

## SERVICES TO THE OIL & GAS INDUSTRIES

SAXUM provides a wide range of engineering services for the Oil & Gas industries, including scoping and feasibility studies, trade-off analyses, conceptual, basic and detailed engineering. Our engineering capabilities encompass all technical disciplines including civil & structural, mechanical & piping, and electrical, instrumentation & control engineering.



SCOPING STUDIES

FEASIBILITY STUDIES,

TRADE-OFF ANALYSIS

MULTIDISCIPLINARY ENGINEERING

CAPEX AND OPEX ANALYSIS

PROJECT MANAGEMENT

CONSTRUCTION MANAGEMENT

PROCUREMENT

PROJECT CONTROL

PROJECT INSPECTION

SITE SUPERVISION

RESERVOIR MANAGEMENT & OPTIMIZATION

SAXUM's Engineering Team uses the most efficient and comprehensive computational software for developing engineering designs in full 3D environments, allowing accurate integration between the designs of all different technical disciplines. SAXUM's engineering approach to projects of the Oil & Gas industries focuses on constructability aspects and added value engineering through cost-effective designs.

Our assigned engineering team in each project of the Oil & Gas industry is complemented and, moreover, coordinated by highly specialized teams for Project Managers, Project Controllers and QA/QC supervisors, reservoir experts & managers, reservoir retrofit engineering/supervision, management of environment sustainability. Furthermore, SAXUM's Procurement and Construction Management services provides the direction, regulation and supervision of Oil & Gas projects from early development to its completion. Our Construction Management team follows the most efficient methods, construction strategies and budgeting. The team is composed by multidisciplinary professionals to allow the coordination of all involved disciplines including safety, supervision, quality, contracts follow-up, administration, commissioning, etc.

## SERVICES TO THE OIL & GAS INDUSTRIES

### **SAXUM'S MULTIDISCIPLINE ENGINEERING SERVICES TO THE OIL AND GAS PRODUCTION AND PROCESSING INDUSTRY ARE THE FOLLOWING:**

- CIVIL AND STRUCTURAL ENGINEERING,
- COST AND SCHEDULE ESTIMATION,
- ELECTRICAL, INSTRUMENTATION AND CONTROL ENGINEERING,
- MECHANICAL AND PIPING ENGINEERING,
- PROCESS ENGINEERING,
- RISK, SAFETY, AND ENVIRONMENTAL ENGINEERING
- EQUIPMENT SIZING,
- BID OF MATERIALS
- CAPEX AND OPEX

### **OUR CONSULTANCY SERVICES SPAN GREENFIELD AND BROWNFIELD DEVELOPMENTS AND INCLUDE:**

- Advisory services – subsurface and surface facilities expertise, including reservoir characterisation, geological modelling and simulation.
- Asset and facilities support – integrity, asset enhancement and modifications.
- Dynamic simulation and transient analysis.
- Flow assurance.
- Complex finite element analyses such as fracking simulation for shell-oil and shell-gas.
- Stress analysis.
- Soil/rock mechanical feature evaluations.
- Non-linear finite element analysis of porous materials and failure behavior.
- Integrated field development planning – feasibility, concept, pre-FEED.
- Late life asset management – production enhancement, concept studies, structural and marine assurance, cost estimating.
- Operations support and production enhancement/production technology chemistry
- Process technology and studies – upstream, midstream, and downstream support across oil production and processing, gas production, sour gas, gas monetisation and refining.
- Renewables – offshore wind, fixed and floating facilities.
- Subsea and pipelines engineering.
- Vibration analysis and acoustic engineering.
- Complex offshore structural analysis and fatigue / life extension assessment.
- Structural damage/pathology evaluations and development of optimal solutions designs.

## SERVICES TO THE OIL & GAS INDUSTRIES



**WE ADD VALUE THROUGHOUT OUR EXTENSIVE EXPERIENCE IN ENGINEERING SOLUTIONS AND PROJECT MANAGEMENT FOR THE INDUSTRY**

### **SAXUM'S EPCM SERVICES FOR THE INDUSTRY INCLUDES:**

- COMPLETE ENGINEERING DESIGNS, FROM CONCEPT TO DETAILED ENGINEERING,
- ISSUING OF BID PACKAGES FOR EQUIPMENT, SERVICES, SOILS MOVEMENT, PERFORATIONS, AND CONSTRUCTION/ERECTION WORKS,
- FOLLOW UP OF BIDDERS QUESTIONS AND REQUEST FOR INFORMATION,
- CONTRACTS ISSUING AND LEGAL DISCUSSIONS WITH BIDDERS,
- ASSISTANCE/SUPPORT NEGOTIATIONS WITH BIDDERS UNTIL CONTRACTS SIGNATURE,
- LOGISTIC AND EXPEDITING SERVICES,
- CONSTRUCTION MANAGEMENT,
- SITE SUPERVISIONS OF ALL ACTIVITIES ON SITE,
- HEALTH, SAFETY AND ENVIRONMENTAL
- COMMISSIONING,
- START-UP,
- CONTRACTS FOLLOW-UP,
- QA/QC

## SERVICES TO THE OIL & GAS INDUSTRIES

### SAXUM CAPABILITIES IN COMPUTATIONAL MODELING AND ANALYSIS OF SHALE GAS/OIL RESERVOIRS

SAXUM has the experience and capability to model and analyze the complex hydro-mechanical response behavior of shale gas/oil reservoirs. Our mathematical models are based on both finite element method and the very effective and recently developed Virtual Element Method (VEM), which is capable to reproduce very complex geometries and boundary value problems. We use our own pore-mechanical and fracture energy-based formulations to reproduce the cracking process under different pore pressure conditions. SAXUM is able to evaluate and model a wide spectrum of problems involving different geomechanical and hydraulic conditions.

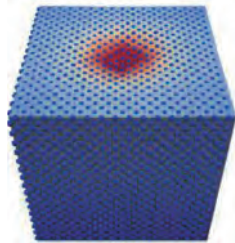


Figure 1: Full 3D modeling and failure analysis

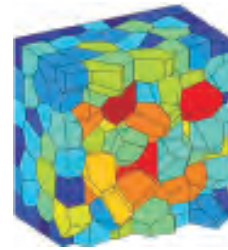


Figure 2: Full 3D model based on Virtual Element Method

Strong localized cracking processes are able to be captured by combining the virtual element technology with fracture energy-based interfaces along all solid element joints. SAXUM's team of consultant in computational modeling of the cracking processes of shale gas/oil reservoirs is highly experienced in analyzing full coupled hydromechanical failure processes in soils and rock. Our leadership in this type of problems and modeling is based on different publications and research activities. Depending on the complexity involved we may proceed with full macroscopic or multiscale modeling. In the last case we are capable to use both, concurrent procedures (see Figure 3) in the framework of DNS scheme (Direct Numerical Simulation), or semi-concurrent ones (Figure 4), based on thermodynamically consistent approaches. Our models were tested with complex problems of the geo-mechanics. Predictions of the required water pore-pressure to accomplish cracking formation and propagations as well as on the involved secondary effects are able to be obtained with high accuracy.

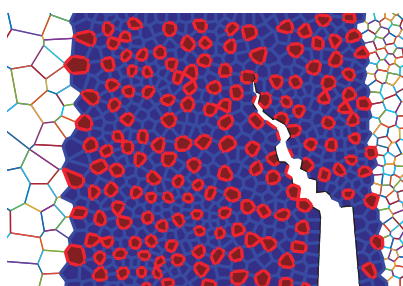


Figure 3: Concurrent modeling for cracking process prediction with Virtual Elements and Interfaces.

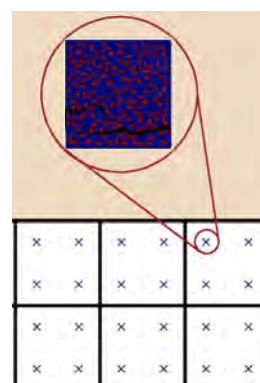


Figure 4: Semi-concurrent multiscale model and analyse