

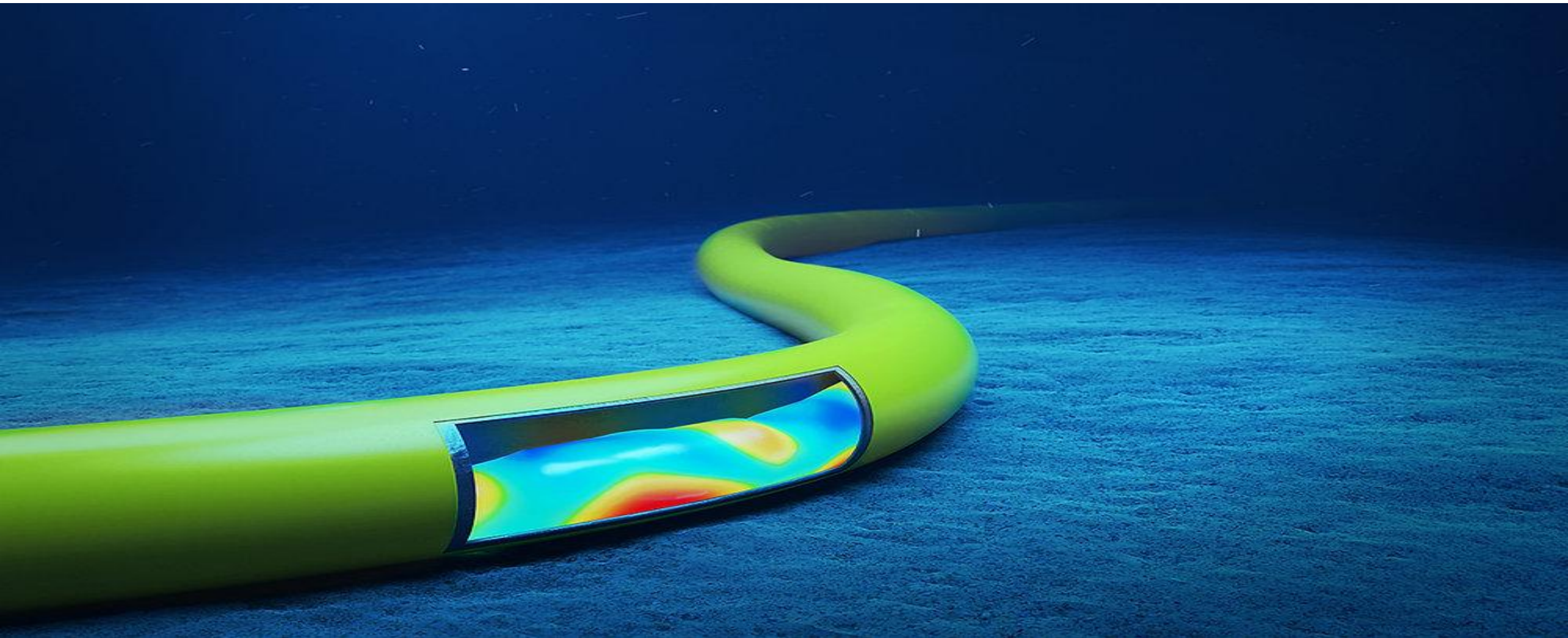


FlowToSim



FLOW ASSURANCE AND HYDRAULICS

CONSULTANCY



Company Profile

Company Profile

Overview

FlowToSim provides complete hydraulic engineering design & consultancy for, Oil & Gas and Water Industries;

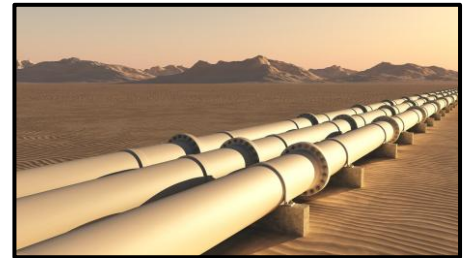
- Well production flow lines, transfer lines, and trunk lines
- Inplant piping
- Tank farms
- Products transfer lines
- Pumping facilities
- Field processing facilities
- Piping & pipeline mitigative solutions
- Optimized hydraulic solutions



Production Well



Tank farms



Transfer pipelines



SCOPE & ACTIVITIES

Scope & Activities

Pipeline & Piping Sizing Selection And Optimization

Pipeline and piping sizing selection and optimization is an engineering process aimed at finding the "Economic Pipe Diameter"—the optimal balance between initial capital expenditure (CapEx) and long-term operating costs (OpEx).

Selecting a smaller pipe reduces the cost of materials, valves, and supports, but results in higher fluid velocities and friction, which significantly increases the energy required for pumping and risks issues like erosion, noise, and vibration.

Conversely, while oversized pipes lower pressure drops and energy consumption



Scope & Activities

Pumps & Compressors Hydraulic Analysis For System Integration And Proper Selection



For pumps, a meticulous calculation of the Total Dynamic Head (TDH) analysis is conducted to ensure the unit operates near its Best Efficiency Point (BEP). A core safety priority in this analysis is verifying that the Net Positive Suction Head Available ($NPSH_A$) remains comfortably above the Required ($NPSH_R$) to prevent destructive cavitation.

For compressors, the analysis shifts to thermodynamic modeling of the compression cycle, identifying the required compression ratio to manage discharge temperatures and power consumption while avoiding "surge" conditions.

Scope & Activities

Surge/Water Hammer Analysis

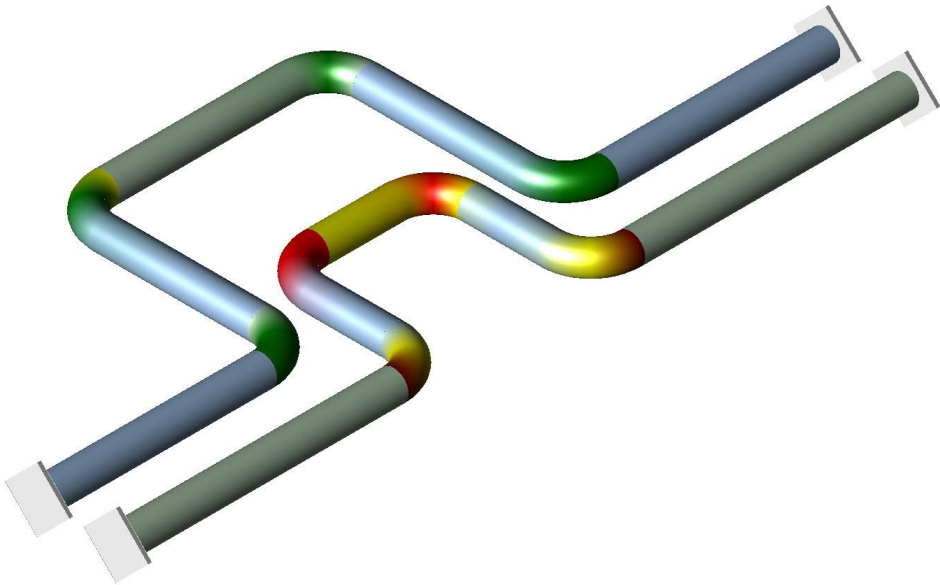
FlowToSim has a robust experience of surge analysis. It aims to study of pressure transients—sudden & high-magnitude pressure waves—caused by rapid changes in fluid velocity within a piping system. These events are typically triggered by emergency shutdowns (ESD), rapid valve closures, or the sudden starting and stopping of pumps.

If left unmanaged, the resulting "hammer" effect can exceed the pipe's pressure rating, leading to catastrophic fatigue, pipe bursts, or the collapse of thin-walled piping due to sub-atmospheric vacuum conditions (column separation).



Scope & Activities

Stress Analysis Due To Transient Scenarios



Stress analysis due to transient scenarios evaluates the structural response of a piping system to time-dependent, unbalanced forces, such as those generated by water hammer, relief valve discharge, or sudden pump trips. Unlike static analysis, which assumes the system is in equilibrium, transient stress analysis accounts for inertial effects and acceleration, where the piping may not have sufficient time to internally distribute loads, leading to movement and heightened stress levels.

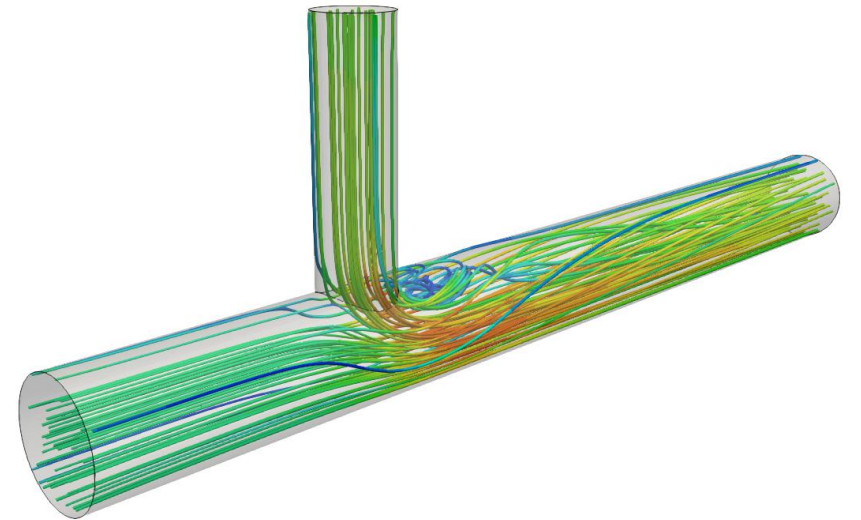
FlowToSim performs stress analysis utilizing software as PIPENET

Scope & Activities

CFD Analysis

FlowToSim aims to conduct a Computational Fluid Dynamics (CFD) analysis which is a high-fidelity numerical method used to solve the Navier-Stokes equations, which govern the conservation of mass, momentum, and energy in fluid systems. While traditional 1D network modeling (like OLGA) handles entire pipeline systems, CFD provides a detailed 3D "micro-view" of complex flow phenomena in localized areas such as pipe bends, manifolds, and valves.

This level of granularity is essential for predicting three-dimensional flow field data, including velocity profiles, pressure distributions, and thermal gradients that 1D tools cannot distinguish



Scope & Activities

Crude Contamination Analysis Due To Switch Over Between Variant Crude Grades Along The Transferring Facilities



FlowToSim performed a crude contamination studies to detect the interface between different crude grades.

For relatively long pipelines, it may be utilized to transfer variant fluids in batch operation that requires transfer certain capacity of one fluid the shipping another fluid; study is conducted to define interface contaminated volume and also calculation of shifted API in pipeline and storage facility due to that contamination.

Scope & Activities

Pipeline Telescopic Design

To optimize pipeline wall thickness, **FlowToSim** perform telescopic design used that pipe diameter is progressively reduced as fluid is delivered to various takeoff points.

This design philosophy ensures that fluid velocity remains within the "Goldilocks zone"—high enough to prevent the dropout of solids (sand), water, or wax, but low enough to avoid excessive pressure drops and erosion-corrosion.

By matching the pipe size to the decreasing (or increasing) volumetric flow, operators can significantly reduce CapEx by avoiding oversized piping in low-flow segments while maintaining the hydraulic efficiency of the overall network.



Scope & Activities

Corrosion Analysis To Estimate Corrosion Rate & Defining Corrosion Inhibitor Dosage Rates



Corrosion analysis aims to mechanical degradation of piping materials caused by their reaction with the produced fluid environment. In oil and gas systems, this is primarily driven by "sweet corrosion" , "sour corrosion", and the presence of produced water containing high concentrations of chlorides.

FlowToSim goal of the analysis is to predict corrosion rates (typically measured in millimeters per year, or mm/y) and define a "corrosion allowance"—extra wall thickness added to the pipe during design—to ensure the asset reaches its intended 20- to 30-year service life without catastrophic thinning or cracking.

Scope & Activities

Hydrate Analysis

As hydrate analysis is the critical flow assurance process of predicting, preventing, and managing the formation of gas hydrates like solids that form when small "guest" molecules (like methane or ethane) become trapped in "cages" of water molecules under high-pressure and low-temperature conditions. As shown in right image, these solids can rapidly aggregate into a dense, cement-like plug, completely obstructing flow and posing a severe safety risk during sudden pressure releases. **FlowToSim** primary goal of this analysis is to define the Hydrate Formation Curve (the pressure-temperature boundary) for a specific fluid composition and ensure that the operating conditions of the pipeline stay safely away of "equilibrium line."



Scope & Activities

Wax Simulation



Wax simulation is the computational process of predicting the precipitation, deposition, and aging of paraffinic hydrocarbons in a pipeline system. Unlike hydrate analysis, which focuses on ice-like structures, wax simulation tracks the transition of dissolved heavy hydrocarbons into a solid phase when the fluid temperature drops below the Wax Appearance Temperature (WAT).

FlowToSim conducts this simulation for determining the location and thickness of deposits, which gradually restrict the pipe's internal diameter, increase pressure drop, and can eventually lead to complete flow blockage

Scope & Activities

Scale Investigation

Scale investigation is the flow assurance process of identifying the potential for inorganic mineral deposits to precipitate from produced water and adhere to internal equipment surfaces. Unlike organic deposits like wax, scale consists of insoluble salts—such as calcium carbonate (CaCO_3), barium sulfate (BaSO_4), and iron sulfide (FeS)—that form due to changes in temperature, pressure, or pH, or when incompatible waters (e.g., seawater and formation water) mix.

FlowToSim performs thorough investigation that is vital because scale buildup can rapidly restrict flow, damage expensive downhole equipment like Electrical Submersible Pumps (ESPs), and lead to total system blockages.



Scope & Activities

Asphaltene Analysis



Asphaltene analysis is the comprehensive investigation of the most complex, polar, and heavy fraction of crude oil to prevent "arterial blockage" in production systems. Unlike wax, which precipitates due to cooling, asphaltenes are primarily destabilized by pressure depletion and compositional changes, such as the mixing of incompatible crudes or the injection of lift gases.

Asphaltenes are defined by their solubility: they are insoluble in n-alkanes (like n-pentane or n-heptane) but soluble in aromatic solvents like toluene

Scope & Activities

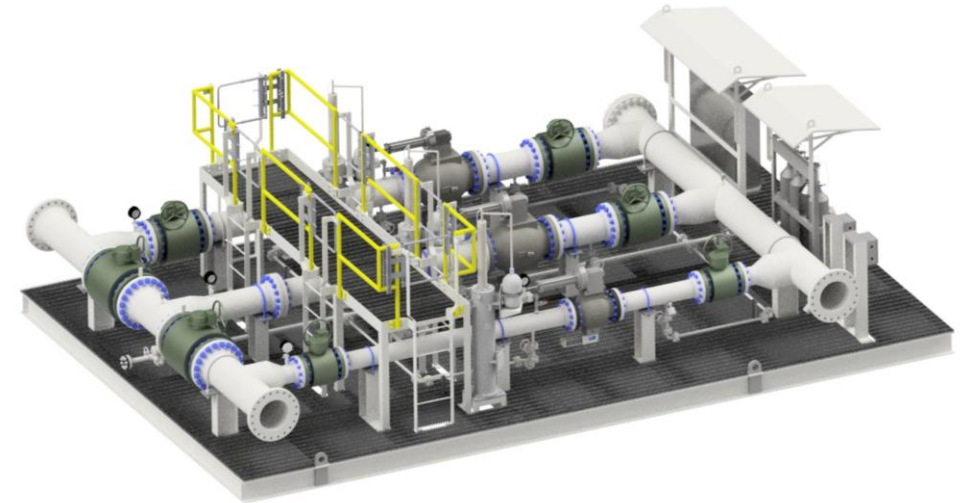
Surge Relief System

Pipeline surge relief valve (SRV) is a fast-acting safety device specifically engineered to protect liquid pipelines from catastrophic overpressure caused by hydraulic transients (water hammer).

FlowToSim deeply conduct surge analysis by specialized software as [SPS, PIPENET, and PIPELINE STUDIO] to define set pressure of surge valves then calculated relieved capacity.

Based on the relieved capacity, size of inlet and outlet piping of surge skid is defined therefore the storage tank capacity [or required surge volume if exiting tanks are utilized]

Moreover, design of surge pumping is conducted to evacuate surge tank within specified duration.



Scope & Activities

HIPPS Design



HIPPS (High-Integrity Pressure Protection System) design is a specialized safety instrumented system (SIS) engineered to isolate a high-pressure source before it can over-pressurize downstream equipment. Instead of relieving excess pressure to a flare or atmosphere like a traditional pressure safety valve (PSV), a HIPPS uses a functional loop of sensors, logic solvers, and fast-acting valves to "shut in" the pressure at the source. This proactive approach allows operators to down-rate downstream piping and vessels to a lower pressure class, significantly reducing capital expenditure (CapEx) and weight.

Scope & Activities

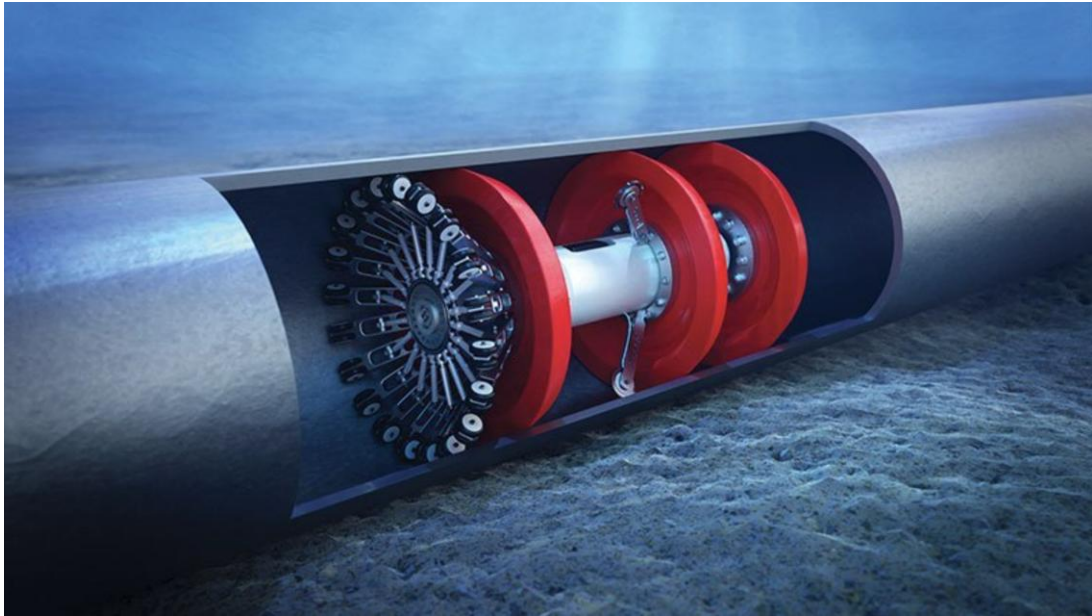
Pipeline Blowdown

Pipeline blowdown is the controlled and rapid depressurization of a pipeline segment by releasing its gaseous or liquid contents, typically through a dedicated Blowdown Valve (BDV) and vent stack. This procedure is a fundamental flow assurance and safety operation required for planned maintenance, inspections, or emergency isolation to prevent a contained volume of high-pressure fluid from fueling a fire or causing structural failure



Scope & Activities

Pipeline Pigging Analysis

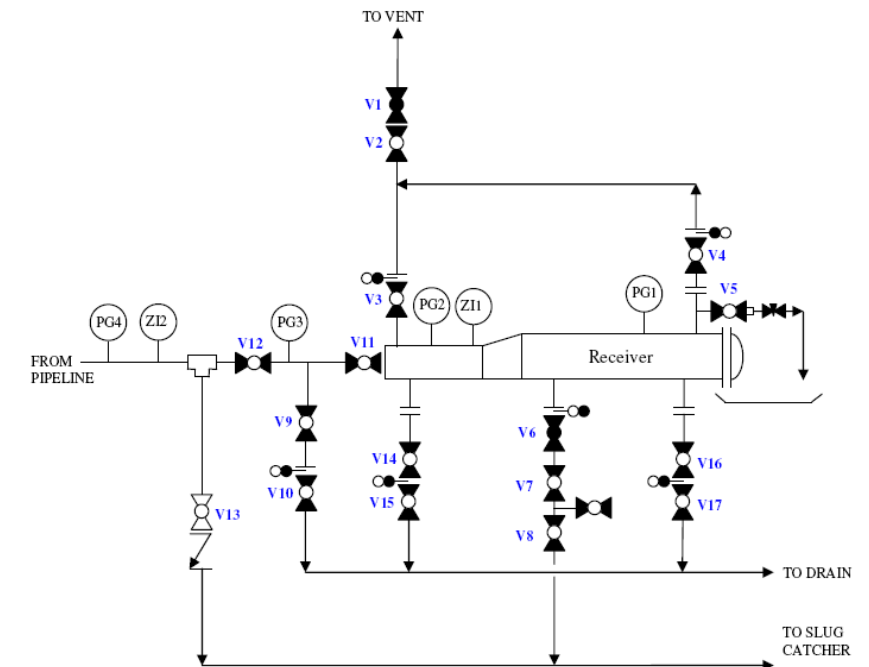


Pipeline pigging analysis is the technical evaluation of the insertion, propulsion, and retrieval of devices (pigs) through a pressurized pipeline to maintain flow efficiency and verify structural integrity. For **FlowToSim**, this analysis is critical for managing solid deposits like wax, removing liquid holdup in gas lines, and providing the foundation for In-Line Inspection (ILI) using "smart pigs" to detect corrosion, cracks, or deformations.

Scope & Activities

Pig Trap Interlock

Following to conducting pigging analysis, **FlowToSim** has the experience to proceed for further design of pig traps configuration. As pig traps sizing with vendor, the operational interlock system is developed by **FlowToSim**, to indicate interlock sequences either manually or automatically to prevent steps overlaps.



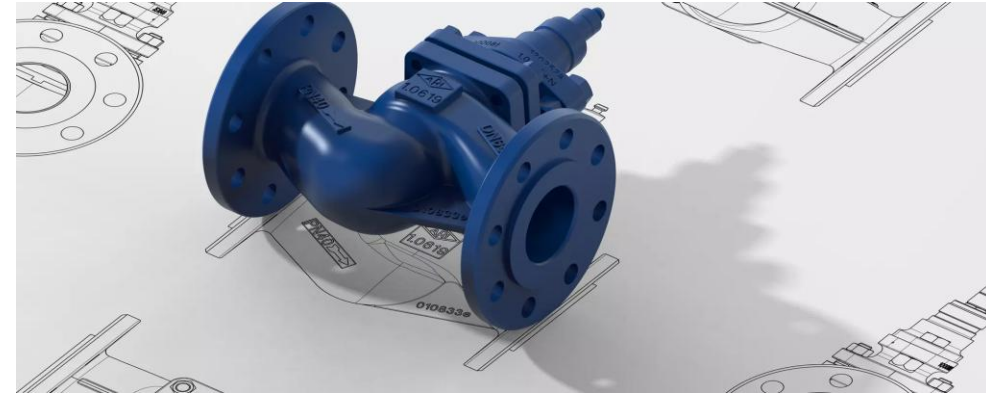
Scope & Activities

Control Valves Sizing

Control valve sizing selection and optimization is a rigorous engineering process centered on calculating the Flow Coefficient which defines the valve's capacity to pass a specific flow at a given pressure drop.

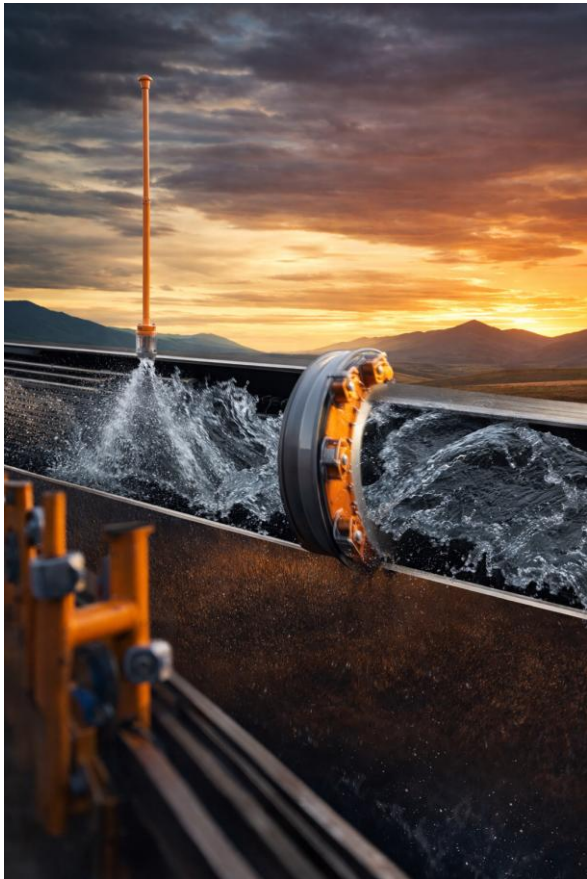
As **FlowToSim** perform hydraulic analysis for piping/pipeline system, the operating conditions are provided to select a valve that operates within its stable control and prevent premature wear.

For pipelines, let down stations [PCVs] and any flow control loops [FCVs] are sized based on the operating scenarios.



Scope & Activities

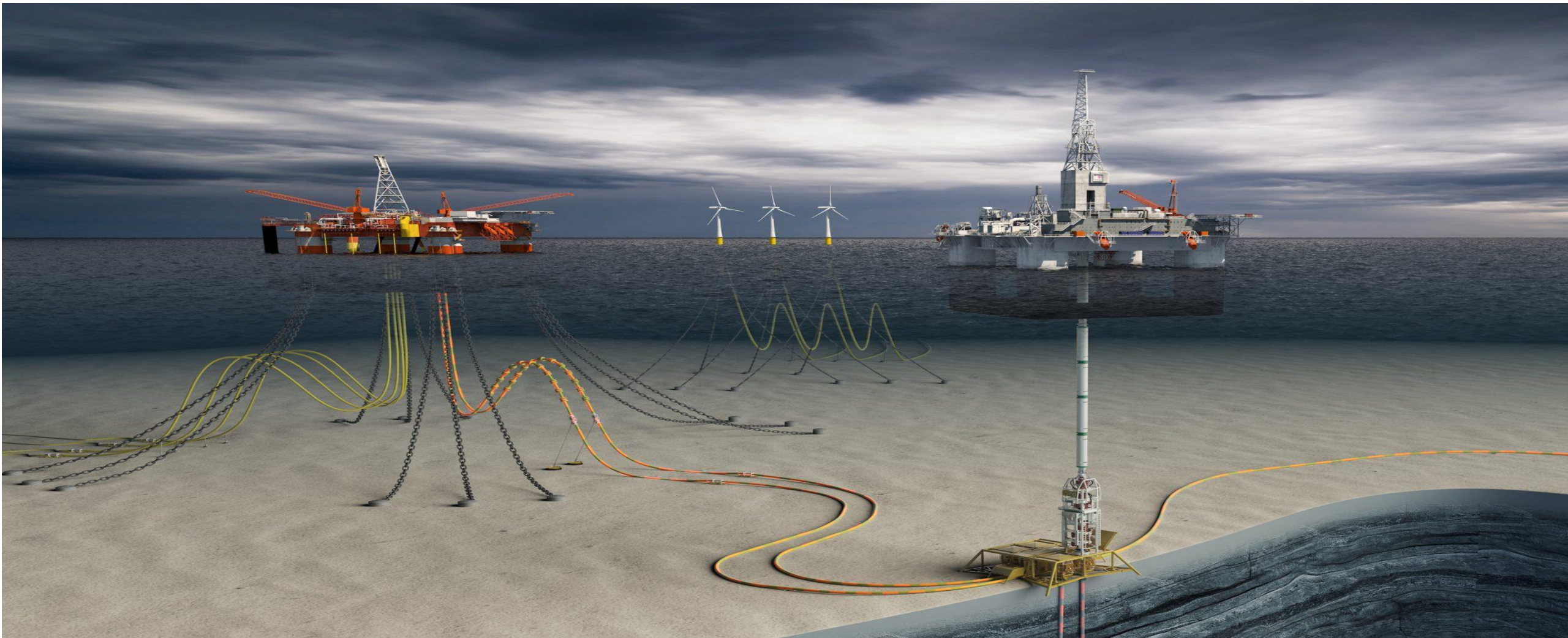
DRA Analysis



Pipeline DRA (Drag Reducing Agent) analysis is a technical evaluation of how chemical additives improve fluid flow by reducing frictional pressure loss.

FlowToSim perform this analysis for pipeline operators to define the optimum dosage rates to increase throughput and lower energy consumption.

Drag can be reduced up to 40%-60% that highly decrease frictional pressure drop across the pipeline.



ENGINEERING PHASES & DELIVERABLES

Engineering Phases & Deliverables

Participation On Every Phase Of Project

- Conceptual Design
- Front End Engineering Design (FEED)
- Basic Engineering
- Detailed Engineering

Engineering Phases & Deliverables

Preparing Project Deliverables

- Flow Assurance and hydraulic Reports [Steady state reports & Transient Hydraulic Reports]
- Process Description
- Process Design Basis
- Process Flow Diagrams (PFDs)
- Heat and Material Balance
- Piping & Instrumentation Diagrams (P&IDs)
- Case & Effect Diagram
- Line Designation Table (LDTs)
- Equipment process data sheets
- Philosophies and narratives



SOFTWARE

Software

Variant software are utilized for flow assurance and hydraulic analysis. Selection of proper software depends on nature of project and objective. Following are list of utilized software

- | | |
|---|--|
| <ul style="list-style-type: none">▪ Synergi Pipeline Simulator (SPS)▪ PIPESIM▪ OLGA▪ PIPENET▪ PIPEPHASE▪ ANSYS | <ul style="list-style-type: none">▪ Pipeline Studio▪ PVT Sim▪ MULTIFLASH▪ HYSYS▪ Electronic Corrosion Engineer (ECE)▪ OLI ScaleChem▪ Inplant |
|---|--|



PROJECTS

Projects

Project Description

- Project Title: SAFANIYA PROJECT
- Location: KSA

Objective

The primary objective of this project is to sustain the future oil production rate of 1300 MBCD, while increase the capacity of the produced water treatment facilities in Safaniyah Onshore Plants from 810 MBCD to 1500 MBCD maintaining the oil in water (OIW) content below 50ppmv. The Arab Heavy crude production will also be increased from 1200 to 1300 MBCD with meeting the specifications as given in the Aramco standards, salt content and BS&W.

SPS software is utilized to perform all steady state and transient hydraulic analysis.

Projects

Project Description

- Project Title: NEW MOL BAB CDS TO MP-21 & NEW MIXER HEADERS PROJECT
- Location: UAE

Objective

Aiming to enhance crude oil transportation between BAB CDS and MP-21, supporting ADNOC's strategic goals for increased production and efficiency. It involves constructing a new 36-inch pipeline with pig launcher and receiver systems, optimizing hydraulic performance and energy efficiency. Upgrade the commingling headers at MP-20 and MP-21 further supports crude commingling and flow management

Projects

Project Description

- Project Title: UPGRADE OF ADCOP FACILITIES TO CATER 2.0 MMBOPD PROJECT
- Location: UAE

Objective

The scope involves installing additional MOL pumps at main and intermediate pumping stations (MPS & IPS), as well as a stand-by surge relief valve at the Fujairah MOT surge relief skid. The scope includes reviewing and updating as-built documentation for existing facilities and verifying pipeline adequacy through transient analysis.

Projects

Project Description

- Project Title: MELEIHA PHASE II PROJECT
- Location: Egypt

Objective

It is required to perform optimization for pipeline network that handle gas from many scattered wells/ clusters to the treatment plant. Optimization is performed utilizing MULTIFALSH software for tab file preparation for each fluid and adjustment of chock valves' opening; transient scenarios as shutdown, hydrate mitigation, methanol injection dosages and startup are simulated utilizing OLGA

Projects

Project Description

- Project Title: NEW OFFSHORE PIPELINES PROJECT
- Location: Egypt

Objective

Project scope is to design and install pipeline from offshore platform to onshore storage tanks for products of Gasoline and diesel; and providing water from onshore to offshore platform

Projects

Project Description

- Project Title: REVAMPING OF RAW WATER PIPELINE PROJECT
- Location: Egypt

Objective

Scope of project is providing detailed engineering activities and deliverables for onshore water pipeline from NILE to refinery plant to serve utility system. Steady state simulation and surge analysis are performed for the non-metallic pipeline

Projects

Project Description

- Project Title: OCTOBER PIPELINES MATERIAL VALIDATION PROJECT
- Location: Egypt

Objective

Project scope is to validate purchased offshore pipeline with respect to operating conditions. A pipeline is constructed to handle multiphase fluid among platforms. All detailed engineering activities are required as design basis report, P&IDs, simulation analysis, flow assurance report, equipment lists and HAZOP participation.

Projects

Project Description

- Project Title: TEBBIN PIPELINE REVERSE OPERATION PROJECT
- Location: Egypt

Objective

Existing 114 km- pipeline is required to be operated to transfer fuel oil and gas oil in reverse direction. Challenge is handling high viscous fuel oil with limited capacities of existing pumps and heaters.

Projects

Project Description

- Project Title: GASCO-MIDTAP C₂/C₃ PIPELINE PROJECT
- Location: Egypt

Objective

Project scope is a validation of proposed pipeline size and specification and guarantee it can handle transferring C₂ in direction and C₃ in the reverse direction. C₂ is liquefied stored then degassed and introduced to the pipeline. For the reverse mode of operation C₃ is shipped by existing pumps. It was required to simulate operating cases and define the controlling parameters and limitations.

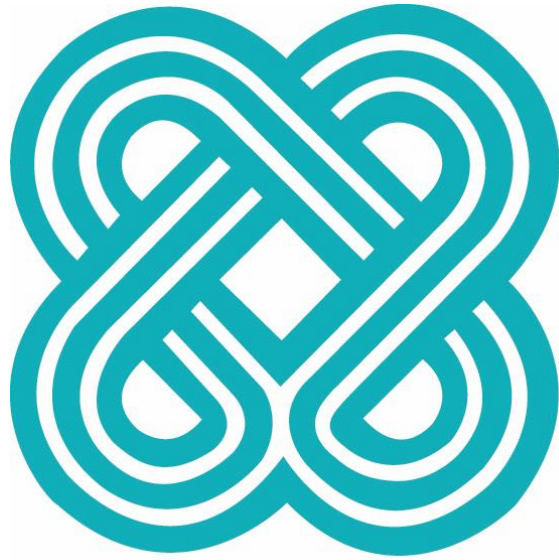
Projects

Project Description

- Project Title: TECHNO-ECONOMIC STUDY FOR FAJR PIPELINE PROJECT
- Location: Egypt

Objective

Project scope is studying the optimum pipeline size with non-metallic material. Pipeline was handling treated crude oil from new production plant to new storage tank. Project deliverables were developing techno-economic study and preliminary PFDs.



FlowToSim