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# Supercomputers grow industry's imaging abilities by leaps and bounds

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HOUSTON -- In a few months, oil and gas giant BP PLC will begin operating the world's largest commercial supercomputer in an office complex on the west side of this city.

Housed in a three-story facility, the expensive expansion of BP's computing power will enable better imaging of the seismic surveys of rock formations deep underground that the company takes throughout the world, BP says. In a synopsis, officials there also said that newer systems being developed today let them process seismic data at speeds that were unthinkable just a few years ago, a result of the new generation of supercomputing technologies and the oil and gas industry's increasing embrace of it.

"BP scientists now have the computing power to complete an imaging project in one day that would have taken 4 years using computing technology from just 10 years ago," the company bragged in an overview.

While oil and gas exploration technology is evolving quickly, supercomputing capabilities may be evolving at an even faster clip with centers capable of much faster processing speeds all while consuming less energy. The BP supercomputer center, for instance, will be able to manage 1,000 trillion calculations each second while shaving energy consumption by 30 percent. Systems in use today are about 10,000 times more powerful than what the largest oil and gas companies were able to play with at the end of the 1990s.

The rapid improvement in high-performance computing (HPC) is getting attention, and other companies are sure to follow BP's example. Jan Odegard, director of the Ken Kennedy Institute for Information Technology at Rice University, said industry interest in supercomputing first hit a turning point around 2004, but now it's really starting to heat up.

Though the industry used to show little interest in HPC, "now it's really interesting to them, because there are tremendous computation sciences, tremendous

computational opportunities," Odegard said. "They realized that there is an opportunity to really make better images and lower the risks."

## 'Burden' becomes positive development

Last week, Odegard and his institute hosted the latest Oil and Gas HPC Workshop, an annual gathering of computing professionals working with industry players or their contractors, alongside Rice students slated to begin their own careers in the field. The building hosting the event was packed -- seating ran out during some presentations.

Discussion was highly technical. But participants also frequently reflected in general on the growing use of supercomputing in the industry and how quickly oil and gas companies are turning their investments toward greater HPC capacity. Students were also assured that available jobs for computational scientists in oil and gas will be increasingly plentiful, though many complained that oil and gas companies still had a tough time wooing new hires away from the major Silicon Valley companies.

Insiders say some oil and gas executives still see investments in HPC upgrades as expensive, often unnecessary headaches that threaten quarterly profit margins. Requiring vast, expensive and energy-hungry data centers, companies once routinely relied on outside firms to process survey data.

"For HPC, there have been times in the past where it has been viewed as a burden or a cost," said Jeff Jackson, leader of the HPC geophysics program at Royal Dutch Shell PLC. "But today it's actually viewed very positively."

John Kuzan, manager of computational sciences at ExxonMobil Upstream Research and a keynote speaker at the Rice University event, said the negative views on supercomputing and the use of massive data centers are all but a thing of the past.

"Indeed, the world of computational sciences is growing in the oil and natural gas business," Kuzan said. For supercomputer experts interested in oil and gas careers, "the world is your oyster."

The computing power is mainly used for seismic imaging data processing and interpretation. Two-dimensional imaging of underground rock layers has given way to advanced three-dimensional images. And increasingly computational modeling is being applied toward utilizing so-called 4D seismic imagining, the fourth dimension being time -- images can be coupled with models predicting how and where oil and gas reserves flow within the formations targeted by drillers.

But officials are also looking at other emerging applications that could help

reduce companies' chances of drilling expensive dry holes, especially offshore.

Complex modeling and simulations run on ultra-fast and powerful supercomputers could improve understanding of other reservoir characteristics long before they're ever probed with a test well. Resource composition, field porosity and other variables could be better understood, reducing investment risks.

Company geologists won't be the only ones allowed to experiment. Engineers will also likely be using more HPC applications in the years to come to aid their designs of offshore drilling rigs and platforms that will be dispatched to remote and hostile regions where oil and gas exploration is planned or under way.

Jackson at Shell predicts that newer, more advanced HPC systems could be used to model harsh weather and wave patterns and the stresses they are likely to create on structures.

"It's indispensible in finding oil, which is one of our extremely important activities obviously," he said. "In the future I think our hope is that it expands out more and more into reservoir and other parts of the business as well."

## More work to do

A more enthusiastic embrace of supercomputing in oil and gas operations still faces obstacles.

Expense is one, and space requirements are another. For instance, the new BP supercomputer coming to Houston will cost the company about $100 million to build and will consume 110,000 square feet of space.

HPC experts say they also still grappling with the problem of overheating and developing more efficient and effective cooling systems. Advanced liquid cooling applications are coming into the field, but those methods are difficult to engineer because computer equipment cannot generally be immersed in cold fluids of any sort.

But the main challenge is encouraging new talent to consider jobs with the industry in Houston or other drilling headquarters and not look just to the California coast -- where pay scales can be much higher -- for their futures.

Tom Tyler, an HPC professional who works with the oil and gas sector, said his firm is adapting to that challenge by doing more to build up the skills of employees already on the payroll. Attracting new supercomputing geniuses to find new oil and gas reserves could prove the most difficult part of companies' adaptation to the new technologies emerging, he said.

"We're seeing a lot of the talent moving to online gaming; those are what the younger talent see as sort of the sexy places to be," Tyler said. "For us to try to go out and recruit from different industries that are paying twice what we can offer is a challenge."