FRACTURED AND UNCONVENTIONAL RESERVOIRS
The power to understand and characterize the properties of your reservoir, to predict future behaviors, and to improve and commercialize its lifetime performance.

EXPLORATION AND DEVELOPMENT SERVICES

Our focus is to help clients realize the full potential of their wells – reservoir optimization is what it’s all about. Golder has extensive experience in hydrocarbon basins, working and guiding oil and gas clients to make better investment decisions throughout the full reservoir life cycle. Our in-depth and practical knowledge of your industry and expertise in development means we understand the technical and commercial challenges you face when developing your reservoirs. Our integrated approach enables clients to discover the potential of their reservoirs, understand the rock properties and make faster, informed decisions, and improve their return on investment (ROI). We know how to solve your problems.

GOLDER’S INNOVATIVE TECHNOLOGIES AND SERVICES WILL

- Improve decision making through better reservoir characterization
- Help reduce operational risks by completing reservoir geomechanics analyses
- Improve production by achieving maximum contact with the reservoir
- Develop better hydraulic fracture stimulation strategies

Golder’s multi-disciplined team will use our comprehensive sub-surface reservoir knowledge to help you maximize your ultimate recovery. Our impartial advice and guidance enables you to make better investment decisions throughout the life cycle and improve your ROI.
Understanding how to read the story told by the earth beneath our feet to find oil and natural gas is a key step in the development process. Our team of petroleum geologists enable a better understanding, and can identify in greater detail, where oil might be found, as well as the best ways to retrieve oil. Golder specializes in petroleum geology at all stages of hydrocarbon exploration and development, from the initial evaluation of a basin to the enhancement of production from a mature field.

- **Structural Core Logging and Interpretation**
- **Data Analysis and Review**
- **Reservoir Geology and Structural Geology**
- **Petrophysics**
- **Geological Modelling**

**Geological Areas of Expertise include:** shale gas, oil shale, basement reservoirs, fractured carbonates, volcanics, and coal-bed methane/coal seam gas.

---

**Geophysics**

Our specialist in-house staff team with GlobalGeophysical® and TaskFrontera® to complete geophysical processing, focused on natural fractures.

Using geophysical techniques we can help form a better understanding of the subsurface.

Our multidisciplinary team of experts offer you the optimal approach to understanding the reservoir. Using available geophysical data to visualize the reservoir, we provide advanced interpretation to reduce uncertainty.

- **Vertical Seismic Profiling (VSP) Analysis & Interpretation**
- **Microseismic Survey Interpretation**
- **Identification of Fractures and Faults from Seismic**
- **Fracture Intensity and Orientation Conditioning**
- **Attribute Analysis**
- **MicroGravity Analysis**
- **Image Log Analysis**
- **Geomechanics and In Situ Stress**
Rocks have a wide range of stiffness and strength and are exposed to variable stresses during drilling, completion, and production. Interpreting the geomechanics will help you avoid and minimize the risks, thus reducing costs. Golder’s geomechanics services include:

- **HYDRAULIC FRACTURE STRESS INTERPRETATION**
- **IN SITU AND CRITICAL STRESS ANALYSIS**
- **COUPLED STRESS-HYDRODYNAMIC ANALYSIS**
- **SAND PRODUCTION MANAGEMENT**
- **WELL AND CAP ROCK INTEGRITY ASSESSMENT**
- **COMPACTION/SUBSIDENCE HEAVE INVESTIGATION**
- **WELLBORE STABILITY ANALYSIS**
- **UNDERGROUND GAS STORAGE (UGS)**
- **RESERVOIR SUBSIDENCE ANALYSIS**

Reservoir image log interpretation provides an in-depth understanding of the geological setting of the reservoir penetrated by an exploration or development well. The findings from these analyses provide an appreciation of the in-situ stress, structural, and stratigraphic information, and can be used to help optimize the completion of future development wells. In extreme geological environments, the detailed understanding of structural features is indispensable for successful hydrocarbon exploration and development. The benefits of this highly sophisticated analysis are:

- NEW WELL TRAJECTORY PLANNING
- WELL COMPLETION - WELL ORIENTATION, SPACING, AND PRODUCING INTERVALS
- WELL STIMULATION – HYDRAULIC FRACTURING
- PRODUCTION IMPROVEMENTS – EOR, INJECTION WELLS

Our team uses Golder’s proprietary FracMan® fractured reservoir analysis tool to better understand and improve production levels. FracMan® will also facilitate smarter development strategies, reduce uncertainty, and identify environmental risk. Static and dynamic reservoir models become living models that facilitate decision making.

- **DISCRETE FRACTURE NETWORK (DFN) STATIC MODELING**
- **FRACTURED ROCK GEOMECHANICS, INCLUDING HYDRAULIC FRACTURE STIMULATION, WELLBORE STABILITY, AND CAPROCK INTEGRITY**
- **POROSITY, ANISOTROPY, & HETEROGENEITY ANALYSIS**
- **FRACTURE STATISTICAL, GEOSTATISTICAL, AND FRACTAL ANALYSIS**
- **WELL TEST DESIGN, INTERPRETATION, AND SIMULATION, INCLUDING PRODUCTION LOGGING TEST (PLT) AND DRILLSTEM TEST (DST) ANALYSIS AND INTERPRETATION**
- **WELL LOCATION, COMPLETION, AND TRAJECTORY OPTIMIZATION**
- **UPSCALING OF FRACTURE PERMEABILITY (MATRIX/FRACTURE)**
- **RESERVOIR VOLUMETRICS**
- **MULTI-PORETYPE DFN DYNAMIC SIMULATION**

Well image log interpretation provides an in-depth understanding of the geological setting of the reservoir penetrated by an exploration or development well. The findings from these analyses provide an appreciation of the in-situ stress, structural, and stratigraphic information, and can be used to help optimize the completion of future development wells. In extreme geological environments, the detailed understanding of structural features is indispensable for successful hydrocarbon exploration and development. The benefits of this highly sophisticated analysis are:

- **NEW WELL TRAJECTORY PLANNING**
- **WELL COMPLETION - WELL ORIENTATION, SPACING, AND PRODUCING INTERVALS**
- **WELL STIMULATION – HYDRAULIC FRACTURING**
- **PRODUCTION IMPROVEMENTS – EOR, INJECTION WELLS**
WELL TESTING AND CHARACTERIZATION

GOLDER SOLUTION

Our Well Testing and Characterization Services deliver a specialist range of testing and measurement services to enable better well test design, analysis, and interpretation used to prove your reservoir from exploration and appraisal to development and production. Working alongside our tool service company partners we are able to provide the required expertise.

- HYDRAULIC PACKER TESTS (PRODUCTION, INJECTION, SLUG/PULSE TESTS)
- HYDRAULIC FRACTURING AND JACKING (IN SITU STRESS MEASUREMENT)
- INTERFERENCE TESTS
- ANALYTICAL AND NUMERICAL DATA ANALYSIS
- PRODUCTION MECHANISM ANALYSIS
- FLOW GEOMETRY

RESERVOIR ENGINEERING

GOLDER SOLUTION

Golder’s core strength is our ability to incorporate the various technical inputs from geophysicists, geologists, and petrophysicists to build a picture of the reservoir potential and predict future performance. We have experts in reservoir simulation as well as the core skills of reservoir fluid characterization and well test analysis.

- MODERN TRANSIENT PRODUCTION ANALYSIS
- DETERMINATION OF PRODUCTION MECHANISM AND PERFORMANCE EVALUATION
- VOLUMETRIC ESTIMATION USING BOTH DETERMINISTIC AND PROBABILISTIC APPROACHES
- HYDROCARBONS IN PLACE AND UNCERTAINTY QUANTIFICATION (PROBABILISTIC METHODS)
- PHASE BEHAVIOR (PVT) ANALYSIS, INCLUDING FLUID PROPERTIES EVALUATION AND BLACK OIL AND COMPOSITIONAL SIMULATION INPUT
- EOR/IMPROVED OIL RECOVERY (IOR) INCLUDING PRODUCTION DIAGNOSIS, WATER-FLOODING OPTIMIZATION, GAS FLOODING AND WATER-ALTERNATING-GAS (WAG) INJECTION, AND CHEMICAL/POLYMER FLOODING
- SECTOR SIMULATION
- FULL FIELD HISTORY MATCHING AND SIMULATION
Our team of experts can work with you throughout the full field life cycle, from prospect evaluation, to well and reservoir studies, exploration, appraisal, development, production, and abandonment. This includes working with you in a variety of complex and challenging environments, including both onshore and offshore deep-water assets.

At Golder, we deliver solutions that will improve your investment decisions, optimize well placement, refine completion and stimulation design, and enhance ultimate recovery. Using our strength and origins in geotechnical engineering and rock mechanics, together with our knowledge and experience in the oil and gas industry, we use a winning combination of technology, reservoir insight, and technical capability to optimize your development costs and help you achieve greater ROI.

FINANCIAL DUE DILIGENCE

GOLDER SOLUTION

Our approach will enhance the purchaser’s understanding of the target business as well as helping identify and understand critical success factors. Our technical due diligence enables clearer understanding and will help identify potential legacy issues.

- COMPETENT PERSON’S REPORTS (CPR)
- INDEPENDENT RESERVES/Resources AUDITS
- ASSESSMENTS FOR INTERNAL COMPANY MANAGEMENT USE
- DUE DILIGENCE ASSET INVESTIGATIONS
- MULTI-DISCIPLINARY TEAMS FOR DATA ROOM EVALUATIONS
MAKE YOUR BUSINESS DECISIONS ON A SOLID FOUNDATION.
CHOOSE A COMPANY WITH THE TECHNICAL EXPERIENCE AND COMMITMENT
TO SERVICE EXCELLENCE AND SUSTAINABILITY THAT YOU NEED TO BE SUCCESSFUL.

JUST ASK GOLDER