

Landmark revolutionizes petroleum frontier exploration by integrating disparate data sources.

Overview

■ **Business Challenge**

To respond to its customers' increasing demand for better decisions about frontier exploration, Landmark needed to develop workflows that would help researchers determine the size and quality of potential oil and gas fields.

■ **Solution**

Landmark collaborated with IBM chemicals and petroleum experts and IBM Research staff on a first-of-its-kind project that would integrate silos of basin modeling data, seismic data and—for the first time—rock physics in a comprehensive, integrated view.

■ **Key Benefits**

- Increases the volume, accuracy and consistency of data to support better exploration decisions
- Reduces the economic and strategic risks of frontier exploration
- Increases the likelihood that investments in drilling and extraction will be profitable



It's a simple matter of supply and demand. Our planet has a limited supply of oil and natural gas that is accessible and suitable for refining into energy. At the same time, there is an accelerating demand on these resources to support the global economy and improve quality of life. In addition to this considerable challenge, today's energy companies face myriad other issues, among them political, environmental, technological and organizational. Therefore, it is no surprise that solving these challenges can offer a distinct competitive advantage to those companies that find the right solutions. And solving these challenges can result in billions of dollars in cost savings and revenue.

“IBM’s proven experience in the chemicals and petroleum industry was extremely important to us. They have demonstrated a commitment to tackling tough problems, and they back up that commitment with research and development resources.”

—Chris Usher, senior director of technology, Landmark

Driving innovation through integration of geological information

Business Benefits

- Development of technology and workflows that Landmark customers can use to improve exploration decisions
- Enhanced understanding of frontier exploration challenges
- Reduced economic and strategic risks of frontier exploration
- Higher recovery rates and greater profitability from drilled basins

“They understood the problem in the industry and spoke our language. IBM approached us with a group of experts in computational sciences that could be devoted to our problem. We worked together to find a solution.”

—Stewart Levin, fellow, Halliburton

Landmark, a product service line of Halliburton Energy Services, creates technology solutions that help its customers—global and national energy companies and services companies in the upstream (prior to refining) marketplace—make better decisions about exploration, reservoir management, drilling and production. Landmark supports what it calls the “Digital Asset,” a real-time collaborative service for modeling, measuring and optimizing assets. The company provides a broad spectrum of integrated tools, workflows and procedures to help support discerning decisions.

IBM is helping companies like Landmark in the chemicals and petroleum industry solve complex industry problems by committing investments into research and development projects. A recent collaborative project has helped Landmark develop a framework that integrates previously disconnected geological information about the location and condition of oil and natural gas reserves within a field.

Boom times

All of the easy oil in the world has been found—those massive pools of oil and natural gas that provided a relatively simple process of speculating, drilling and extracting with a high rate of success and return on investments have been depleted. To respond to increasing demand and help ensure a future competitive advantage, it is only natural that energy companies are investing significantly in exploration. They’re reexamining existing fields where their risks and costs are lower, but they are also actively developing new fields in places that were previously inhospitable to drilling or were too costly for extraction activities.

Frontier exploration is a calculated risk. A sufficient volume of oil and natural gas must be found in order to make worthwhile the huge investments in drilling. Key to this is drilling in the right place within a field, because finding the right location can extend the productive life of the field; drilling in the wrong place can ultimately leave a precious resource in the ground. And the quality of a field is also a factor in deciding where to drill, as organic source matter must have had sufficient burial time, temperature and pressure to mature into commercially producible hydrocarbons.

Basin analysis aims to lower the risks of exploration by using multiple data sources to create a more complete picture of the true possibilities in any given field. Three disciplines within this analysis are:

- *Basin modeling, which is the creation of three-dimensional representations of geologic strata*
- *Seismic data interpretation, which is the use of seismic soundings to interpret the composition, fluid content, extent and geometry of rocks*
- *Rock physics, which is the interpretation of well data to determine the physical properties of rocks.*

These disciplines, while related, have traditionally been isolated due to the considerable computational challenges inherent in integrating their huge volumes of data.

Better data, better decisions

Landmark had already started developing an integrated environment for basin-scale exploration and assessment on behalf of a national energy company. Stewart Levin, Halliburton fellow and manager of the project, saw an opportunity to extend the value of this integrated framework by adding rock physics to the equation. Levin knew that such an effort would require both large-scale computation and deep understanding of the scientific and technical issues involved.

“IBM brought two things to the table. One is domain expertise. They understood the problem in the industry and spoke our language,” says Levin. “The second is the first-of-a-kind program, where IBM approached us with a group of experts in computational sciences that could be devoted to our problem. We worked together to find a solution.”

The resulting project is called basin simulation optimization. Essentially, the project takes known data parameters and creates simulations to fill in the blanks of missing data using complex algorithms and modeling. It is a workflow designed to reduce the uncertainty of petroleum accumulation and thermal maturation by ensuring that the numerical modeling is consistent with the seismic data actually recorded in the field.

The end result of basin simulation optimization is a geologic history, thermal and maturation history, and a sedimentary volume that are consistent with the seismic data actually recorded.

Key Components

Services

- IBM Chemicals and Petroleum Industry
 - IBM Research
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Why it matters

A first-of-its-kind research and development collaboration program between Landmark and IBM integrates multiple geologic disciplines, breaks down silos of information and optimizes huge volumes of data. The end goal is a new Landmark workflow solution that will help change the way petroleum geologists evaluate basin data, increasing the likelihood of finding profitable sources of oil.



Trusted expertise

IBM has more than 3,500 employees worldwide who are committed specifically to the chemicals and petroleum industry. In addition to mathematicians and analysts, IBM employs petroleum geologists, chemists and physicists dedicated to solving some of the world's greatest energy problems.

Key members of the IBM Research team had extensive experience in rock physics, understood the issues involved and brought unique expertise to the project. "[We] found out just how much expertise they had in our industry," says Levin. "They had backgrounds in basin modeling, in addition to seismic interpretation, and rock physics. That experience was critical to this project's success."

Changing the culture of exploration

The basin simulation optimization project is a research and development effort that is still in its early stages. Initial tests and simulations have proved the concept, and Landmark and IBM are sharing some of their initial findings with the industry.

Landmark expects to develop a software product with practical application that it can market to its customers in the near future. It is hoped that from a single interface, petroleum geologists and economic analysts will be able to see, quickly and with a high degree of accuracy, the geologic features of a basin. The bottom line is that Landmark expects this research project to eventually help its clients increase the likelihood of finding profitable sources of oil in frontier areas. Reducing the risks will mean that oil producers will be able to search in remote areas and in difficult conditions and know that they can depend on the resulting data.

Just as extensive analysis and 3-D basin modeling have changed the culture of the industry, Levin expects that those companies that invest in an integrated approach to basin modeling that includes rock physics will see significant advantages. "From our point of view, basin modeling itself is a commodity. There are many solutions out there," says Levin. "What is new and exciting is the ability to link it all together, to make it a consistent workflow that is tightly optimized, tightly integrated—that is the innovation."

For more information

To learn more about how IBM can help your organization realize innovation that matters, contact your IBM sales representative or IBM Business Partner, or visit:

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