Smarter oil and gas exploration with IBM
IBM can offer a combination of hardware, software, consulting and research services to help you address challenges connected with oil and gas exploration.
Finding oil forty years ago was mainly hit or miss. Drilling “dry holes” wasn’t uncommon. Today, success rates have improved greatly, thanks largely to the impressive technological advances in seismic imaging, sensors and remote monitoring, and visualization. These, along with high-performance computing technologies and algorithms that have enabled 3-D and 4-D seismic imaging and reservoir modeling, have increased the chances of finding viable exploratory and production wells.

Three-dimensional seismic imaging is now mainstream practice in the industry for exploration. Furthermore, seismic imaging coupled with accurate reservoir modeling allows for “virtual drilling,” which helps engineers better optimize the number and placement of wells in a reservoir or even on an entire basin composed of multiple reservoirs—without actually drilling. This computational capability is immensely valuable, especially because costs can exceed US$50 million to drill a new deepwater well.¹

Today’s petroleum companies are challenged to continually improve hydrocarbon recovery strategies, predict the nature of the fields, rapidly bridge the gap between technical and business decision making, and eliminate system engineering delays and guesswork. This requires a robust environment that combines advanced research with high-performance computing technologies to provide the insight and analytics needed to improve oil and gas exploration and production.

Because oil is getting harder to find, many companies are pursuing re-exploration, and lifting costs are increasing dramatically each year. Oil is being found in smaller reservoirs, but huge reservoirs are necessary to support expensive deepwater development costs.

How can companies access these locations? How can they improve recovery rates? At IBM, we realize that even a single-digit improvement in oil recovery can make a huge difference. We have been working with various companies within the industry to help them find smarter ways to explore for new petroleum sources.

**Improved exploration with IBM**

IBM applies a unique, multidisciplinary combination of industry-specific knowledge, modeling, analytics, visualization, computational sciences and high-performance computing expertise to help reduce exploration risk and cost through reservoir modeling, seismic data processing, and advanced rendering and visualization.

IBM works with oil and gas organizations to improve exploration success by driving greater information accuracy and insight—from initial evaluation through field development planning. One area for opportunity is geological and geophysical analysis. Improved results are achieved from processing the petroleum company’s accumulated data through innovative mapping and modeling of unique, scalable algorithms. Another area for opportunity is using high-performance computing capabilities that provide faster and deeper insights. This is extremely important, as advances in deep computing are vastly improving 3-D seismic modeling, enabling scientists to discern fields that previously were invisible.

Seismic imaging can be used either to find petroleum or to better characterize a producing reservoir. For example, an oil company might use seismic analysis every few months to monitor the progress of the oil production. Once the analysis of an area yields enough data to improve the reservoir model for forecasting future petroleum yield, IBM can apply algorithms to the data to help find the oil. Or, if the company already has its own algorithms, IBM can use high-speed computer capabilities to help accelerate algorithmic processing and increase the efficiency of the existing algorithm. Using basin models, IBM can also model an entire area’s geological history, and estimate how much oil was generated and where it might have migrated. The oil company can then combine these calculations with physical processes and geochemistry findings, reducing the risk of finding oil.
IBM capabilities for exploration

IBM offers you the technology and expertise to help your company improve exploration success in three main areas.

Seismic analysis
- Improve oil and gas exploration and recovery—with computing performance far greater than that of traditional systems.
- Gain the capacity to perform larger, more complex, time-sensitive analysis.
- Increase the speed of finding, developing and lifting oil.
- Identify promising acreage and improve drilling success.

Reservoir simulation
- Gain the tools to help build better and more accurate reservoir models and assess uncertainty.
- Increase efficiency with virtual real-time data capture and analysis.
- Employ parametric studies and compute-intensive algorithms that yield more accurate, lower-risk results.

Visualization
- Gain access to industry-leading seismic interpretation, simulation and analysis applications.
- Employ specialized software and clustered implementation to enable scalable, flexible, collaborative visualization.
- Analyze more opportunities faster.

Finally, IBM works with clients in the area of inversion, a process similar to performing a sonogram, except this is a model of the earth. This method can help scientists determine the configuration of the earth in a given location. Multiple models are run and compared to reduce mismatches between observations. This increases the accuracy of the models used in the analysis, which in turn makes it easier for companies to make field management decisions.

High-performance computing and more
As newer acquisition techniques are combined with more compute-intensive seismic algorithms, the pressure to increase computing capacity is driven exponentially. Users are pressured in multiple dimensions, including compute density as measured in floor space and rapidly increasing demand for energy to power and cool these systems. Clearly, innovation is needed in both areas.

Our systems, typically IBM® BladeCenter® platforms or IBM System x® iDataPlex™ servers, can provide the power needed to perform analyses on the results of reservoir simulations or seismic analyses. We can offer a combination of integrated hardware, middleware, services and consulting to help you solve business problems, including those connected with the location and production of oil and gas.

Both BladeCenter and iDataPlex systems achieve approximately double the industry standard for compute density when measured on a per-rack basis, and both provide for significant energy savings of as much as a 40 percent reduction in energy usage. When combined, these factors result in industry-leading total cost of ownership (TCO). Additionally, these platforms are openly engineered, which allows for the introduction of new technologies.

For example, there is a tremendous level of interest in various acceleration techniques today to address the compute requirements of newer algorithms, such as reverse time migration. The iDataPlex system allows for the installation of
as many as 84 GPGPU (general-purpose computation on graphics processors) adapters into existing racks, which can coexist with x86 servers. This results in a breakthrough level of compute capacity in a single two-foot by four-foot 42U rack.

Smart advances in deep computing are pushing 3-D seismic modeling into the next generation, enabling scientists to discern fields that previously defied modeling. Through virtualization, companies can monitor fields remotely, reducing the strain on the workforce. Autonomic sensing technologies and data analytics are being used to improve oil exploration by:

- Identifying viable reserves.
- Increasing oil production.
- Improving reservoir management productivity.
- Anticipating risks to people and the environment.

Using these technologies, IBM can perform analyses such as reverse time migration, which provides superb imaging for complex structural plays—allowing companies to find reserves that might be disregarded or seen as “noise.”

**In summary**

IBM combines advanced analytics with deep computing and other products and services that can help you locate oil and gas faster and optimize reservoir management by making better decisions with lower risks. We offer solutions to help improve your competitive position in exploration, production and visualization with:

- Improved cycle time for prospect evaluation.
- Better field development.
- Optimized operations.
- Enhanced data management.
- Multi-discipline collaboration.

For more information, visit IBM at [ibm.com/chemicalspetroleum](http://ibm.com/chemicalspetroleum)
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Route 100
Somers, NY 10589
U.S.A.

Produced in the United States of America
June 2010
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1 Information in the first two paragraphs is based on *Productive High Performance Computing for Upstream Petroleum with the IBM Cluster Solution Powered by the Intel Xeon Processor 5500 Series*, Srini Chari, Ph.D., MBA, April, 2009

2 “IBM System x iDataPlex” solution brief, July 2008

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