Onshore Pipeline Systems and Field Development

Samir Abbas - VP Sales and Proposals
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1. Technip in Germany
Competence Center for
Onshore Pipeline Systems
Our Offices

TECHNIP GERMANY GmbH
Theodorstrasse 90
40472 Düsseldorf
Germany
Our Product Portfolio

PROCESS PLANTS
- Refining plants
- Chemical plants
- Petrochemical plants
- Gas Oil Separation Plants
- Re-injection units

MATERIAL HANDLING
- Sulphur handling
- Coke Calcining
- Direct reduction iron
- Aluminium fluoride

DISTRIBUTION
- Onshore pipeline systems
- Oil and gas field developments
- Flow lines
- Pressure boosting stations
- Gas storages
- Tank farms

SUPPORT TO THE POWER INDUSTRY
- Lifetime monitoring system
- Surge analysis
- Fluid dynamics
- Vibration equalizer
- Damage analysis
Our Scope of Services

Studies and Conceptual Design

- Process optimisation and conceptual engineering
- Economic and financial viability analysis
- Cost - benefit analysis
- Cost estimation and assets evaluation
- Rehabilitation and rationalisation programs

Basic & Detail Design

- Value engineering
- Process simulation
- System design and hydraulic simulations
- Cost estimating and tariff calculation
- Operation and maintenance philosophies

EPC Implementation

- Project management
- FEED verification / endorsement
- Detail design
- HSE responsibility
- Procurement of all materials and equipment
- Construction management and Supervision

Commissioning & Start-up

- Commissioning and start-up planning and supervision
- Coordination of vendor representatives
- Loop checks
- Training
- HSE responsibility
- As-build documentation
- Hand over
Global Procurement Network
EPC internet-based procurement system

A worldwide network for increased flexibility and competitiveness
2. Onshore Pipeline Systems Technology
In 1999 Technip acquired assets of the former Mannesmann Group which included Mannesmann’s Pipeline Business.

Mannesmann had started the pipeline business in 1936 and had over the years become one of the largest and most experienced onshore pipeline contractors in Europe.

At the same time Mannesmann was Europe’s leading line pipe manufacturer giving its pipeline business an exceptional access to innovative applications in the industry.

Technip Germany today combines in a unique manner Mannesmann’s material and construction know-how with Technip’s vast experience and competence in the design and implementation of the most demanding projects for the oil and gas industry.

Since 1999 Technip in Germany is the competence center of the Technip Group of Companies for Onshore Pipeline Systems.
**Pipeline Systems Types**

- **Transmission Pipelines**
  - Oil, Natural Gas, Water, Sulphur
    - Cross Country Pipeline
    - Transport Network

- **Product Pipeline / Petrochemical Products**
  - Multi-Product Pipeline
  - Single-Product Pipeline

- **In-Field Pipelines / Multiphase**
  - Flow, Gathering and Trunk Lines
  - Re-injection
Business Fields

- **Pipelines**
  - Transmission pipelines
  - Product pipelines
  - In-field pipelines

- **Terminals / Stations**
  - Pump and compressor stations
  - Storage terminals
  - Metering and filtering units
  - Block valve stations
  - Scrapers
  - Slug catchers
Capabilities

- People
- Tools and Systems
Capabilities – Our People / Our Expertises

- Lead Engineers with Ø >20 years of experience in Pipeline design and construction
- Hydraulic experts with experience in Pipeline system design, multiphase flow systems
- Senior Experts for GIS systems and GIS based Pipeline design
- CAD operators / designers with specific Pipeline related expertise
- Process engineers with specific expertise for pipeline systems incl. pump/compressor stations, pressure regulation and metering, etc.
- Mechanical Engineers with specific Pipeline related expertise for material selection and requisitioning
- Welding engineers
- Geographer with expertise in routing and mapping
Capabilities – Tools specific for Pipeline Engineering

**Hydraulic Simulation Software:**

- Pipeline Studio – Single Phase Flow transient and steady state software for design of pipeline systems
- OLGA – Multiphase Flow transient and steady state pipeline systems design / flow assurance software

**GIS**

Smallworld (GE) – GIS system with a **Pipeline specific, customised application module** enabling predominantly automated alignment sheet production; compatible with PODS

**Mapping**

- Smallworld
- Google Earth Professional
- Descartes - visualization, mapping, and raster-to-vector conversion software
GIS and spatial data management is a profound part of data processing and data exchange between Technip and its customers.

A combination of dedicated pipeline Engineering Tools has been setup & customized in TPGY to make cost efficient Pipeline design.

Expertise Knowledge has been built-up over 10 years to be able to operate the system + do the necessary adjustments for each Project.

Contribution to Summits & Conferences and constant training of Experts ensures that the system is State-of-the-Art and upcoming / future Client requirements are met / implemented early.
Material Optimization

- **Material Selection Criteria**
  - Standardised Dimensions
  - Adequate Strength to Operate at Pressure
  - Adequate Fracture Toughness
  - Adequate Internal / External Corrosion Resistance
  - Pipe has to be weldable under Site Conditions

- **Materials used**
  - Carbon Steel from X42 to X80, API 5L
  - Pipe in Pipe with CRA´s, API 5LC, ASTM
  - Clad or lined Pipes with CRA´s
  - GRP / GRE, ISO 14692, API 15HR

- **Calculation and Simulation-Tools**
  - Hydrocor
  - ECE
Special Calculations

- System Design Including Strength & Stress Calculation
  - Design in Compliance with National and International Codes & Standards
  - Reliability Based Design (RBD)
  - Continuum Mechanics

- Calculation and Simulation-Tools
  - ANSYS, Finite Element Program
  - Rohr 2, CAESAR II
  - INROS
  - PACAP
  - DIMy
Slug Catchers Design

- Types of Design
  - Taylor Forge Design
  - Shell Design
  - Modified Shell Design

- Basis of Design
  - Case Studies
  - Ramp-up Scenarios
  - Liquid Hold-ups
  - Gas / Water Separation
  - Residence Time for Oil / Water

- Calculation and Simulation-Tools
  - OLGA 2000
  - PVT Sim
EPC Experience

- **Pipeline Systems**
  - **Oil**
    - Total Length: > 6,000 km
    - Diameter / Material: 10" - 56" / X60-X70
  - **Water**
    - Total Length: > 2,800 km
    - Diameter / Material: 32" - 64" / X42-X70
  - **Gas**
    - Total Length: > 17,000 km
    - Diameter / Material: 10" - 56" / X60-X80

- **Station Duty for Oil and Gas Systems**
  - Pump and Compression: 8,400 MW

- **Electrical Generation for Oil and Gas**
  - Power Generation: 2,600 MW
3. Oil- and Gas Field Development
Overview

- **Field Development and Underground Storage Projects are very similar**
  - **Field Development**
    - In-field lines (multiphase)
    - Process plant, a real challenge
    - Export pipelines (gas, oil, condensate, others …)
    - Re-injection lines (gas and/or water)
  - **Underground Storage**
    - Withdraw (multiphase, but only gas and water)
    - Process plant, drying and compression are the main units
    - Import / Export pipeline (gas)
    - Injection (gas)

- **Very suitable projects for TPGy**
  - TPGy is the competence center for onshore pipelines and underground storage of the TP Group
  - Process excellence of all TP offices
Our Expertise and Scope of Services for Field Development Facilities

- Basic engineering and dehydration studies
- Compressor capacity optimisation
- EPC and EPCM execution models
- Project financing in liaison with EIB, WB, ADB, etc.
- Technip Group global procurement network
- Close relationship to a leading material research institute (MFI)
- Close relationship to gas storage operators
- Preferred access to construction equipment through Maats equipment pool
Typical Process Plant for Field Development
4. Selected Pipeline Systems and Field Development References
## Selected Pipeline Systems (PL) Projects and Field Development (FD) (FEED / EPC) - 1

<table>
<thead>
<tr>
<th>Country</th>
<th>Client</th>
<th>Type</th>
<th>Product</th>
<th>Year of completion</th>
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<td>Detailed</td>
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<td>WINGAS</td>
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</table>
Badra Project – Iraq

- **Contract Award:**
  - 2010

- **Completion Date:**
  - 2011

- **Client:**
  - Gazprom Neft / Kogas / Petronas / TPAO and local

- **Scope of Work:**
  - Conceptual Design
  - FEED
  - Oil field development 170000 bpd
  - The field is about 16 km long and 6 km wide
  - Reserves estimated at 2 billion barrels of oil
  - To be developed in two phases.
  - The first phase production target is 21000 bpd with a plateau production target of 170000 bpd in the second phase.
  - Gas processing plant
  - Flow lines
West Qurna 2 – Early Production – Iraq

- **Contract Award:**
  - 2010

- **Completion Date:**
  - 2011

- **Client:**
  - Lukoil / Statoil / SOC

- **Scope of Work of TPGY:**
  - FEED of infield facilities
  - Oil field development in three phases.
    - Phase 1; Preliminary Early Production 150,000 bpd
    - Phase 2; Early Production 400,000 bpd
    - Phase 3; Full production 700,000 bpd
  - Well Pad design (6 well pads)
  - Flow and trunk lines (90 flow lines, 6 trunk lines)
  - Slug catcher and pigging stations
Inter Refineries Pipelines-II (IRP-II) Project – UAE

- **Contract Award:**
  - 2009

- **Completion Date:**
  - 2010

- **Client:**
  - TAKREER, United Arab Emirates

- **Scope of Work:**
  - FEED Services
  - Project jointly executed with Technip Abu Dhabi
  - Project objective: Handling of increase in future product (Jet A1, Gasoil, Gasoline) movements by pipeline up to year 2025
  - Main project facilities:
    - 700 km of new pipelines (max. 28'')
    - Product tank requirements (storage capacities for max. 90 days)

- **Special Studies:**
  - Optimization Studies for Ruwais – Mussafah Pipeline System and Storage Tank Facilities
  - Hydraulic Simulations (steady state & transient)
  - Pipeline Technology: Design Basis, Prelim. Stress Analysis
  - Interface coordination
Heringsdorf Gas Field Development Project – Germany

- **Contract Award:**
  - 2008

- **Completion Date:**
  - 2008

- **Client:**
  - GDF SUEZ

- **Scope of Work:**
  - Conceptual Study for a Sour Gas Field Development plus Transmission Pipeline consisting of:
    - Sour Gas Flow Line
    - Dry Natural Gas Transmission Pipeline
  - Pre-Environmental Impact Study
  - Route Selection
  - Conceptual Design (Hydraulics)
  - Cost Estimation (CAPEX)
  - Permitting and interface management

  - **Total length:** 14 / 40 km
  - **NPS:** 8” / 6”
  - **MAOP:** 100 bar
  - **Throughput:** 1 MMSCFD
FUJAIRAH – Water Transmission System - Phase 2 – UAE

- **Contract Award:**
  - 2008

- **Completion Date:**
  - 2010

- **Client:**
  - Transco, United Arab Emirates

- **Scope of Work:**
  - EPC - LSTK
  - Increase system capacity from 100MIGD up to 230MIGD:
    - Additional 3rd pipeline system
      - 130km, 64”, X65-X42
      - Extension/additional TOs, BVSs …
    - Extension of Qidfa Pumping Station and Intermediate Reservoir
      - 5 x main pumps (11 MW each)
      - 12 x surge vessels …
    - Extension of Intermediate Reservoir
      - 5 MIG Tank
SHELL CONNECT – Germany

- **Contract Award:**
  - 2007

- **Completion Date:**
  - 2011

- **Client:**
  - SHELL Deutschland Oil GmbH, Germany

- **Scope of Work:**
  - Conceptual & Basic Design (FED Phase 1, 2 & 3)
  - HDS revamp in Rheinland Refinery South
  - HMU revamp to produce H₂ for additional demand
  - Oil logistics infrastructure in Rheinland Refinery North and South including new tanks
  - Double Rhein crossing with 4 transfer pipelines
    - Diameter: 4 x 12" – Pressure: 50 bar
    - Length: 6km with river crossing
  - Permitting and interface management
TAP – Trans Adriatic Pipeline – Greece / Italy

- **Contract Award:**
  - 2007

- **Completion Date:**
  - Ongoing

- **Client:**
  - EGL (TAP), Switzerland

- **Scope of Work:**
  - Basic Engineering package review
  - FEED Engineering package review
  - Review of the compressor station design
  - Optimisation of the pipeline system design
  - Interface coordination management

- **Project Description**
  - Onshore & Offshore pipelines with compressor & metering stations
    - length onshore: 400 km 48” diameter
    - length offshore: 120 km 42” diameter
ANARAN - Phase II – Iran

- **Contract Award:**
  - 2007

- **Completion Date:**
  - 2008

- **Client:**
  - STATOIL HYDRO, Norway

- **Scope of Work:**
  - FEED
  - Phase A – Reimbursable
  - Phase B - Lump Sum
  - FEED for an Oil and Gas Field Development in Iran, incl. in-field lines, GOSP, export pipelines and cost estimation +/-10%.
AZAR – Oil and Gas Field Development – Iran

- **Contract Award:**
  - 2006

- **Completion Date:**
  - 2007

- **Client:**
  - HYDRO, Norway

- **Scope of Work:**
  - FEED – LSTK
  - Scope includes a familiarization phase for an Oil and Gas Field Development, including in-field lines, GOSP and export pipelines.
Intermediate Crude Oil Pump Station PS9 – Kazachstan

- **Contract Award:**
  - 2005

- **Completion Date:**
  - 2006

- **Client:**
  - BLOK for Kazakhstan-China Pipeline Ltd, Kazakhstan

- **Scope of Work:**
  - Basic Engineering Review and Detailed Engineering of an Intermediate Crude Oil Pump Station with 10 Mt/y and 20 Mt/y Capacity
  - Part of the 960 km Kazakhstan to China Crude Oil Pipeline Export System
  - Assistance to Technip’s Local Subsidiary and Supervision of Local Engineering Company
SHWE – Shwe Phyu Development – Myanmar

- **Contract Award:**
  - 2005

- **Completion Date:**
  - 2006

- **Client:**
  - Daewoo International Corporation

- **Scope of Work:**
  - Feasibility Study, for a Gas Pipeline Transmission System consisting of:
    - Pressure Reduction Station
    - Custody Transfer Station
    - SCADA and Telecommunication System
  - Conceptual Design
  - Pipeline Construction Methods
  - Risk Assessment
    - CAPEX Estimations
    - Implementation Schedule
    - Benchmarking against other, comparable Projects

  Total length: 61 / 222 km
  NPS: 28” / 36”
  Steel Grade: X70
SAMSUN to CEYHAN - Phase 2 – Turkey

- **Contract Award:**
  - 2005

- **Completion Date:**
  - 2006

- **Client:**
  - TOTAL / Galik

- **Scope of Work:**
  - Pre-Feasibility Study, of the Crude Oil Pipeline Transmission System from Samsun (Black Sea) to Ceyhan (Mediterranean) consisting of:
    - Pump Station
    - SCADA and Telecommunication System
    - Seismological Investigation
    - Route Selection
    - Conceptual Design
    - Cost Estimation
    - Economic Analysis (CAPEX)

  - Total length: 94 / 457 km
  - NPS: 36” / 44”
  - Steel Grade: X70
KCTS – Caspian Transportation System – Kazakhstan / Azerbaijan

- **Contract Award:**
  - 2005

- **Completion Date:**
  - 2006

- **Client:**
  - TOTAL S.A., France

- **Scope of Work:**
  - Pre-FEED and Permitting Activities for a Crude Oil Transmission System consisting of:
    - Sea Terminals in Kazakhstan and Azerbaijan
    - Pump Stations
    - Transmission Pipelines Onshore and Offshore
    - SCADA and Telecommunication System
  - Environmental Impact Study
  - Seismological Investigation
  - Route Selection & Conceptual Design
  - Cost Estimation
  - Economic Analysis (CAPEX and OPEX)

- Total length: 641 km
- NPS: 44"
- Steel Grade: X56 – X65
Anaran - Phase I – Iran

- **Contract Award:**
  - 2005

- **Completion Date:**
  - 2005

- **Client:**
  - HYDRO, Norway

- **Scope of Work:**
  - Feasibility Study of the Azar to Chesmeh Kosh Crude Oil Pipeline Transmission System consisting of:
    - Pump Station
    - SCADA and Telecommunication System
  - Seismological Investigation
  - Route Selection
  - Conceptual Design
  - Cost Estimation
  - Economic Analysis (CAPEX)

- **Technical Specifications:**
  - Total length: 178 / 170 km
  - NPS: 16” / 14”
  - Steel Grade: X65
Samsun to Ceyhan - Phase I – Turkey

- **Contract Award:**
  - 2005

- **Completion Date:**
  - 2005

- **Client:**
  - TOTSA TOTAL Oil Trading SA
  - ÇALIK Enerji Sanayi ve Ticaret A.S.

- **Scope of Work:**
  - Conceptual Study of the Crude Oil Pipeline Transmission System from Samsun (Black Sea) to Ceyhan (Mediterranean) consisting of:
    - Pump Station and Transmission Pipeline
    - SCADA and Telecommunication System
  - On-site Investigation
  - Pre-Environmental Impact Study
  - Seismological Investigation
  - Route Selection
  - Conceptual Design
  - Cost Estimation & Econ. Analysis (CAPEX/OPEX)

Total length: 860 / 543 km
NPS: 48” / 44” / 36”
MAOP: 100 bar
Steel Grade: X60 – X70
Throughput: 55 MTA
KCTS – Kumkol Aralsk Kenkiyak – Kazakhstan

- **Contract Award:**
  - 2003

- **Completion Date:**
  - 2003

- **Client:**
  - Kaztransoil / Hurricane Kumkol Munai

- **Scope of Work:**
  - Feasibility Study for a Crude Oil Pipeline Transmission System consisting of:
    - Terminals and Pump Stations
    - SCADA and Telecommunication System
  - On Site Investigation
  - Evaluation of Existing Facilities
  - Environmental Impact Study
  - Route Selection & Conceptual Design
  - Cost Estimation
  - Economic Analysis (CAPEX and OPEX)

Total length: 752 km
NPS: 32” / 36”
MAOP: 80 bar
Steel Grade: X42 – X70
Throughput: 7.2 to 21 MTA
Ethylene Pipeline – Iran

- **Contract Award:**
  - 2002

- **Completion Date:**
  - 2003

- **Client:**
  - NPC - National Petrochemical Company, Iran

- **Scope of Work:**
  - Feasibility Study for an Ethylene Pipeline Transmission System consisting of:
    - Terminals and Compressor Stations
    - SCADA and Telecommunication System
  - On Site Investigation
  - Environmental Impact Study
  - Seismological Investigation
  - Route Selection
  - Conceptual Design
  - Cost Estimation
  - Economic Analysis (CAPEX and OPEX)

- Total length: 1,405 km
- NPS: 20” / 8”
- MAOP: 94 bar
- Steel Grade: X56 to X60
- Throughput: 1,500 kTPA
Gas Pipeline – Morocco

- **Contract Award:**
  - 2002

- **Completion Date:**
  - 2002

- **Client:**
  - TOTAL / SAMIR

- **Scope of Work:**
  - Feasibility Study for a Conversion of an existing Oil Pipeline into a Gas Pipeline with Extensions. The new transmission System consists of:
    - Metering and Compressor Station
    - SCADA and Telecommunication System
  - On Site Investigation
  - Route Selection & Conceptual Design
  - Cost Estimation
  - Economic Analysis (CAPEX and OPEX)

- **Technical Specifications:**
  - Total length: 250 km
  - NPS: 18” / 14”
  - MAOP: 80 bar
  - Steel Grade: X60
**NEB – North East BAB - Phase 1 – UAE**

- **Contract Award:**
  - 2003

- **Completion Date:**
  - Mechanical Completion December 2005

- **Client:**
  - Abu Dhabi Company for Onshore Oil Operations (ADCO), UAE

- **Scope of Work:**
  - EPC – LSTK Field Development
  - Oil Production from two Fields, Al Dabb’iya (Offshore) Shallow Water / Sabkhat and Rumaitha (Onshore) Desert Area including new Central Processing Plants (CPP) in UAE
  - Pipelines / Flowlines (~530 km / 3”-20” Off-/ Onshore), Electrical Works along the Pipe Route
HARADH – Gas Development Program – Kingdom of Saudi Arabia

- **Contract Award:**
  - 2001

- **Completion Date:**
  - 2004

- **Client:**
  - Saudi Aramco, Kingdom of Saudi Arabia

- **Scope of Work:**
  - EPC - LSTK
  - Gas & Condensate Pipelines including scraper station, line valve stations, cathodic protection system from the Haradh Gas Plant in the Kingdom of Saudi Arabia. (First 56” Gas Pipeline outside Russia and Iran).
  - 634 km; 18” - 56”; X60 - X65
FUJAIRAH – Water Transmission System - Phase 1 – UAE

- **Contract Award:**
  - 2001

- **Completion Date:**
  - 2004

- **Client:**
  - UAE Offsets Group (UOG) Abu Dhabi, United Arab Emirates

**Scope of Work:**
- EPC - LSTK
- Complete Water Pipeline Transmission System from Fujairah to Sweihan & Al Dhaid - UAE
- 2 x 180 km 64” mainline and 2 x 20 km 24” branch line, steel grade X42 - X70, 56 barg MOP, flow rate of 18,900 m³/h, including 1 booster / main pumping station at Qidfa, water reservoirs (590,000 m³), 8 block valve stations, and surge vessels.
Thank you