landfarming (for contaminated soil treatment) - Pump & treat (for contaminated groundwater)
Italy, Portiglioni Scarlino	Eni E&P	Site remediation of Portiglioni/Terrarossa mining site & archeological park construction
Italy, Ferrera Erbognone	Praoil	Monitoring natural attenuation - Interim remedial action for accidental oil spill
Italy, Porto Marghera	Syndial S.p.A.	In-Situ Chemical Oxidation (ISCO) and Electro-Kinetic Remediation Technology (EKRT) soil treatment plant
Italy, Ravenna	Syndial S.p.A.	Sediment remediation project - Chemical inertization of mercury-contaminated sediments
Italy, Pisticci	Eni E&P	Oil-pit remediation project - Direct Contact Thermal (DCT) desorption of hydrocarbon-contaminated drilling cuttings & sludges

KEY FACTORS	SCOPE OF WORK	ON STREAM
Design & construction of ISCO pilot-plant. Modeling evaluation of peroxide oxidation reaction	EPC	2010
16,000 t of hydrocarbon-contaminated soil treated at SW plant	EP	2010
40,000 t of hydrocarbon-contaminated soil treated at SW plant, operated on-site 40,000 t of hydrocarbon-contaminated soil treated at landfarming plant, operated on-site 90 m^3/h of contaminated-groundwater treated at n. 2 physical-chemical plants, operated on-site	EPC	2010
Removal of 4,400 t pyrite, 2,000 t other substances	EPC	2009
45 monitoring points along a 1 km contaminated plume	EPC	2009
Field verification of innovative technologies for in-situ soil and groundwater remediation	EPC	2009
20,000 t of hydrocarbon-contaminated cutting & sludges treated at on-site plant	EPC	2007
20,000 t of hydrocarbon-contaminated cutting & sludges treated at on-site plant	EPC	2004

SITE REMEDIATION PROJECT REFERENCES

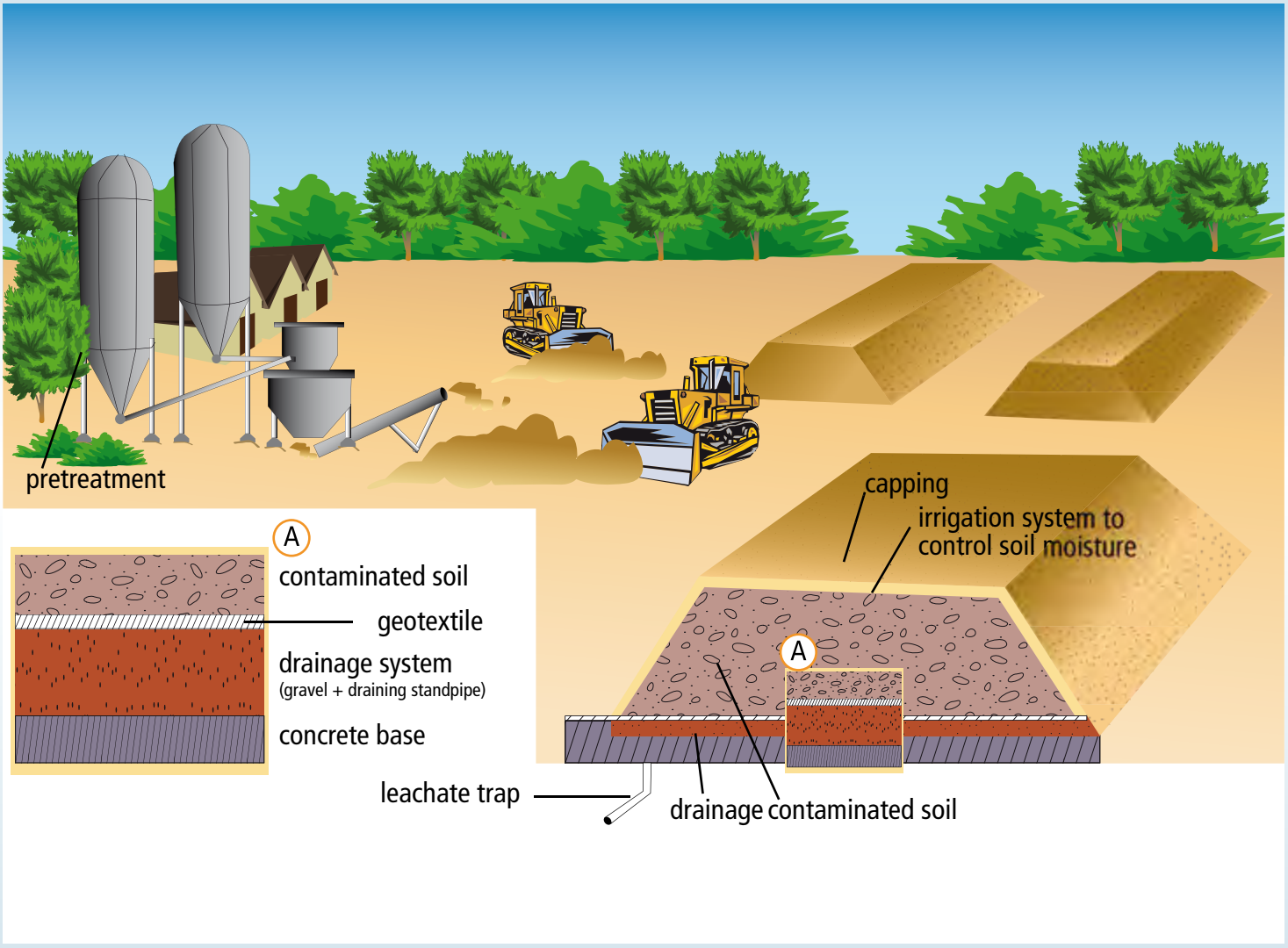
LOCATION	CLIENT	PROJECT
Italy, Porto Marghera	Eni R&M	Contaminated soil remediation
Italy, Vigevano	Snam - Praoil	Soil remediation project - Accidental oil spill remediation through biosparging

ENI R&M CONTAMINATED SOIL REMEDIATION PORTO MARGHERA (ITALY)

The 11 hectares large former oil tank farm & industrial site of Eni R&M is located close to Venice, Italy. In 1998 Eni R&M initiated a detailed and comprehensive site assessment. A preliminary representation of distribution and type of contamination in the environmental matrices (soil and groundwater) was achieved. The unsaturated zone was found to be contaminated with adsorbed petroleum hydrocarbons. Bioremediation techniques were selected for soil treatment during preliminary screening phases. To evaluate the effectiveness of bioremediation, laboratory and field tests were carried out. The degradation reaction rate was shown to be higher with nutrients & perlite addition and with forced aeration.
Based on test data, a full-scale biopile treatment plant was designed, constructed and operated on-site by Saipem.

Capacity: 54,000 tons of contaminated soil.
Contract: EPC.
Completed in 2002.

KEY FACTORS	SCOPE OF WORK	ON STREAM
54,000 t of hydrocarbon-contaminated soil treated at on-site plant	EPC	2002
In-situ treatment of contaminated area	EPC	2000



DECOMMISSIONING AND WASTE MANAGEMENT

Assemini Plant Dismantling

Design and execution of site assessments, clean-ups from many hazardous compounds, removal of residues, washing, gas free certification, dismantling and waste management.
(Characterization, packaging, transportation and definition of disposal methodologies).

Nuclear decommissioning treatment and conditioning of liquid nuclear waters equipment and structure dismantling, waste management.

DECOMMISSIONING AND WASTE MANAGEMENT PROJECT REFERENCES

LOCATION	CLIENT	PROJECT
Italy, Saluggia	Sogin	Cementation plan for conditioning for radioactive waste
Italy, Rotondella	Sogin	Cementation plan for conditioning for radioactive waste
Gabon, Loango	Eni E&P	Loango field development project - Feasibility study for: - PP platform decommissioning; - DP1 platform decommissioning; - DP2 platform decommissioning; - DP3 platform decommissioning; - Subsea network decommissioning; - Sea bed restoration.
Italy, Assemini	Syndial S.p.A.	Plant decommissioning (Step 5): - PVC 2; - VCM 2; - Power plant CTE 1; - Ammonia sulphate.
Italy, Giglio Island	Costa Crociere	Costa concordia decommissioning project - Feasibility study for: - Yard material handling; - Waste management (with Risamb).
Italy, Cremona	Tamoil	Technical economical study for plant decommissioning - Feasibility study for: - Dismantling evaluation costs; - Deconstruction evaluation costs.
Mexico	Pemex	Oil field revamping - Bid Within the project an evaluation of the decommissioning activities was requested for: - Approx. n. 100 well sites; - n. 10 storage/separation/pumping stations.
Italy, Gela	RA.GE	Power plant decommissioning: - Steam generation unit; - 90 m chimney.
Italy, Cirò Marina	Syndial S.p.A.	NaCl production plant decommissioning: - Depuration unit; - Essication unit; - Storage unit; - Utilities; - Power generation unit; - Onshore loading utilities; - Offshore loading utilities.

KEY FACTORS	SCOPE OF WORK	ON STREAM
227 m^3 of radioactive liquid wastes	EPC	Under Exec.
3.5 m^3 of radioactive liquid wastes	EPC	Under Exec.
Overall structures weight is approx. 60,000 t Waste to be disposed/treated approx. 15,000 t	FEED	2013
Overall structures weight is approx. 25,000 t	FEED	2013
Overall structures weight is approx. 45,000 t	FEED	2013
Overall structures weight is approx. 25,000 t	FEED	2013
Overall structures weight is approx. 10,000 t; Waste to be disposed/treated approx. 20,000 t	FEED	2012
The power plant units are close to other active units utilities that will be operative during the dismantling activites. Overall structures weight is approx. 2,500 t	FEED	2012
Overall structures weight is approx. 45,000 t	FEED	2012

DECOMMISSIONING AND WASTE MANAGEMENT PROJECT REFERENCES

LOCATION	CLIENT	PROJECT
Nigeria, Kaduna	KPRC Ltd.	KPRC rehabilitation project - Feasibility study for: - Demi unit decommissioning.
Nigeria, Warry	WPRC Ltd.	WPRC rehabilitation project - Feasibility study for: - KHT unit decommissioning; - Alkylation unit decommissioning.
Italy, Brindisi	Syndial S.p.A.	Enipower power plant decommissioning n. 3 steam turbines; n. 4 vapor generation units 400 t/h; n. 4 60 metres chimneys; related utilities (storage tanks, buildings). Waste management.
Italy, Bari	Eni R&M	Underground structures decommissioning within the ex refinery plant including: - Underground pipe clean-up; - Asbestos removal; - Excavation activities; - Waste management.
Italy, Barletta	Eni R&M	Fuel depot plant decommissioning including equipment and pipe cleaning (building excluded). Asbestos removal. Equipment and pipe and civil structures dismantling excavation activities; waste management.
Italy, Brescia	Eni R&M	Fuel depot plant decommissioning including equipment and pipe cleaning (building and underground structures excluded). Equipment and pipe and civil structures dismantling; excavation activities; waste management.

KEY FACTORS	SCOPE OF WORK	ON STREAM
Overall structures weight is approx. 200 t	FEED	2012
Overall structures weight is approx. 1,000 t	FEED	2012
The power plant units are close to other active units utilities that will be operative during the dismantling activites. Overall structures weight is approx. 17,000 t	FEED	2012
Overall structures weight is approx. 1,500 t	FEED	2012
Overall structures weight is approx. 9,000 t	FEED	2012
Overall structures weight is approx. 2,000 t	FEED	2012

DECOMMISSIONING AND WASTE MANAGEMENT PROJECT REFERENCES

LOCATION	CLIENT	PROJECT
Italy, Assemini	Syndial S.p.A.	Petrochemical (Starlene, ACN, mercury cells) plant decommissioning including equipment and pipe cleaning. Asbestos removal. Equipment and pipe and civil structures dismantling. Waste management.
Italy, San Donato Milanese	Eniservizi S.p.A	Building, civil plant and underground structures demolition. Relocation of utilities. Asbestos removal. Waste management.
Italy, Napoli	Eni R&M	Fuel depot plant decommissioning including equipment and pipe cleaning (building and underground structures excluded). Asbestos removal. Equipment and pipe and civil structures dismantling. Waste management.
Italy, Ravenna	Eni R&M	Underground structures decommissioning within the ex refinery plant including: - Underground pipe clean-up; - Asbestos removal; - Excavation activities; - Waste management.
Italy, Manfredonia	Syndial S.p.A.	Excavation activities, transport and waste disposal.

KEY FACTORS	SCOPE OF WORK	ON STREAM
Overall structures weight is approx. 70,000 t	FEED	2011
Overall structures weight is approx. 70,000 t Waste management: 5,000 t of contaminated soil	FEED	2011
Overall structures weight is approx. 13,000 t	FEED	2011
Overall structures weight is approx. 25,000 t	FEED	2011
270,000 t	EPC	2010

DECOMMISSIONING AND WASTE MANAGEMENT PROJECT REFERENCES

LOCATION	CLIENT	PROJECT
Italy, Assemini	Syndial S.p.A.	Plants dismantling
Italy, Priolo Gargallo	Polimeri Europa - Air Liquide Sicilia - Syndial S.p.A.	Waste management and disposal
Italy, Brindisi	Eni S.p.A.	Dismantling of equipment from Aquila Field (risers, umbelicals, buoyancies) and waste management
Italy, Assemini	Syndial S.p.A.	Plants and tank cleaning and dismantling

SYNDIAL S.P.A. PLANTS DISMANTLING ASSEMINI (ITALY)

Engineering services for asbestos removal, plants remediation, removal of sewage system, plant dismantling, demolition of structures and waste management.

Contract: E.
Completed in 2010.

KEY FACTORS	SCOPE OF WORK	ON STREAM
	E	2010
Waste 160,000 t	EPC	2010
Waste management: 150,000 t of waste	EPC	2009
Contaminated water 55,000 m^3	EPC	2009

SYNDIAL S.P.A.
PLANTS AND TANK REMEDIATION AND DISMANTLING
ASSEMINI (ITALY)

Removal, management and disposal of hazardous residues and chemical compounds contained in several tanks and other equipment on site.

Contract: EPC.
Completed in 2009.

DECOMMISSIONING AND WASTE MANAGEMENT PROJECT REFERENCES

LOCATION	CLIENT	PROJECT
Italy, Brindisi	Eni E&P	Dismantling of equipment from Aquila Field and waste management
Italy, Sarroch	Syndial S.p.A.	Landfill decommissioning, waste management and disposal
Italy, Porto Torres	Syndial S.p.A. - Endesa Italia	Waste management and disposal, clean-up of two tanks containing orimulsion and fuel oil, plants decommissioning, clean-up of various tanks, containing slop and biological sludges
Italy, Pieve Vergonte	Syndial S.p.A.	Waste management and disposal; tanks clean-up and plants decommissioning
Italy, La Spezia	Eni R&M	Removal of soil contaminated by hydrocarbons/asbestos and final disposal
Italy, Iglesias	Enirisorse S.p.A.	Landfills for not hazardous waste
Italy, Bari	Agricoltura	Clean-up storage tanks

KEY FACTORS	SCOPE OF WORK	ON STREAM
Waste 150,000 t	EPC	2009
Waste incineration 5,000 t	EPC	2009
3 tanks of 80,000 m^3; 2 tanks of 50,000 m^3; waste 170,000 t	EPC	2009
Waste 38,000 t	EPC	2005
Soil 41,000 m^2	EPC	2004
Genna Luas site 1,400,000 m^3, Acqua Sa Canna site 835,000 m^3	EPC	2004
26,500 t	EPC	1999

DECOMMISSIONING AND WASTE MANAGEMENT PROJECT REFERENCES

LOCATION	CLIENT	PROJECT
Italy, Portoscuso	Singea	Design, construction of two landfills for no-hazardous waste and final disposal
Italy, Borgofranco d'Ivrea	Snam	Waste management and disposal of soil contaminated by hydrocarbons
Italy, Genova	Snam	Clean-up oil tank and waste management, final disposal of soil contaminated by hydrocarbons

ENIRISORSE S.P.A. LANDFILLS FOR NOT HAZARDOUS WASTE GENNA LUAS, ACQUA SA CANNA AND GURONEDDU, SARDINIA (ITALY)

Design and execution of three landfills for not hazardous waste:

In Genna Luas (Iglesias) in place of an old pyrite mine. The landfill project included the construction of a plant for the treatment of leachate.
Waste Capacity: 1,400,000 m^3
Contract: EPC.
Completed in 2003.

In Acqua Sa Canna and Guroneddu
Waste Capacity: Guroneddu 230,000 m^3, Acqua Sa Canna 835,000 m^3
Contract: EPC.
Completed in 2004.

KEY FACTORS	SCOPE OF WORK	ON STREAM
Sludges 250,000 t	EPC	1999
Contaminated soil 86,000 t	EPC	1996
35,000 m^3	EPC	1994

ENVIRONMENTAL TREATMENT PLANTS

TAF project in Priolo - Italy: Overview of the groundwater treatment plant with a capacity of 600 m^3/h

Planning and construction of plants for site remediation, waste recycling and treatment of groundwater, process water and waste streams.

These plants reduce the amount of pollution generated by industrial processes, by converting a pollutant after it is formed and reducing its impact on the environment. Pollution prevention is based on a "Green Design" environmental management strategy: using more efficient manufacturing processes and better materials to reduce the quantity of waste as well as its toxicity and hazard level.

ENVIRONMENTAL TREATMENT PLANTS PROJECT REFERENCES

LOCATION	CLIENT	PROJECT
Abu Dhabi	Takreer	BeAAT expansion project
Italy, Milazzo	Milazzo Refinery (RAM)	Revamping of biological waste water treatment plant
Kuwait	KOC	Jurassic plant - Produced water treatment plants
Algeria	Sonatrach/FCP	Menzel - Produced water treatment plants
Italy, Cremona	Tamoil	Groundwater treatment plant
Italy, Cremona	Tamoil	Multi-phase extraction plant
Italy, Cremona	Tamoil	Soil vapor extraction plant
Italy, Priolo Gargallo	Syndial S.p.A.	Groundwater treatment plant and soil remediation - Physical/chemical and biological (MBR) treatment plant

CAPACITY	SCOPE OF WORK	ON STREAM
Upgrade and expansion of central environmental protection facilities in Ruwais area to safely treat and dispose hazardous industrial waste	FEED	Under Exec.
600 m^3/h		Under Exec.
150,000 BWPD (995 m^3/h)	EPC	Under Exec.
5,000 BWPD (35 m^3/h)	EPC	Under Exec.
Capacity: 40 m^3/h of contaminated water Plant type: physical/chemical treatment plant Treated contaminants: organic pollutants: TPH, BTEX, MTBE, LNAPL	EPC	2013
Capacity: 10 m^3/h of contaminated water 1,350 Nm^3/h of contaminated air Plant type: physical/chemical and thermal treatment plant Treated contaminants: organic pollutants: TPH, BTEX, MTBE, LNAPL	EPC	2013
Capacity: 180 Nm^3/h of contaminated air Plant type: physical/chemical treatment plant Treated contaminants: organic pollutants: TPH, BTEX, MTBE	EPC	2012
600 m^3/h	EPC	2010

ENVIRONMENTAL TREATMENT PLANTS
PROJECT REFERENCES

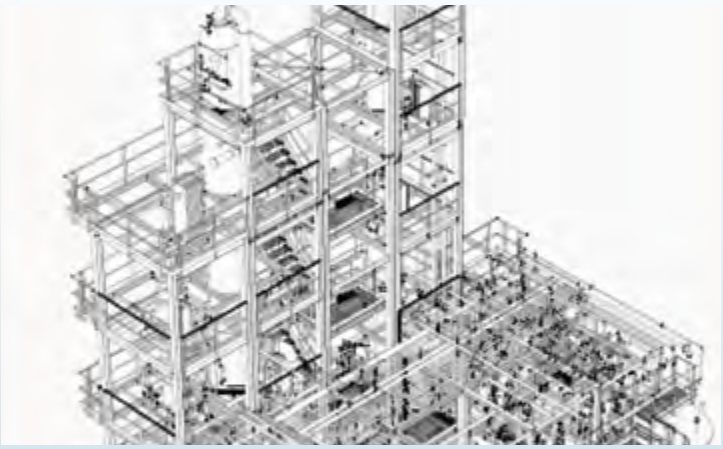
LOCATION	CLIENT	PROJECT
Italy, Gela	Raffineria di Gela S.p.A.	Ensolvex plant - Oil sludge recovery and soil treatment from hydrocarbons mixture dumped in a pit
Italy, Porto Marghera	Syndial S.p.A.	Groundwater treatment plant - Physical/chemical treatment plant
Italy, Gela	Raffineria di Gela S.p.A.	Not Pumpable Fluids (NPF) extraction plant with recovery of slop oil by sedimentation and centrifugation
Italy, Gela	Raffineria di Gela S.p.A.	Industrial waste water treatment plant - Biological denitrification/nitrification with pure oxygen

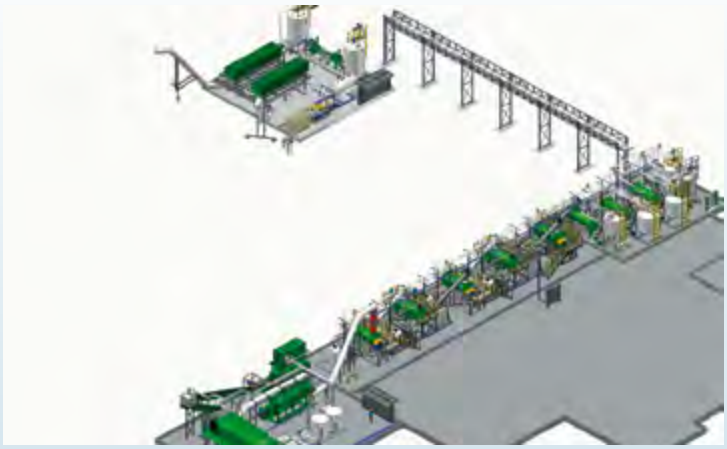
RAFFINERIA DI GELA S.P.A.
ENSOLVEX PLANT - OIL SLUDGE RECOVERY AND SOIL TREATMENT FROM HYDROCARBONS MIXTURE DUMPED IN A PIT
GELA (ITALY)

Soil remediation technology applied to soil contaminated by hydrocarbons (TPH):

The new Ensolvex proprietary technology consists of the following treatment phases: soil excavation and storage, soil pre-treatment, hydrocarbon extraction stages by Ethyl Acetate (ETAC), ethyl acetate recovery by distillation, hydrocarbons recovery and storage, soil washing and dewatering, treated soil storage/reuse or disposal.

Capacity: 4 t/h
Contract: EPC.
Completed in 2010.





CAPACITY	SCOPE OF WORK	ON STREAM
4 t/h	EPC	2010
50 m^3/h	EPC	2009
72 t/d	EPC	2008
850 m^3/h	EPC	2007

ENVIRONMENTAL TREATMENT PLANTS
PROJECT REFERENCES

LOCATION	CLIENT	PROJECT
Italy, Mantova	Eni R&M	In Well Stripping (groundwater circulation well) - Pilot test
Italy, Taranto	Eni R&M	Industrial waste water treatment plant - Desulfurization by air and catalist injection, biological filtration, sludge thickening and dewatering by centrifugation
Abu Dhabi	ADCO	Bu-Hasa - Produced water treatment plants
Kazakhstan	Agip Kazakhstan North Caspian Operating Co.	Groundwater physical/chemical treatment plant
Italy, Porto Torres	Syndial S.p.A.	Hydraulic barrier as safety measure, implementation of 3 groundwater treatment plants (TAF) - Physical/chemical treatment plant
Venezuela	Eni Lasmo - PDVSA	Groundwater treatment plant
Italy, Avenza	Syndial S.p.A.	Groundwater treatment plant (TAF), physical/chemical treatment plant
Italy, Filago	Eco-Lombardia 4	Waste to energy - Plant for thermal treatment of industrial + toxic and hazardous waste and refuse derived fuels
Italy, Assemini	Syndial S.p.A.	Thermal treatment of chlorinated contaminated soil and tar - Rotary kiln type furnace
Kuwait	KOC	Minaghish - Produced water treatment plants
Abu Dhabi	ADCO	Sahil - Produced water treatment plants
Italy, Ravenna	Ambiente	Waste to energy - Plant for thermal treatment of industrial + toxic and hazardous and RDF
Italy, Bolzano	Bolzano Municipality	Waste to energy - 1st and 2nd line of the plant for thermal treatment of municipal solid waste
Italy, Schio	Schio Consortium	Waste to energy - 1st and 2nd line of the plant for thermal treatment of municipal solid waste
Italy, Pollenza	CON.SMA.RI	Waste to energy - Plant for thermal treatment of municipal solid waste
Italy, Sarroch	Sarlux	Waste to energy - Plant for thermal treatment of oil residues
Italy, Sannazzaro de Burgondi	Eni R&M	Waste to energy - Plant for thermal treatment of oil residues

CAPACITY	SCOPE OF WORK	ON STREAM
Capacity: 10 m^3/h of contaminated water Plant type: physical/chemical treatment plant Treated contaminants: organic pollutants: TPH, BTEX, MTBE, LNAPL	EPC	2007
550 m^3/h	EPC	2006
90,000 BWPD (595 m^3/h)	EPC	2006
30 m^3/h	EPC	2005
180 m^3/h	EPC	2005
Capacity: 30 m^3/h of contaminated water Plant type: physical/chemical treatment plant Treated contaminants: inorganic pollutants: Ni, Co, Cd, Pb Organic pollutants: petroleum hydrocarbon, phenols	EPC	2005
70 m^3/h	EPC	2004
200 t/d	EPC	2003
5 t/h	EPC	2002
250,000 BWPD (1,655 m^3/h)	EPC	2000
9,000 BWPD (55 m^3/h)	EPC	1998
100 t/d	EPC	1997
400 t/d	EPC	1994
160 t/d	EPC	1991
100 t/d	EPC	1987
3,600 t/d	EPC	1980
600 t/d	EPC	1980

MARINE ENVIRONMENTAL MANAGEMENT

↘ Environmental Engineering
- Environmental Impact Assessment
- Characterization and Monitoring
- Remotely Operated Veichles (ROV)
- Permitting

↘ Oil Spill Management Services
- Engineering and Consulting
- Oil Fate Modeling and Remote Sensing
- Oil Spill Operations Organization & Direction
- Coastal Environmental Monitoring
- Shoreline Clean-up and Remediation.
- Waste Management
- Equipment Maintenance
- Training Courses according to IMO OPRC 90 Standards

↘ Marine Projects & Engineering Supports
- Naval Green Dismantling Platform (Hong Kong Convention 2009)
- Waste Recovery (oil & chemicals) from Wreck at Deep Water.

OFFSHORE ENVIRONMENTAL ENGINEERING

- Environmental Impact Assessment
- Environmental Permitting
- Environmental Plans and Supervision
- Definition of Mitigation Measures
- Marine Environmental Characterization
- Studies on:
  - Sediment and pollutant dispersion
  - Turbidity mapping
  - Seagrass mapping
  - Seagrass restoration
  - Marine traffic
  - Oil and gas dispersion
  - Underwater noise

Activities at sea are often assisted by remotely operated vehicles (ROVs).

OFFSHORE ENVIRONMENTAL ENGINEERING PROJECT REFERENCES

LOCATION	CLIENT
Italy	Statoil & E.ON
Congo	Eni E&P
Mediterranean Sea	Eni E&P
India	GAIL
Norway	Statoil
Qatar and Emirates	Dolphin
Saudi Arabia	Aramco
Iraq	Eni E&P
Russia, Sakhalin Island	ExxonMobil
Mediterranean Sea	Eni Corporate
Italy	ExxonMobil

PROJECT	SCOPE OF WORK	ON STREAM
TAP project - Gas corridor from Azerbaijan to South Europe. Permitting support. ESIA disclosure among stakeholders	E	Under Exec.
Decommissioning feasibility study of oil facilities. Sediment characterization plan	E	Under Exec.
Pipeline integrity monitoring project. Environmental consequences study due to pipeline rupture	E	Under Exec.
GAIL project. Conceptual study for the FSRU and landfall location selection	E	2012
Utsira project. Feasibility study for the landfall location selection	E	2012
Dolphin EPSR management. Environmental impact assessment for decommissioning activities	E	2012
Jeddah storm water drainage program. Environmental study	E	2012
Zubair seawater intake prefeasibility study - Turbidity Map. Marine traffic map	E	2010
Sakhalin 1 project - Support to the client for permitting and environmental issues. Interface with project design team	E	2009
Medstar project. Risk analysis - Environmental consequence evaluation of an oil spill in the Mediterranean and Black Sea	E	2009
ALNG project - Support to the client for permitting and environmental issues. Interface with project design team	E	2007

OFFSHORE ENVIRONMENTAL ENGINEERING PROJECT REFERENCES

LOCATION	CLIENT
Mauritania	Sphere Mauritania S.A.
Mediterranean Sea	Saipem S.p.A.

SPHERE PREFEASIBILITY STUDY MAURITANIA

Conceptual and prefeasibility study on supply the internal Mauritania area with treated water for industrial and domestic use by a seawater desalination and pipeline from the west coast of Mauritania to the F'Derik/Zouerate mining area. The following activities have been performed, in order to select the technical and economical best case between locations and project options:

- Outfall Environmental Impacts Study
- Marine Traffic Study
- Turbidity Study
- Offshore Environmental Overview Study
- Environmental Baseline by Marine and Coastal Surveys

PROJECT	SCOPE OF WORK	ON STREAM
Water study for a desalination plant to deliver water from the coast to mining operations field. Characterization of the marine environment, marine traffic, turbidity map, pollutant dispersion simulations	E	Under Exec.
Experimental study for Poseidonia transplanting and restoration.	E	Under Exec.

SAIPEM
POSEIDONIA TRANSPLANTING AND RESTORATION MEDITERRANEAN SEA

Experimental study has been performed in order to define a methodology to transplant Poseidonia oceanica. The study was subdivided in two phases: a laboratory test and a field test. The methodology will be applied after the laying of sealine inside a Poseidonia meadow, in order to restore and compensate environmental damages.

OIL SPILL MANAGEMENT SERVICES PROJECT REFERENCES

LOCATION	CLIENT
Italy	Agip/Eni E&P
Italy, Sicily	EniMed
Italy	Jonica Gas, Adriatica Idrocarburi
Italy & abroad	Oil Companies and Authorities
Italy	Eni Corporate University
Italy	Eni E&P

ENI E&P - ENIMED OIL SPILL RESPONSE (ITALY)

Support and management of antipollution operations, equipment supply and maintenance, training, emergency services and waste management.

Services provided since 1997

Engineering and Consultant Procurement and Assembling Oil Spill Support for:
- Oil Spill Services Organization-Direction
- Naval Means Response Selection
- Coastal Enviromental Monitoring
- Shoreline Clean-up and Remediation
- Wastes Management
- Oil Fate Modeling and Remote Sensing Monitoring

Equipment's Maintenance
Training Courses according to IMO OPRC 90.

PROJECT	SCOPE OF WORK	ON STREAM
Offshore antipollution services	EPC	Under Exec.
Offshore antipollution services	EPC	Under Exec.
Offshore antipollution services	EPC	Under Exec.
Oil spill response training courses	E	Under Exec.
IMO OPRC 90 training provider level 1-2-3	E	Under Exec.
Management of the offshore antipollution services since 1997	E	Under Exec.

OIL SPILL MANAGEMENT SERVICES
PROJECT REFERENCES

LOCATION	CLIENT
Italy	Eni Congo
Congo	Eni Congo
Philippines	Petron

PROJECT	SCOPE OF WORK	ON STREAM
Marine antipollution services	EPC	2007
Offshore antipollution services	E	2007
Oil recovery from "Solar 1" wreck. Operations include a single dynamic positioning vessel equipped with ROV for deepwater activities	EPC	2007

OIL SPILL MANAGEMENT SERVICES
PROJECT REFERENCES

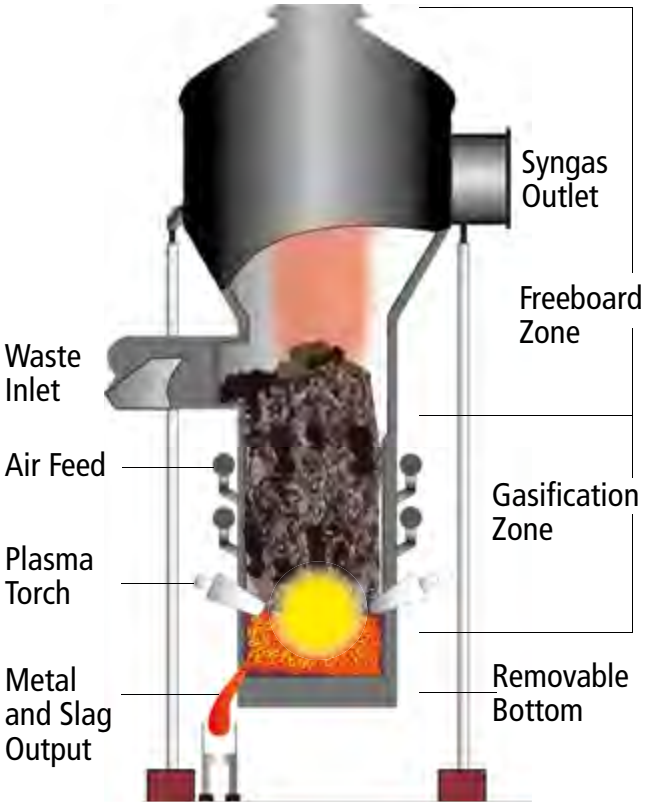
LOCATION	CLIENT
Spain, Galicia	Repsol
Italy, Augusta	Exxon
Italy	Eni E&P and Praoil
Italy, Genova	Merchant Fleet Ministry & Civil Protection Department
Italy, Genova	Ministry of Interior & Civil Protection Authority
Italy	Ministry of Interior National Civil Protection Department

PROJECT	SCOPE OF WORK	ON STREAM
Oil recovery from "Prestige" Cargo. Operation to a depth of over 3,800 m assisted by ROVs	EPC	2005
Marine pollution prevention training courses	E	2000
Offshore antipollution services: audit and feasibility studies	E	1996
Coordinated activities for the remediation of environmental damage, result of the Haven vessel accident (Genova sea), relict recovery, water monitoring and waste management	EPC	1993
VLCC Haven accident - Management of underwater operations, spill evaluation, environmental monitoring (DSV vessel), coastal remediation supervision	E	1991
Gulf of Genoa - VLCC Haven disaster Management of underwater operations, discovery of parts of the wreck, verification of losses of crude oil and fuel oil, environmental monitoring by means of a DSV vessel. Coordinated activities for the remediation of environmental damage and wastes management	E	1991

TECHNOLOGIES: PROPRIETARY AND/OR APPLIED UNDER LICENSE

- SAIPEM SULPHUR MANAGEMENT SYSTEM - SSMS (Saipem proprietary).
- ENSOLVEX: SOLVENT EXTRACTION TECHNOLOGY TO TREAT HEAVILY CONTAMINATED SOILS (Saipem/Eni proprietary).
- IN WELL STRIPPING TECHNOLOGY FOR IN-SITU GROUNDWATER DECONTAMINATION (Under license from IEG Gmbh).
- PLASMA TECHNOLOGY FOR INDUSTRIAL WASTE TREATMENT (Under license from Westinghouse Plasma Corporation).
- MODELING TOOLS FOR RESERVOIR AND GROUNDWATER SIMULATION (Saipem proprietary).

PLASMA GASIFIER REACTOR
Cross section of Westinghouse Plasma Corporation's, Plasma Gasification Vitrification Reactor.



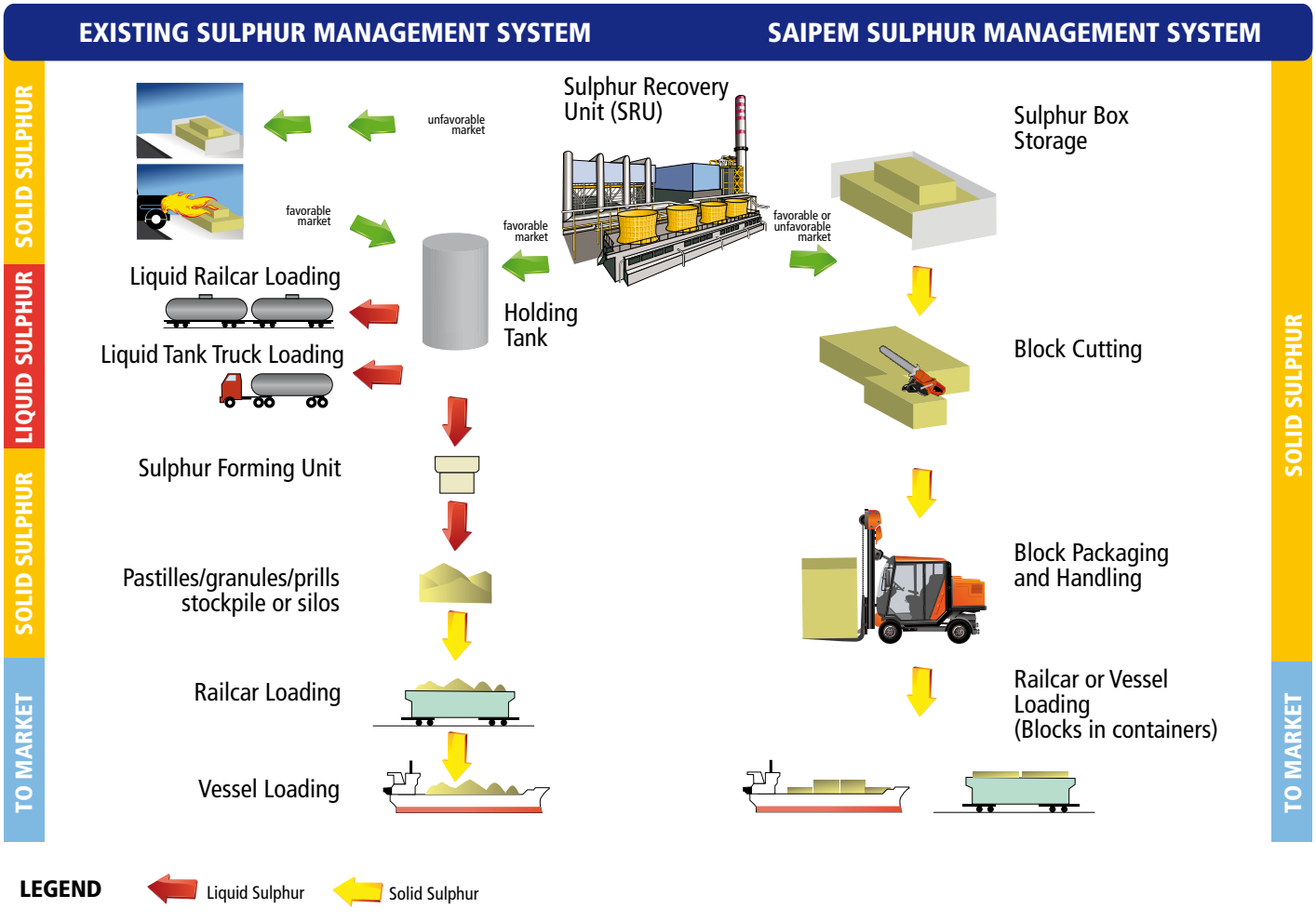
Alter Nrg Plasma Gasifier

SAIPEM SULPHUR MANAGEMENT SYSTEM (SSMS)

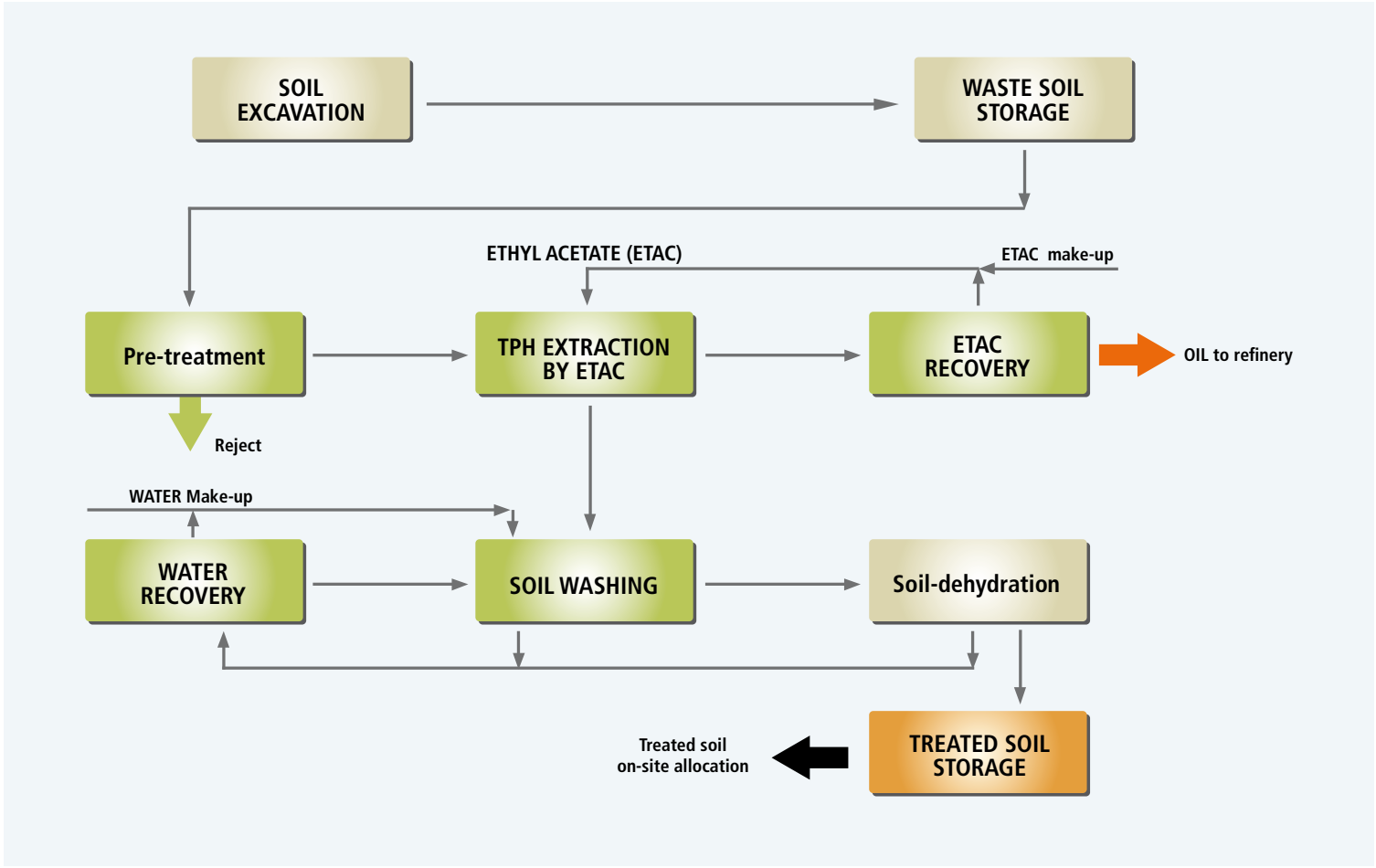
Over the last few years Saipem has developed a remarkable know-how regarding the sulphur management downstream of the Claus Process up to the final product export and utilization.
An Innovative Proprietary Technology (SSMS) that allows the certified "zero emission" transportation of the final product has been developed.
The technology consists of the production of solid sulphur blocks wrapped with a plastic film.

The above technology has been developed following the target of proposing a competitive investment in terms of:
- cost reduction (capex/opex);
- controlled emission levels;
- low risk associated.

Moreover, regarding the solid sulphur handling operation, the SSMS presents the main advantage of being certified as a "zero emission" technology (SGS, 2007) making possible the transport of the wrapped sulphur blocks as a "not dangerous good" with relevant cost reduction and advantages in terms of health, safety and environment.
In order to face the entire chain of sulphur management, strong efforts have been addressed to the utilization of sulphur as a soil amender (fertilizer).



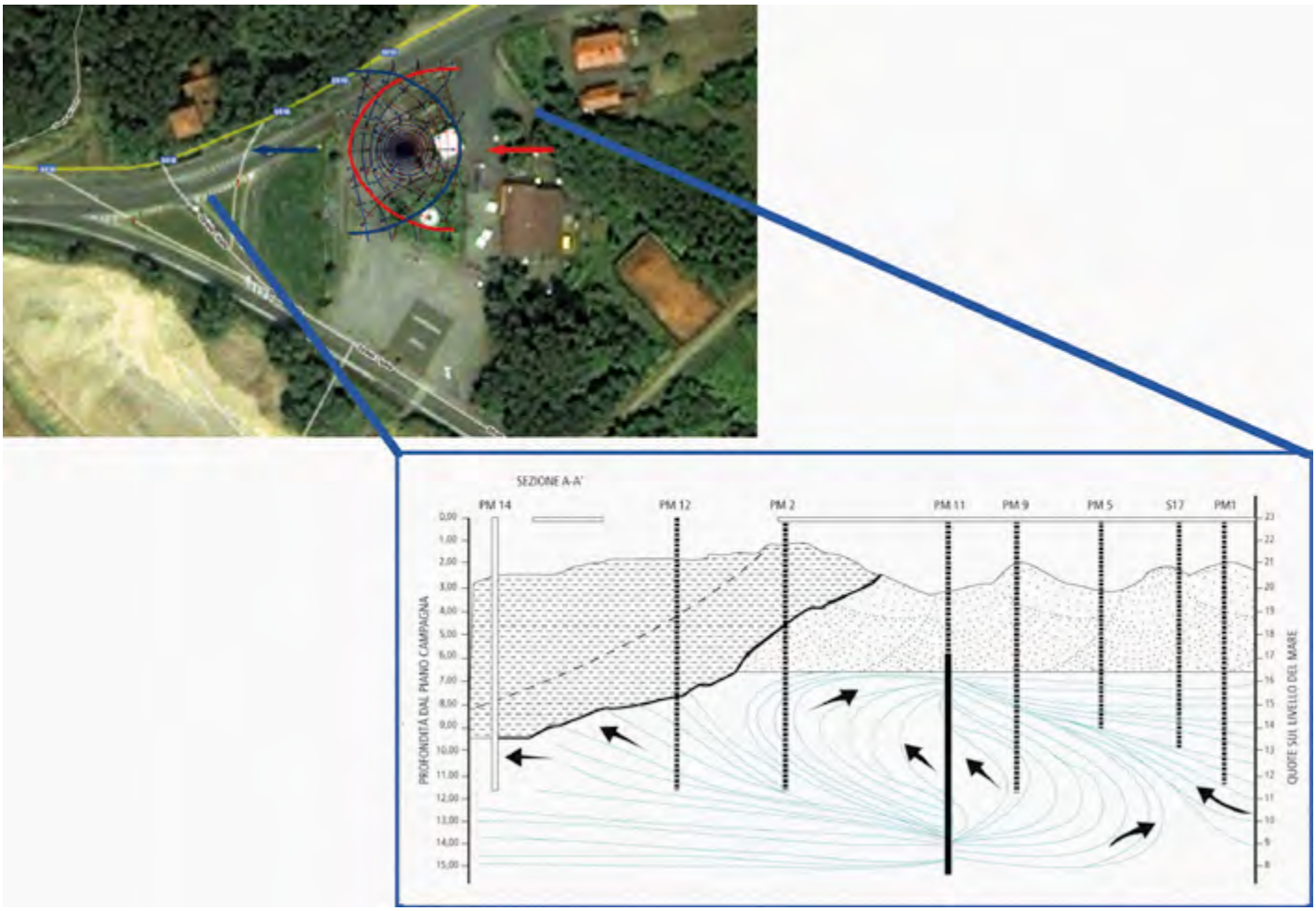
ENSOLVEX:
Remediaton technology for soil/waste contaminated by hydrocarbons (TPH), via Ethyl Acetate (ETAC) extraction.



GROUNDWATER CIRCULATION WELL (GCW) TECHNOLOGY

The total amount of water circulating around a GCW will consist of up gradient groundwater being captured, groundwater being recirculated and groundwater of down gradient release zone following treatment.

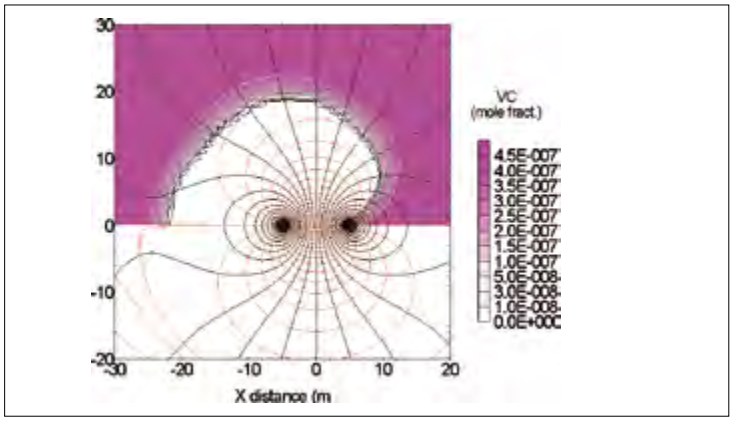
In Italy, the technology was firstly applied by Saipem at the Polimeri Europa Plant, in Mantova, in 2006.



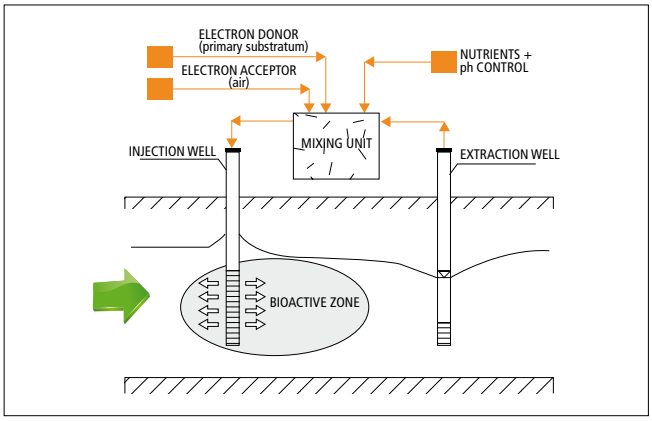
Example of a new application of GCW technology for groundwater treatment in a retail station

MODELING TOOLS FOR RESERVOIR AND GROUNDWATER

An application of Saipem's proprietary modeling tool: simulation of a pilot test of direct and cometabolic aerobic degradation reactions of chlorinated organic compounds using the TMVOC V.2.0 numerical simulator.



Spatial distribution of vinyl chloride within the treatment zone after 10 days of well doublet operation at the end of pilot test



Conceptual scheme of the pilot test based on an extraction/injection well doublet in a phreatic aquifer

NOTES