



Roadmap for Rapid Reserves Analysis

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From the Middle East to the Americas, the petroleum industry is managing a record number of mature and aging fields, along with emerging exploration and development opportunities from unconventional, deepwater, and remote plays.

Many brownfields still possess large, untapped potential volumes of production and reserves, which must be considered in evaluating production strategies and reserve estimates. Pinpointing reserves and production improvement opportunities requires deep insight into the subsurface and historical asset performance. Oil and gas field owners, operators, and investors must continually refine and update their understanding of a field's remaining hydrocarbon reserves to maximize production from the field. Like filing a tax return, the process of compiling a field study is often a labor and time consuming activity that most companies undertake once a year or even less frequently per field.

What if you could evaluate a field's proven, probable, and possible reserves in just a few weeks? Rapid reserves analysis is possible with the right technical approach, technology, and processes. Here are five areas on which you can focus for a roadmap for timely, data-driven, and actionable field studies:



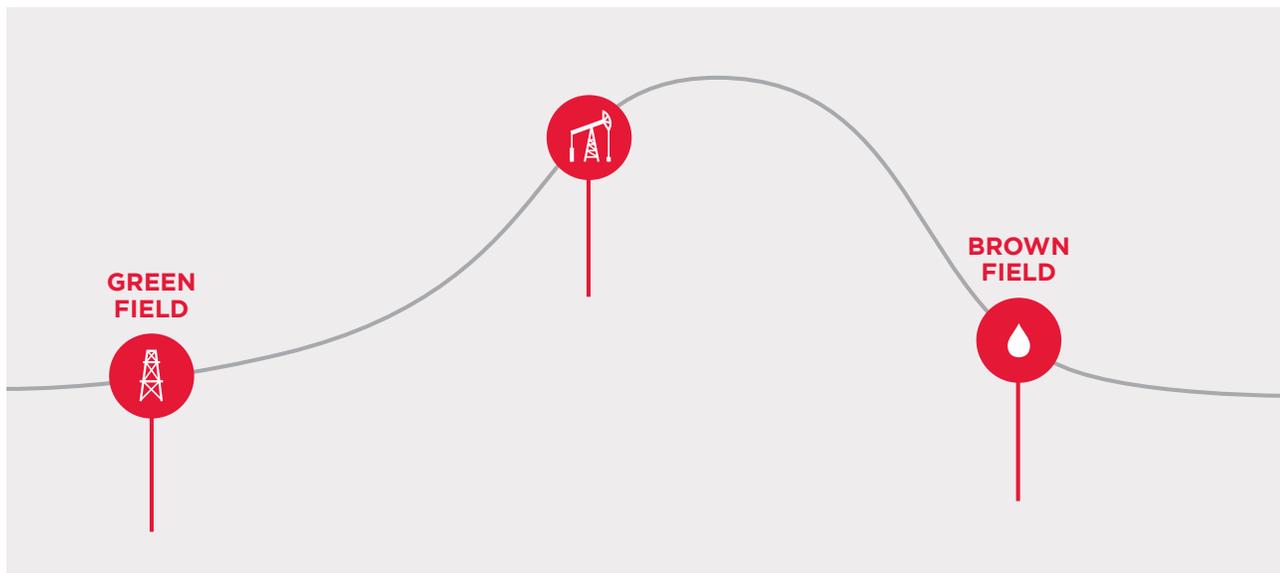
Knowing Where to Start

Operators often manage multiple oil and gas fields, so knowing which field to prioritize for a comprehensive study is not always clear. Dozens of interconnected variables determine which fields should be evaluated first and foremost.

Significant time can be spent just deciding which field to study first. Economic conditions, production decline, and field maturity play a role in field ranking. A wide variety of parameters can help prioritize fields based on their reserves, production, and economic potential, including:

- ▶ Number and status of wells
- ▶ Productive area of field
- ▶ Cumulative production
- ▶ 1P and 3P reserves
- ▶ Original in place oil and gas
- ▶ And more

With the appropriate tools, a variety of indicators can be created from these inputs, such as well spacing, production cost, and ROI, which can be used to create a prioritized list of fields to be studied.



Build a Dynamic Team

Oil and gas asset teams often manage a large number of fields. Reservoir management and operations staff are increasingly having to do more with fewer resources. Even with a clear view of the fields that should be prioritized for study, it can still be a time consuming task to find the right team to evaluate a selected field.

In many situations, reservoir and geoscience personnel must juggle many operational and strategic responsibilities and may only be able to produce field studies in a serial fashion as time permits teams to form in order to evaluate a specific area. The following steps can help expedite the formation and effectiveness of the field study team.

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- 1) **Parallel processing** – Ranking your field study opportunities can guide the order in which you proceed, but it can also identify areas where duplication of effort can be reduced and time can be saved. Having a prioritized order in which the fields should be reviewed helps teams know which fields share reservoir characteristics and data sets, allowing some field studies to progress in parallel.
 - 2) **Supplement your expertise** – Faced with limited resources, many teams can be assembled and disbanded as needed if expertise is leveraged from internal or external sources. Large companies can leverage pools of engineering and geoscience staff from other assets and regions to augment short term field study objectives. Contractors and consultants also provide excellent options for supplementing a field study team with on-demand expertise. What's more, web and mobile technology can improve team collaboration, enabling virtual teams to work together from wherever they are in the world.
 - 3) **Leverage specialists** – A multidisciplinary team is essential to producing detailed, thorough field studies that address all aspects of field development and reserves evaluation. A team should typically consist of an engineer, geologist, geophysicist, and petrophysicist. Also important is a dedicated technician who can focus on data management and technology, enabling the rest of the team to focus on analysis.



Overcome Barriers to Data

One of the main challenges to timely reserves analysis is access to technical data of known high-quality. Assessment and documentation of remaining proven, probable, and possible (3P) reserves requires engineering and geoscience staff to find, access, and organize a vast array of subsurface data before reservoir analysis is performed. Such data is all too often scattered across multiple database systems and departments with multiple versions of the “truth,” inconsistent or missing data, and data silos slowing the process.

Assembling the data needed for a field study can take months. Because business and economic conditions often change during the completion of a field study, implementing the results is much like trying to hit a moving target with an arrow. The following outlines some of the types of data needed.

▶ Wells and Well Data

- List of all existing wells in the field, including exploration and plugged wells, with:
 - ♦ Surface and bottom hole locations
 - ♦ Processed deviation survey
 - ♦ Current status
 - ♦ Reference depth
 - ♦ Driller’s Total Depth
 - ♦ Geologic column for area
 - ♦ Formation and reservoir flow unit tops for all wells
 - ♦ Open hole well logs for as much of the well as was logged
 - ♦ Processed well logs and petrophysical analysis
 - ♦ Net pay cutoff parameters by reservoir

▶ Wells and Well Data Cont’d

- ♦ Well core analysis
- ♦ Well PVT data and analysis
- ♦ Reservoir volume factors for oil and gas by reservoir

▶ Mechanical Well Status and History

- Wellbore schematics
- Well perforation history
- Summary well histories

▶ Production and Injection

- Allocated production histories by well and reservoir
- Production well test results
- Regular well readings
- Injection histories by well and reservoir

▶ Well and Reservoir Pressures

- Well pressure test reports
- Well downhole pressure gauge details and history
- Production logs
- Pressure transient analysis
- Summary of reservoir pressure readings
- Well nodal analysis
- Material balance analysis

Data aggregation technology now enables the full breadth and depth of data needed for a field study to be quickly brought together in weeks instead of months.



Pinpoint Reserves & Production Opportunity

The ultimate value of conducting a field study is the identification of opportunities to improve hydrocarbon reserves and production potential. The field ranking, team building, and data access techniques that have been described can significantly reduce the time needed to start the evaluation process. Analysis can be expedited further by focusing on a process that creates specific outcomes and recommendations.

The field evaluation process should provide a uniform approach and give teams a reusable process for evaluation of reserves and production potential. The following describes a general process for field evaluation.

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- 1) *Review geologic framework, fluid types, and drive mechanisms.*
 - 2) *Review well logs and log analysis to determine the net pay thickness, porosity and permeability relationships, capillary pressures, rock and fluid compressibility, reservoir stratigraphy (layering), type of trap, and petrophysical properties.*
 - 3) *Review PVT data, pressure, and fluid analysis to document the initial reservoir pressure, current pressure, bubble point pressure, barriers, distance to faults, GOR, Bo, and NGL content.*
 - 4) *Review production history and calculate remaining reserves from decline curve analysis.*
 - 5) *Calculate volumetric original hydrocarbons in place for the field and estimate recovery factors and remaining reserves.*



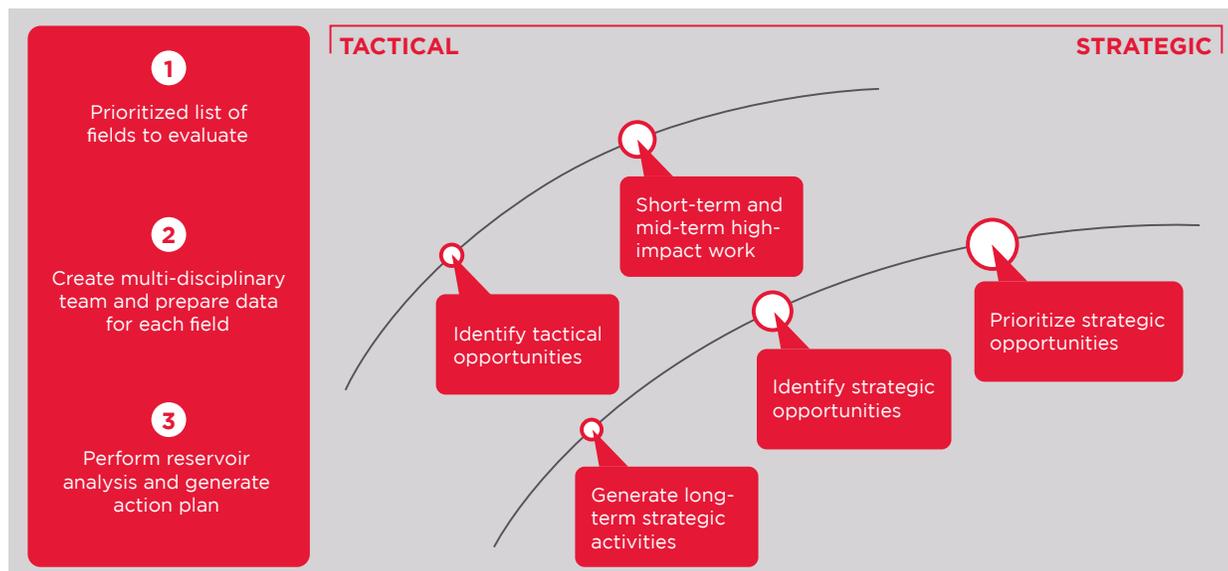
Take Action on the Results

Results of many field studies can be voluminous and often attempt to document everything known about the field from discovery to current status. In addition to the extensive time required to produce many reports, reading and understanding the study can take company experts weeks or months.

The results of a field evaluation should include summary findings and analyses with a specific focus on generating recommendations for field development and production optimization. At a minimum, the following areas should be explored:

- ▶ Sedimentary Model and Seismic Sections
- ▶ Geologic Sequences and Stratigraphy
- ▶ Petroleum System and Productive Formations in the Field and Surrounding Area
- ▶ Total Field, Production, and Injection Histories
- ▶ Gas Oil Ratio and Water Cut Plot
- ▶ Historical Production and Decline Analysis
- ▶ For Each Reservoir
 - Formation description
 - Typical log
 - Rock types
 - Stratigraphic sections
 - Monthly oil production
 - Number and status of wells
- ▶ For Each Reservoir Cont'd
 - Cumulative production
 - General reservoir properties
 - Reservoir pressures
 - Core permeability vs. porosity
 - Relative permeability and fractional flow
 - Fluid properties and PVT analyses
 - Original oil and gas in place

Ideally, a field study should provide an action plan to identify high impact, tactical opportunities that can be implemented in 3 to 6 months, such as recompletions and workovers. Field studies should also generate and prioritize long-term strategic activities consistent with business goals (6+ months).



Roadmap Review

Reservoir evaluation, field studies, and reserves analysis can be performed rapidly with the right approach and techniques:

- ▶ Know where to start by prioritizing fields for evaluation
- ▶ Build a dynamic team by tapping the right expertise and creating virtual teams
- ▶ Overcome barriers to technical data by leveraging new technology
- ▶ Pinpoint reserves and production opportunities through a uniform process
- ▶ Take action on results through clear action plans for the short and long term

iStore's Quick Value Assessment (QVA®) field study solutions offer you industry leading expertise in data management, petroleum engineering, and geosciences, as well as patented technology and processes. With QVA®, your next field evaluation will be delivered faster and provide a clear, concise action plan for increasing production to extend the life of your field.

iStore provides integrated products, services, and solutions for the oil and gas industry focused on maximizing the value of data by providing quick and easy access to organized, high quality information.

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