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The Year Ahead

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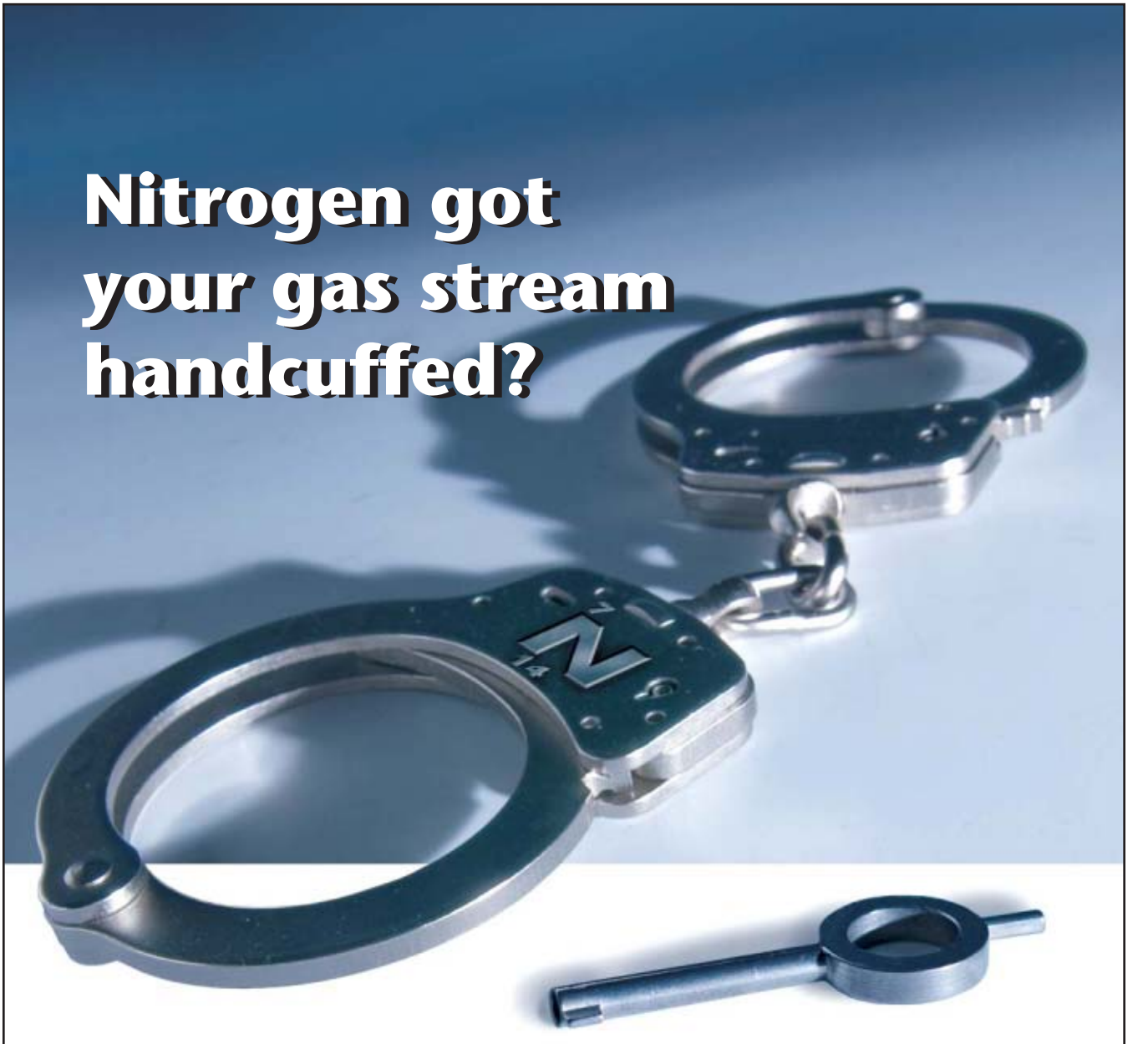
China's low-permeability gas resources await development
Study examines effect of cetane improvers
Kazakh export plans affect regional gas producers, buyers



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Jan. 5, 2009
Volume 107.1

THE YEAR AHEAD

REGULAR FEATURES

COVER

The wild oil price swing and global economic collapse of 2008 create huge questions at the start of 2009. Where is the bottom of the economic slump? When will oil and gas prices rebound? Where and when, if ever, will prices stabilize? In The Year Ahead special report (p. 18), Oil & Gas Journal's news writers and editors grapple with these and other crucial issues of the new year.

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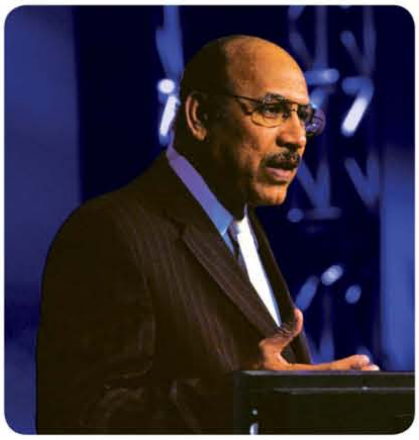

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Jan. 5, 2009

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General Interest — Quick Takes

NPRA, others ask for more ethanol blend tests

Fourteen organizations, including the National Petrochemical & Refiners Association, on Dec. 18 called for "unbiased and comprehensive testing" before the US Environmental Protection Agency permits the use of midlevel ethanol blends in engines.

Other groups included the Sierra Club, Natural Resources Defense Council, American Lung Association, Engine Manufacturers Association, and Motorcycle Industry Council.

Calling themselves an informal coalition, the groups said they are concerned about air quality, engine compatibility, and safety.

"There has not been sufficient testing of motor vehicle and nonroad equipment engines to justify a determination that any midlevel ethanol blend would meet the requirements," they said in a letter to EPA Administrator Stephen L. Johnson.

The test results that exist suggest midlevel ethanol blends might be incompatible with current motor vehicle and nonroad equipment engines, might cause emission control devices or systems to fail, might defeat engines' safety features, and might lead to significantly higher emissions over the engines' useful life, they continued.

"Collectively, our organizations strongly believe that this issue should not be part of the rulemaking proposal for the revised Renewable Fuel Standard under the [2007 Energy Independence and Security Act]. The midlevel ethanol blend issue should be discussed at length, but the vehicle should be a separate advance notice of proposed rulemaking," said the groups.

Australian CSM players continue to consolidate

Two recent takeover announcements will further reduce the number of Australia's coal seam methane (CSM) players in 2009.

Brisbane-based Arrow Energy Ltd. made a cash and share takeover offer for fellow Brisbane company Pure Energy Resources Ltd., which values Pure at $673 million (Aus.).

This was followed by Sydney company AGL Energy Ltd.'s $171 million all-cash takeover bid for Sydney Gas Ltd.

Arrow's offer is made up of $2.70/share in cash plus 1.21 Arrow shares for each Pure share.

Arrow began the move already holding 19.9% interest in Pure, setting the net acquisition cost at $551 million. Arrow says it will fund the cash component of its offer through a combination of existing cash reserves and proceeds from an earlier deal to sell 30% of its upstream coal seam methane interests to Shell.

Pure's independent directors have unanimously recommended the offer to the company's shareholders, if no superior bid is forthcoming.

The acquisition will provide Arrow with control of additional acreage and reserves in the prospective Walloon Coal Measures in the Surat basin of southeast Queensland, adjacent to its proposed Surat-Gladstone pipeline, as well as further acreage in the Bowen basin further north adjacent to its proposed Moranbah-Gladstone pipeline.

If successful, the acquisition will bring Arrow's total uncontracted 2P CSM reserves to 2 tcf, which is sufficient to underpin two 1.5-million-tonne/year LNG trains planned for Gladstone.

Arrow's offer will open Feb. 11 and close Mar. 11.

AGL Energy's move on Sydney Gas also appears to be friendly in that Sydney Gas directors have unanimously agreed to recommend the offer and will accept shares in the absence of a superior offer.

AGL's offer values Sydney gas at 42.5¢ (Aus.)/share. AGL will fund the acquisition with cash reserves.

The offer follows AGL's purchase earlier this month of the prospective permit PEL 285, in the Gloucester basin of northern New South Wales, from fellow CSM players Molopo Australia and AJ Lucas for $370 million.

The Sydney Gas deal will bring AGL full control of the producing and prospective CSM acreage in the Camden and Hunter Valley regions of the Sydney basin in New South Wales.

With AGL's capacity to meet funding requirements, it believes it is best placed to develop the Sydney basin resources.

AGL's offer will open Jan. 12 and close Feb. 13.

This recent takeover activity comes hard of the heels of the British BG Group's successful takeover of Queensland Gas Co., which also gathered in Sunshine Gas Co. and Roma Petroleum—all CSM players in Queensland. ✦

Exploration & Development — Quick Takes

Total finds oil near Ofon field off Nigeria

France's Total SA discovered oil in shallow water near its producing Ofon oil field in southeastern OML 102 off southeastern Nigeria.

The Etisong-1 well went to TD 2,207 m in 70 m of water and tested more than 6,000 b/d of 40° gravity oil from turbiditic reservoirs.

The well is the first step in an exploration and appraisal program designed to demonstrate the feasibility of a new development pole on OML 102 that would combine production from the Etisong main discovery and as-yet-undrilled surrounding structures.

Total E&P Nigeria operates OML 102 with a 40% interest, and Nigerian National Petroleum Corp. has 60%.

Total E&P Nigeria, already a large oil producer in Nigeria, plans to start production from Akpo deepwater oil field on OML 130 in

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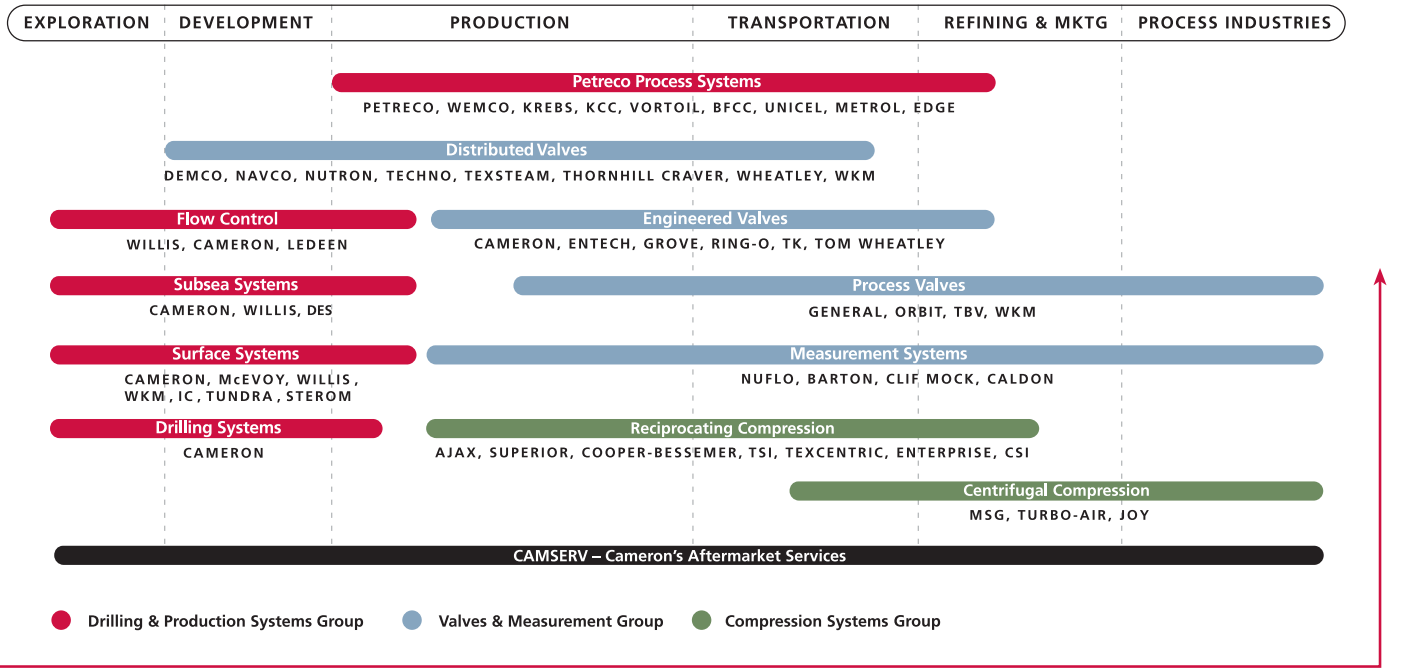

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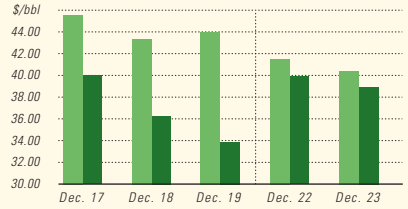
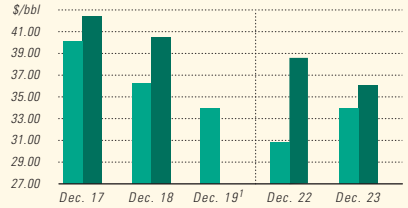
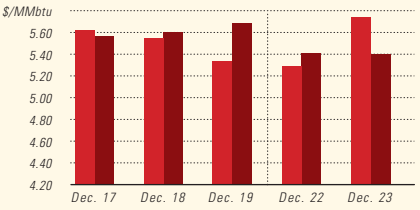
IPE BRENT / NYMEX LIGHT SWEET CRUDE



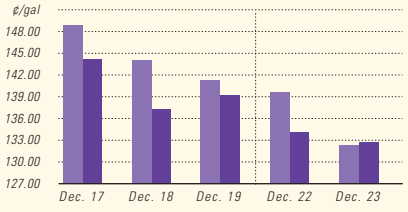
WTI CUSHING / BRENT SPOT



NYMEX NATURAL GAS / SPOT GAS - HENRY HUB



IPE GAS OIL / NYMEX HEATING OIL



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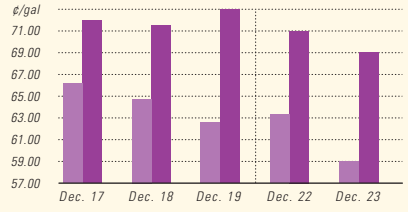
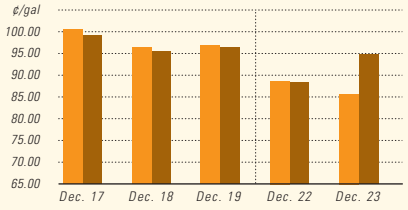


NYMEX GASOLINE (RBOB)[2] / NY SPOT GASOLINE[3]



[1]Not available. [2]Reformulated gasoline blendstock for oxygen blending. [3]Nonoxygenated regular unleaded.

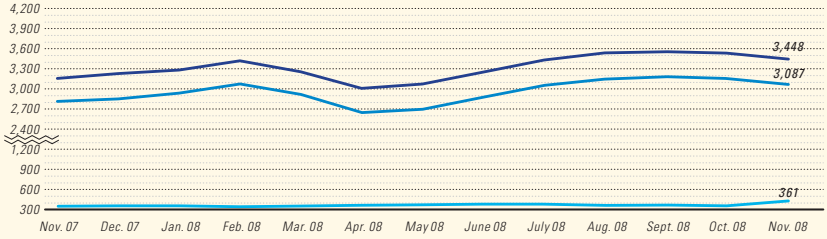
US INDUSTRY SCOREBOARD — 1/5

Latest week 12/19	4 wk. average	4 wk. avg. year ago[1]	Change, %	YTD average[1]	YTD avg. year ago[1]	Change, %
Demand, 1,000 b/d						
Motor gasoline	8,998	9,243	–2.7	8,977	9,287	–3.3
Distillate	3,939	4,151	–5.1	3,948	4,196	–5.9
Jet fuel	1,415	1,602	–11.7	1,515	1,623	–6.7
Residual	769	702	9.5	605	725	–16.6
Other products	4,664	4,955	–5.9	4,626	4,834	–4.3
TOTAL DEMAND	19,785	20,653	–4.2	19,445	20,679	–6.0
Supply, 1,000 b/d						
Crude production	5,052	5,042	0.2	4,950	5,065	–2.3
NGL production[2]	2,387	2,537	–5.9	2,272	2,411	–5.8
Crude imports	9,564	9,889	–3.3	9,779	10,031	–2.5
Product imports	3,132	3,088	1.4	3,124	3,452	–9.5
Other supply[3]	1,209	1,000	20.9	1,375	1,025	34.1
TOTAL SUPPLY	21,344	21,556	–1.0	21,500	21,984	–2.2
Refining, 1,000 b/d						
Crude runs to stills	14,656	15,373	–4.7	14,656	15,156	–3.3
Input to crude stills	14,915	15,482	–3.7	14,915	15,443	–3.4
% utilization	84.9	88.8	—	84.9	88.5	—

Latest week 12/19	Latest week	Previous week[1]	Change	Same week year ago[1]	Change	Change, %
Stocks, 1,000 bbl						
Crude oil	318,188	321,289	–3,101	293,633	24,555	8.4
Motor gasoline	207,295	203,959	3,336	205,857	1,438	0.7
Distillate	135,337	133,523	1,814	126,608	8,729	6.9
Jet fuel–kerosine	37,347	37,916	–569	39,245	–1,898	–4.8
Residual	35,993	35,930	63	40,991	–4,998	–12.2
Stock cover (days)[4]			Change, %		Change, %	
Crude	21.7	21.8	–0.5	19.2	13.0	
Motor gasoline	23.0	22.7	1.3	22.0	4.5	
Distillate	34.4	33.9	1.5	28.2	22.0	
Propane	43.5	43.9	–0.9	37.3	16.6	
Futures prices[5] **12/26**			**Change**		**Change**	**%**
Light sweet crude ($/bbl)	37.99	39.65	–1.66	91.35	–53.36	–58.4
Natural gas, $/MMbtu	5.69	5.58	0.11	7.14	–1.45	–20.3

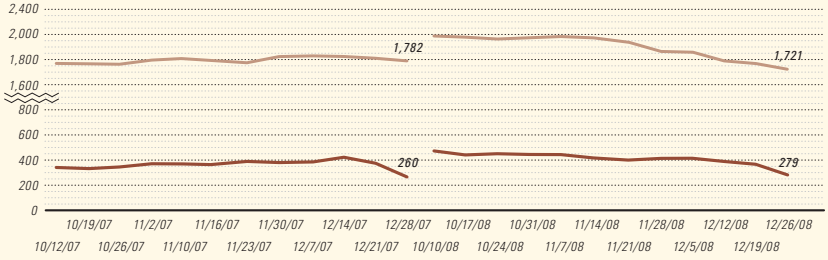
[1]Based on revised figures. [2]Includes adjustments for fuel ethanol and motor gasoline blending components. [3]Includes other hydrocarbons and alcohol, refinery processing gain, and unaccounted for crude oil. [4]Stocks divided by average daily product supplied for the prior 4 weeks. [5]Weekly average of daily closing futures prices.
Sources: Energy Information Administration, Wall Street Journal

BAKER HUGHES INTERNATIONAL RIG COUNT: TOTAL WORLD / TOTAL ONSHORE / TOTAL OFFSHORE



Note: Monthly average count

BAKER HUGHES RIG COUNT: US / CANADA



Note: End of week average count

early 2009. The company is undertaking development studies for Egina oil field on the same block.

ExxonMobil to drill for gas in Poland

Poland's environment ministry has given ExxonMobil Poland permission to explore for natural gas deposits in eastern and southeastern Poland.

ExxonMobil Poland, which obtained two 5-year licenses for conducting the related operations, plans to conduct seismic surveys and drilling in the Mazowieckie and Lubelskie provinces.

The first concession covers a 1,200 sq km area near Wolomin, northeast of Warsaw, while the second covers a 1,000-sq km area near Zamosc, in southeastern Poland.

ExxonMobil Poland paid $290,000 for the concessions, the ministry said. ExxonMobil Poland's exploration activities are expected to last 3 years.

Shell cancels 2009 Beaufort Sea drilling program

Shell Oil Co. canceled its exploratory drilling program for 2009 in Alaska's Beaufort Sea, a region in which the company invested $44 million as recently as 2005.

Instead, Shell said it will focuses on court challenges to its offshore plan. The decision results in a loss of 700 jobs directly related to drilling, more than 100 local support service jobs on the North Slope, and millions of dollars for the region.

Shell also canceled its seismic program in Beaufort for 2009. A company spokesperson said this decision was unrelated to the 9th Circuit Court of Appeals ruling last month that federal regulators improperly granted Shell permission to drill in the Beaufort Sea.

Alaska Gov. Sarah Palin said that state officials intend to support Shell's petition to the appeals court for a rehearing before the full court.

The US Minerals Management Service environmental assessment determined the proposed exploration "would not significantly affect the quality of the human environment."

However, the court ordered MMS to reconsider how exploratory drilling would affect wildlife and Inupiat Eskimo subsistence hunting and fishing.

StatoilHydro drops rigs procurement for NCS

StatoilHydro cancelled its rig procurement for operations on the Norwegian Continental Shelf because of high costs and the global economic uncertainty that has dampened oil prices.

The company said it is focused on reducing costs and determining priorities.

On Aug. 25, StatoilHydro received tenders from 15 contractors for 28 rigs, including semisubmersibles and jack ups. Contracts were to start at the end of 2012.

But back when the tenders were made, rates were higher because of greater demand for rigs in those days of higher oil prices. Since then, oil prices have dropped 60%, reducing the number of drilling prospects. As a result, StatoilHydro asked for updated tenders, including reduced rig rates, by Dec. 1.

"Despite the reduction in the prices offered, there is still a considerable gap between the tenders and the expectations we have concerning the rates," said Anders Opedal, head of procurements in StatoilHydro. "We have therefore decided to terminate the procurement process."

BP's Thunder Horse field reaches full production

BP PLC's Thunder Horse field in the ultradeepwater Gulf of Mexico has begun full production, with output of more than 200,000 boe/d.

Full operation was reached as BP brought the third and fourth wells on stream in the high-pressure, high-temperature field. Thunder Horse platform is in 6,050 ft of water in Mississippi Canyon about 150 miles southeast of New Orleans.

Thunder Horse platform has the capacity for 250,000 b/d of oil and 200 MMcfd of natural gas. The field began producing in June. In 2005, Hurricane Dennis left the platform listing, which slowed the scheduled start of production.

Production is from reservoirs 14,000-19,000 ft below the seabed with reservoir pressures of 13,000-18,000 psi, said BP, which operates Thunder Horse with 75% interest. ExxonMobil Corp. holds the remaining interest.

Additional production from nearby Thunder Horse North field is scheduled for the first half of 2009.

GeoPetro extends Bengara-II appraisal

The Indonesian government granted GeoPetro Resources Co. a 1-year extension to 2010 to submit its work program and 2009 budget to appraise and evaluate commerciality of an oil discovery on Bengara-II Block, Tarakan basin, onshore East Kalimantan.

The oil discovery was made last year on the Seberaba prospects, and the approval could be extended for subsequent years subject to approvals based on an annual review of progress and results of appraisal work, said GeoPetro Resources.

GeoPetro's 12% owned subsidiary Continental-GeoPetro (Bengara-II) Ltd. (CGB2) will carry out the work. GeoPetro is based in San Francisco.

If CGB2 decided to move to development, it can draw up a commercial development plan. If the government approves the development plan, Bengara-II Block will be held for a 30-year term through December 2027.

"The majority 70% shareholder and manager of CGB2, CNPC (Hong Kong) Ltd., has called a shareholders meeting for mid-January 2009 to discuss appraisal plans which are expected to include a 3D seismic program," GeoPetro said. ✦

Drilling & Production — *Quick Takes*

Pertamina to invest $1 billion on production

Indonesia's state-owned PT Pertamina plans to spend 11 trillion rupiah ($1 billion) to upgrade assets and boost production in Limau oil fields in South Sumatra and Tambun gas fields in Bekasi, West Java.

Of the total upstream investment, 6 trillion rupiah will go to PT Pertamina EP, said Karen Agustiawan, Pertamina's upstream director.

The company expects to increase oil production 7% in 2009 to 171,250 b/d from an estimated 159,000 b/d in 2008.

Pertamina's production comes from two subsidiaries. They are

Pertamina EP, which produces 80% of the parent firm's total output, and PT Pertamina Hulu Energi, which manages and develops oil and gas upstream assets through partnerships.

Of the 2008 targeted 159,000 b/d, some 125,000 b/d will be from Pertamina EP while Pertamina Hulu provides the rest. Of 2009's targeted 171,250 b/d, Pertamina EP is expected to contribute 132,250 b/d.

"The two fields are the backbone of Pertamina EP, and they will become pilot projects (for facility upgrading)," said Agustiawan, who did not specify the upgrades. Pertamina EP expects 6,750 b/d of production to come on stream next year from an oil block in Cepu.

Pertamina plans to acquire bigger shares in several blocks, including the West Madura block in East Java, Total's Mahakam block in East Kalimantan, and Chevron's deepwater fields off East Kalimantan.

Pertamina requested a bigger stake in Inpex's Masela offshore block in the Timor Sea.

"We hope we can get 30% (of the block)," said Pertamina Pres. Director Ari Soemarno.

Pertamina also is negotiating with Verenex Energy Inc. to buy the Canadian firm's stakes in Libya's Ghadames basin.

Heritage Oil starts drilling in Kurdistan

Heritage Oil Ltd. has commenced drilling the Miran West-1 well in the Kurdistan Region of Iraq, the first exploration well to be drilled on the Miran license.

Heritage received its license 15 months ago, said Tony Buckingham, Heritage chief executive officer. The drilling contractor is Great Wall Drilling Co. Ltd.

"The Miran block is highly prospective, containing two anticlines that have the potential to contain billions of barrels of oil from multiple potential reservoir targets," Buckingham said.

The rig will drill the Miran West structure to an anticipated depth of 2,500-3,000 m, targeting what Heritage calls the three principal proved reservoir formations. They are the Shiranish, Kometan, and Qamchuqua reservoirs.

The Miran license contains two large structures, Miran West and Miran East that have been mapped from some 332 km of seismic data acquired by Heritage.

Heritage has a strategic agreement with the Kurdish Regional Government to establish a 50:50 joint venture company aimed at building, owning, and operating a 20,000 b/d oil refinery in the vicinity of the license. The refinery is scheduled to be operational within 2 years.

Heritage is operator and holds a 100% interest in the Miran license, an area of 1,015 sq km west of the city of Suleimaniah.

Indonesian firm forecasts reduced 2009 output

Indonesia's publicly listed oil and gas company PT Medco Energi Internasional predicts that its oil and gas production could drop in 2009 by as much as 10% due to asset sales and aging fields.

Medco finance director Cyril Noerhadi said the firm had sold participating shares in the Tuban block to state-owned PT Pertamina and in the Simenggaris block to Salamander Energy Ltd.

"Aside from that, our fields on average are already at the aging stage and can no longer produce optimally," Cyril said.

During the first 9 months of 2008, Medco oil and gas production totaled 65,460 b/d of oil equivalent, down 6.4% from the 69,970 b/d produced during the same period in 2007.

Last year, Medco's oil production alone reached 50,411 b/d, down from 56,367 b/d in 2006.

The director said Medco's oil and gas output likely would start increasing again in 2011 after seven key projects are completed.

Although Medco recorded a 51.6% increase in revenue between the first 9 months of 2008, climbing to $972.2 million over last year's $641.4 million, Cyril declined to state how much the firm planned by way of capital expenditure next year.

"The current economic conditions will narrow down alternatives for capital access," Cyril said, adding that Medco normally spends $250-300 million annually.

Meanwhile, Medco Pres.-Director Darmoyo Doyoatmojo said new gas facilities being installed on South Sumatra's Lematang Block would be completed in June 2009.

Darmoyo said the remaining projects, which will be completed in 2011-12, include Block A gas field in Aceh, the enhanced oil recovery project on Block Rimau in South Sumatra, Area 47 in Libya, the Senoro gas field in Central Sulawesi, and a power project in Sarulla, North Sumatra.

Darmoyo also said the company would intensify its search for overseas oil and gas fields as the success rate for confirming feasible reserves in Indonesia remains very low at between 10-15%. ✦

Processing — *Quick Takes*

Irving Oil lets NB refinery contract

Irving Oil Ltd. has selected Fluor Canada, a subsidiary of Fluor Corp., to perform front-end engineering design for a proposed $7 billion, 300,000-b/d refinery to be constructed in St. John, New Brunswick, 65 miles from the US border.

Irving conducted initial feasibility work and informal public consultation in 2006, and has been engaged since January 2007 in permitting, public consultation, and engineering design for the proposed refinery. It would be situated near Irving's existing 300,000-b/d refinery and the existing Irving Canaport deepwater crude oil terminal, which receives cargoes via very large crude carriers.

Construction would begin in 2011, and operations start-up is scheduled for 2015. ✦

Transportation — *Quick Takes*

USGS: Planned LNG line lies in quake zone

Pipelines from a proposed deepwater LNG terminal off Southern California face a 16-48% probability of a damaging earthquake within 30 miles of their route, the US Geological Survey reported Dec. 23.

While the US Department of the Interior agency does not make recommendations for or against proposed projects, researchers found that the probability of an earthquake measuring 6.5 or above on the Richter scale along the OceanWay Secure Energy project's

planned pipeline route in Santa Monica Bay ranged from 16% at its origin 23 miles offshore to 48% at its planned terminus near Los Angeles International Airport.

"Earthquakes of this size can cause damage over a large region," said USGS in the report, citing impacts of the 1994 Northridge quake, which measured 6.7 points at its epicenter.

USGS said the proposed deepwater LNG project would be situated in 3,000 ft of water and would be connected to onshore systems by twin 24-in. pipelines to onshore systems 35 miles away. Facilities would include a deepwater port, including submersible buoys, manifolds, and risers.

The deepwater terminal would be 27 miles from the Los Angeles coast and more than 5 miles from shipping lanes, according to project sponsor Woodside Natural Gas of Santa Monica, Calif. USGS said the regasified LNG would be delivered onshore into an existing Southern California Gas Co. system. Woodside Natural Gas is a subsidiary of Woodside Petroleum Ltd.

USGS reported that the proposed project's pipelines would face hazards from potential sea floor offsets because they cross at least two faults, as well as tsunamis, erosion or scouring, shallow gas deposit venting, and pipeline settling.

It added that 27 USGS and California Geological Survey scientists reviewed regional geologic hazards identified in a 2007 report prepared by Fugro West Inc. as part of OceanWay's 2007 deepwater port application.

US Rep. Jane Harmon (D-Calif.), in a Mar. 25 letter to USGS, also requested information on geologic hazards that should be considered in connection with the proposed project.

TAQA, Gazprom sign MOU for Bergermeer project

Gazprom Export and TAQA Energy BV., a wholly owned subsidiary of Abu Dhabi National Energy Co., signed a memorandum of understanding to partner in Europe's largest new gas storage project in the Netherlands, the Bergermeer gas storage.

Operator TAQA is finalizing technical design, permitting, and planning processes to start converting the existing depleted Bergermeer gas reservoir into Europe's largest new seasonal gas storage facility. The project is essential to the Dutch government's ambition to realize the North-West European gas hub in the Netherlands.

The Bergermeer consortium consists of Energie Beheer Nederland, Dyas BV, Petro-Canada, and TAQA Energy BV.

Construction is expected to start in second-quarter 2009, with commercial operations scheduled to begin in second-quarter 2013. Once operational, most of the facility's capacity will be available for third party access.

Gazprom will deliver cushion gas for injection in the summer months over the next 4 years. Cushion gas will ensure that the reservoir has the optimal pressure to start commercial storage operations.

TAQA and Gazprom Export aim to finalize all technical and contractual discussions in coming months to reach a final investment decision by the end of first-quarter 2009. At the same time TAQA is continuing discussions with other potential partners and cushion gas suppliers to create a diverse consortium of global energy players to participate in the project and ensure on-time completion of Bergermeer.

Santos lets FEED contract for CSM-fed LNG plant

Santos Ltd. hired Bechtel as its front-end engineering and design contractor for a proposed 3.5 million tonnes/year coalseam methane (CSM)-fed LNG plant in Gladstone, Queensland.

The $40 million contract is expected to provide an updated estimate of project cost, Santos said. An initial estimate was $7.7 billion. Petronas is working with Santos to produce LNG using CSM.

Santos expects to make a decision during the first half of 2009 on whether to proceed with the project. Construction tentatively is scheduled to begin in 2010, with first shipments of LNG scheduled for 2014.

Conventional natural gas reserves in fields close to eastern Australian markets are declining while gas demand continues to grow substantially. CSM resources are close to large potential markets in eastern Australia.

Nippon Oil boosts stake in PNG LNG

Nippon Oil Corp. has purchased AGL Energy Ltd.'s entire 3.6% stake of the PNG LNG gas production and liquefaction project off Papua New Guinea, increasing Nippon's share to 5.4% from 1.8%.

The PNG LNG project, led by ExxonMobil Corp., is designed to liquefy natural gas at a local facility and export 6.3 million tonnes/year of LNG, starting in third-quarter 2013 (OGJ Online, Dec. 18, 2008).

The agreement with AGL Energy also stepped up Nippon Oil's interest in two Papua New Guinea producing oil fields, increasing its share of output to 8,000 b/d from 2,000 b/d.

The sale to Nippon Oil is a plus for the project, especially after recent reports that ExxonMobil, due to the current global financial crisis, has been searching for $10 billion in financing for the LNG venture.

"At a time when we are seeking to borrow more than $10 billion on the international money market, it would be foolish of me to stand here and tell you that this project is—and will remain—completely immune from the fallout of the current financial crisis," ExxonMobil's LNG venture manager Peter Graham told an investors conference.

"We continue to look for ways to protect this project from the global financial uncertainties, and I emphasize we're still targeting fourth-quarter of 2009 for that all-important financial investment decision," Graham said.

In November, the PNG LNG project received a financial boost when the government concluded a $1 billion agreement with Abu Dhabi's state-owned International Petroleum Investment Co. (OGJ Online, Nov. 5, 2008).

"This is an exceptional deal in the current global financial climate," PNG's Minister for Public Enterprise Arthur Somare said of the agreement with IPIC.

According to Somare, the IPIC loan "should also assist the project developer, ExxonMobil, in its efforts to conclude LNG marketing arrangements and to raise the 70% debt finance required for this Kina 40 billion ($16 billion) venture."

Following the AGL Energy sale, the PNG LNG project consortium includes ExxonMobil subsidiary Esso Highlands Ltd. 41.5%, Oil Search 34%, Santos 17.7%, Nippon Oil 5.4%, MRDC 1.2%, and Petromin PNG Holdings' Eda Oil 0.2%. ✦

Letters

Westbrook responds

The letter by Jeff Temple (OGJ, December 8, 2008, p. 14) on my letter (OGJ, Nov. 3, 2008, p. 12) has about a dozen areas deserving comment. I will cite six.

1. I started out by asking about three physicists (Dr. Richard Lindzen, Dr. Robert Jastrow, and Dr. Habibullo Abdussamatov). Mr. Temple berates me by observing one of these was deceased. I didn't realize it was not cricket to refer to scientists who have passed on. Furthermore, the work by Dr. Jastrow that I cited (Reference 1) was from 1990, when he was very much alive.

2. Next he complains that none of these three have "ever authored a testable theory, produced data, or presented papers explaining the current global temperature trend." That is a mere listing of charges and opinions. How about some significant analysis of their work, not just generalities. See Reference 2. For example, how about a definitive assessment of Lindzen's research and writings? Reference 3 lists 229 publications by Lindzen. Besides being the Sloan Professor of Meteorology at Massachusetts Institute of Technology, Lindzen is a member of the National Academy of Science, the youngest scientist ever elected.

3. Mr. Temple then twists my statement "of a barely discernable 0.6° C. increase" to one where I "denigrate the 0.6° C. increase." He argues "small changes in mean global surface temperature claims do indeed matter." However, he provides zero input on the quality of the measurements that go into this mean with no indication that errors involved maybe larger than the changes themselves.

4. Going back to Point 2, the work by Jastrow et al., contrary to Mr. Temple's claim, did explain or estimate the current global temperature trend at 0.4 -1.8° C. See Reference 1.

5. He charges that my comments on temperature change indicate "he does not understand climate science." Well, I understand chemistry and economics with advanced degrees in both areas, each with a minor in math. And the chemistry I took was very heavy into physical chemistry and hence physics. I have studied the climate issue since 1988, so I like to think I absorbed some-

thing in that span.

6. Finally, he claims there are many thousands of physicists who accept anthropogenic global warming as a reality. Just as in any court case one cannot call thousands of witnesses to testify, I called nine witnesses and mention another ten in the background essay. My position is that these are high-horsepower, competent witnesses. The fact that they are skeptical on this issue is rather important.

Gerald T. Westbrook
Houston

References

1. Jastrow, R., Nierenberg, W., Seitz, F., Scientific Perspectives on the Greenhouse Problem, The Marshall Press, Jameson Books Inc., Ottawa, Ill., 1990.

2. For an overview of Lindzen's career see: http://www.answers.com/topic/richard-lindzen?cat=technology.

3. A listing of Lindzen's publications can be seen at: http://www-eaps.mit.edu/faculty/lindzen/PublicationsRSL.html.

Calendar

✦ Denotes new listing or a change in previously published information.

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New SEC reserves rules

Guntis Moritis
Production Editor

The oil and gas industry will have modernized US Security and Exchange Commission's rules for reporting oil and gas reserves. Ryder Scott Petroleum Consultants, in its most recent quarterly newsletter, summarized the industry's concerns with the rules as proposed in July 2008.

As of this writing, SEC had not made available the new rules on the internet but the rules will come into effect on Jan. 1, 2010.

SEC published the proposed revisions to its oil and gas reporting requirements in July 9, 2008 (17 CFR Parts 210, 229, and 249). The rules will apply to companies that file with SEC.

The existing rules are set out in Regulation S–K and Regulation S–X under the Securities Act of 1933 and the Securities Exchange Act of 1934, Industry Guide 2, and disclosure requirements adopted in 1978 and 1982.

The comment period for the proposed rule changes ended on Sept. 8, 2008.

Ryder Scott notes that 308 oil and gas companies file with SEC and 29 oil and gas companies submitted comments regarding the proposed rules. Of the companies commenting, 19 were independents, 9 were integrated oil companies, and 1 was a national oil company.

The full comments are available on SEC's web site at www.sec.gov/comments/s7-15-08/s71508.shtml.

Burdensome disclosures

To conform better to current industry practices, the industry has sought changes to the rules for many years, but the comments sent to SEC indicate that various companies do not agree with many of the proposed changes. One contentious point, as Rider Scott notes, is that an integrated oil company and large independent with operating units worldwide may require up to 20,000 hr for its internal staff to prepare the additional data required in the proposed rules. This time compares with SEC's estimate of a company needing only 35 hr.

As Ryder Scott said, "Under proposed rules, companies would have to track field maturity and conversion of proved undeveloped reserves, report material reserves by field or basin and reservoirs as conventional or continuous, account for drilling activities by new well categories—extensions and suspended—and by location, disclose new technology, and submit qualifications of evaluation staff."

Ryder Scott also noted, "None of the 29 [oil and gas] companies fully supported all eight items of Subpart 1200 of Regulation S-K, with most saying that the additional disclosures were overly burdensome, provided little value to investors, compromised competitive positions and, in some cases, were outright illegal in host countries."

Other comments

Some other comments highlighted by the Ryder Scott newsletter included:

- Five companies favored disclosing evaluator qualifications. ExxonMobil Corp. questioned "how standards could be established considering differences in education systems, licensing and certification requirement and professional bodies from country to country."
- Only one company, PetroCanada, favored mandated reporting of probable or 2P reserves. Security regulations in Canada require 2P reporting, but ExxonMobil said that reporting these reserves would expose companies to additional litigation due to the uncertainty of these reserves. ExxonMobil favored optional reporting such as currently is done in press releases and discussions.
- Only one company, Petrobras, favored mandated third-party evaluations.
- No company favored mandatory disclosure of proved undeveloped data. SEC had proposed that companies would have to submit a table showing how PUD reserves would be converted to proved developed during a 5-year period.
- No company was against the proposed rules covering indirect measurement technologies such as wireline, formation tests, and seismic to define the lower limits and aerial extent of the proved reservoir volume.
- Most companies wanted to change from a single yearend price to a 12-month historical average for estimating proved reserves. Some suggested averaged daily prices instead of month-end prices and prices on the first day of the month rather than the last. Other comments called for the 12-month reporting period to conclude 1-3 months before the calendar yearend date to allow more preparation time for March filings. A few companies wanted prices from the futures market. For instance, McMoRan Exploration Co. said, "Historical prices have little meaning in considering future investments." The company added that future prices would make disclosures much more relevant to investors. ✦

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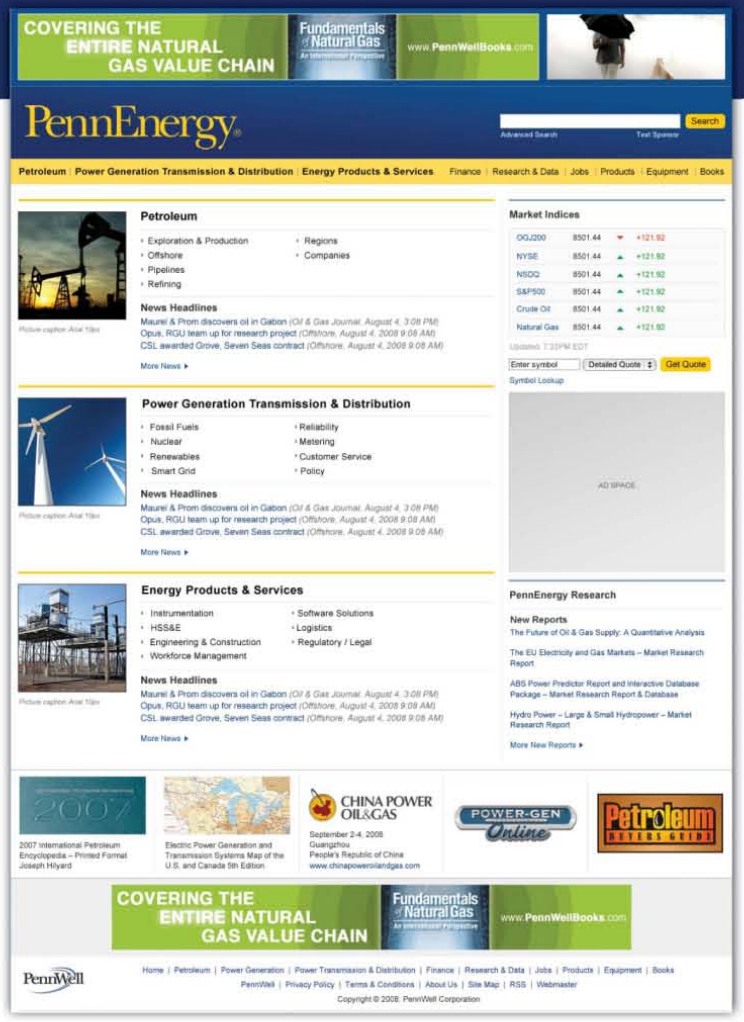

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Peak oil and politics

Peak oil theory is important both to consider and to keep in perspective, especially as government activism regains traction in the world's largest oil-consuming country. The theory addresses a question of obvious importance: future availability of an energy source with competitively overwhelming form value. It also raises problems.

According to peak oil theory, geologic constraints are closing in on global capacity to produce crude oil. After reaching a postulated peak, which may be imminent, production must decline, perhaps rapidly. The scenario leads some observers to seek governmental responses to a looming if indistinct decline in energy supply.

Intuitive theory

To some extent, peak oil theory is intuitive. The world has an essentially fixed endowment of liquid hydrocarbon; as far as anyone knows, rates of extraction greatly exceed rates of natural oil generation. Intuition says the world someday must exhaust the resource. Before then, production must peak.

Nature, however, isn't that simple. Oil production is not a uniform activity. Some of it is cheap and based on massive reservoirs that were relatively easy to find. Some of it is more costly, coming from complex reservoirs in difficult environments. Some reservoirs now on production were invisible to exploration early in the Petroleum Age, awaiting refinements of geologic theory and exploratory methods. Those refinements have not ceased.

Serious proponents of peak oil theory understand the evolutionary nature of exploration and production knowledge and skill. They have concluded nevertheless that prowess can't develop fast enough to prevent calamity. Other, equally serious observers see flaws in this reasoning.

A problem with peak oil theory is its tendency to become a political cause and hence to escape the professional debate it deserves. In politics, peak oil too easily comes to mean—simply, definitively, and incorrectly—resource exhaustion. Policy responses thus become panicky, expensive, and misdirected.

The surge in oil prices that ended last July did not signal the fateful manifestation of geologic limits on oil supply. It did signal, among other things, the world's latest encounter with limits on the ability to bring oil products to market at rates demanded by consumers. The constraints were on the surface, not underground: production equipment, drilling rigs, pipelines, tankers, refining capacity, equipment, and supplies. Obviously undaunted by thoughts of geologic constraint, producers were adding production capacity when the market reversed and prices plunged.

The prior hard encounter of consumption with supply limits occurred in the mid-1990s after a decade of bottom-bumping oil prices and rising consumption. Pressure subsided when consumption fell after the Asian financial collapse of late 1997. When demand revived, another price-rising squeeze became inevitable.

A comparison of these episodes is useful. Global production of crude oil and lease condensate in 1997 was 65.7 million b/d. When data stabilize for the year just ended, annual average production probably will be about 74 million b/d. In fact, the global trend since the recent low of 53.3 million b/d in 1983, despite occasional down years, is solidly upward. The gains, though, come from increasingly expensive projects. Among casualties of the recent price slump are projects not nearly so prevalent in the 1990s, such as heavy oil expansions in Canada and developments in ultradeep water.

Complex message

The message in all this is not simple. The world will not soon run out of oil, but new oil supplies are increasingly hard to find or expensive to produce—or both. While the timing of peak oil production remains subject to dispute, the faster consumption grows the sooner that landmark must arrive. Furthermore, in times of economic health, oil consumption reaches growth rates that the physical supply system can't match unless prices climb to levels that prove to be unsustainable. If nothing else, the geologic constraints that inform peak oil theory amplify this effect.

These observations should alarm no one. They define an evolution in the nature of supply within an expanding energy market. They do not require panicky political responses. They do highlight the importance of conservation, nonoil energy forms, and a regulatory environment in which adaptation receives guidance more from economics than from politics. ✦

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Texas tall tale provides metaphor for oil industry: a bouncing target

Sam Fletcher
Senior Writer

There's a Texas tall tale about legendary cowboy Pecos Bill who succumbed to his new bride's pleas to ride his wild mustang, Widowmaker—a one-man steed previously ridden only by Bill. Of course, the horse bucked her off, sending her flying cloud-high. She plummeted back to earth, landing on her bustle, and its spring-like metal frame bounced her even higher. So there she was, rebounding ever higher, falling ever lower until Bill finally had to shoot her so she wouldn't starve to death.

Sounds a lot like the oil industry,

where the front-month crude futures contract plunged to intraday lows just under $40/bbl on the New York Mercantile Exchange in early December from nearly $150/bbl in July. No one imagined at the start of 2008 that crude prices would shoot so high or fall so low. And it's impossible to guess now when—or how high—the market will rebound.

The global economy is a mess with the US, UK, Europe, and Japan simultaneously in recession for the first time since World War II. For 2009, Deutsche Bank analysts are predicting the worst economic performance among industrialized countries "since the Great Depression." They forecast global growth rising 1.2%—the lowest rate since the early 1980s—as economic problems spread to the emerging markets.

Some economists expect the economy to remain shaky beyond 2010, undermining energy demand. But optimists talk of a possible rebound in the second half of 2009 as energy supplies fall below projected demand levels.

Tightening supply

In the final months of 2008, markets were so focused on falling demand for oil that they ignored signs of tightening supply. On Dec. 17, OPEC members agreed to bundle their previously announced cuts of 500,000 b/d in September and 1.5 million b/d in October with another cut of 2.2 million b/d for a total reduction of 4.2 million b/d effective Jan. 1. The proposed 2.2 million b/d cut would be the largest single reduction by OPEC, surpassing a 1.795 million b/d cut in the spring of

About this report

In this special report, Oil & Gas Journal's General Interest editors write about their expectations for 2009. As members of OGJ's core news team, they write and edit nontechnical articles that appear on OGJ Online (www.ogj.com) and the PennEnergy portal (www.pennenergy.com), in the General Interest section of Oil & Gas Journal, and in eight daily, weekly, and monthly electronic newsletters.

1999. But even as OPEC members again promised to rein in production, front-month crude futures prices hit a new 4-year low on the New York Mercantile Exchange.

At that time, industry observers estimated OPEC had achieved only 60% compliance with the September and October cuts and doubted that members would do any better after Jan. 1. However, analysts speculated that 50% compliance would reduce OPEC production by 2 million b/d in 2009, while 75% compliance would take 3 million b/d off the market.

Meanwhile, low crude prices are wrecking the budgets of OPEC members, many of whom need more money to fund social programs and to expand exploration and development of new fields. So they have a major incentive to shut down enough production to raise prices—but perhaps not to the $75/bbl level that several OPEC members favor.

Analysts project a 400,000 b/d decline in non-OPEC production, but if low prices shut in stripper wells and disrupt stripping out natural gas liquids, the non-OPEC loss could be 1 million b/d. In the interim, the oil industry appears virtually "on strike," with decisions postponed, projects cancelled, and maintenance delayed. The US rig count is expected to drop 600 units in 2009. Low commodity prices may further undercut development of nonconventional resources such as oil sands. And there is always the risk of another Hurricane Ike or a political blowout in Africa, South America, or the Middle East

Meanwhile, there are signs that US motorists are reviving their driving. Although demand for gasoline is down from the comparable period a year ago, retail gasoline sales have increased with pump prices at a 58-month low in mid-December.

Gas production up

US gas production has increased since mid-2007 primarily because of key onshore plays such as the Barnett shale. US gas storage also is strong, so there is less chance of an escalation in gas prices absent a frigid winter and a sizzling summer to boost demand.

High energy prices in early 2008 renewed interest in energy conservation, but developed nations have been insulating buildings, expanding public transportation, and requiring more efficient appliances since the 1980s. Now it will take time and money to capture the last few percentage points of industrial pollution and to build a new fleet of higher-mileage and alternative-fueled vehicles along with the infrastructure to support them.

Among several wild cards in 2009 are the new US president and a Congress dominated by Democrats who were critical of oil and supportive of "green" energy during the 2008 campaign. After the grilling of oil industry executives over high prices last year, it's not yet clear whether Congress, like Pecos Bill, may shoot a few CEOs or just starve the industry. ✦

Oil and gas opportunities endure amid the many uncertainties of 2009

Judy R. Clark
Senior Associate Editor

While 2009 will be characterized by uncertainty, lower oil and gas prices, a hostile Congress, demand shrinkage, and major investment pullbacks by the global oil and gas industry, there also will be a number of positive developments and opportunities for the industry.

One point of encouragement is that President-elect Barack Obama no longer plans to seek a windfall profits tax on oil and gas companies as long as the price of oil remains below $80/bbl, according to an aide quoted by CNBC Dec. 2.

The funds were to be tagged as a rebate for American consumers when fuel costs were exceptionally high, unnecessary since the price dropped so dramatically.

Environmentalists will continue to push for taxes on the oil and gas industry, however, to pay for alternative energy initiatives, but that action is unlikely to be successful for two reasons:

• Obama's energy policy is hugging the National Petroleum Council's 2007 recommendations to the secretary of energy, which clearly conclude that fossil fuels will remain indispensable through 2030. Obama will seek to clean up emissions to protect the environment, but it would be counterproductive to hamstring the industry that must continue to invest heavily in exploration and production in order to provide the nation with oil and gas. In an interview for Fortune magazine in late June, Obama had said the single economic concern that most worried him was the "supply of energy."

• While Obama pays lip service to the mantra that the US "can't drill its way" out of the energy problem, he does say on his web site that he will "promote the responsible domestic production of oil and natural gas." He adds that his administration will "establish early identification of any infrastructure obstacles-shortages or possible federal permitting process delays to drilling in the Bakken shale formation, the Barnett shale formation, and the National Petroleum Reserve-Alaska." That bodes well for some companies in 2009.

He also says in his energy policy that he will give high priority to the building of the Alaska gas pipeline system and will work with Canadian and Alaska government officials, oil and

gas producers, and other stakeholders to facilitate its construction.

His agenda definitely includes development of alternative energy as well, and oil companies that have invested in such programs can profit from further developments.

Consumption decline

Energy consumption will drop in developed countries but continue to grow in developing nations whose national oil companies are supported by governments keen to maintain their countries' upward economic momentum. Their growth will be somewhat slower until tangent global economic crises fade, however. The US Energy Information Administration said global oil consumption in 2009 will decline by 450,000 b/d.

As companies postpone E&P projects because of lower oil prices, more rigs and services will become available to operators having funding in place and choosing to proceed. The greater availability of materials and services will alleviate shortages and lower E&P costs. It may take several months to see such cost results, but the active rig count already is dropping steadily in North America.

The industry has pulled through downturns many times in the past, and while the current recession will be more severe than many, several bankers surprisingly do not expect it to last beyond 2011 as governments pour trillions of stimulus dollars into global economies. ING expects that the US economy could return to growth as early as late 2009, while Credit Suisse predicts global growth holding off until 2011, and Deutsche Bank expects growth to bounce up in 2010.

One accomplishment that could help the US and its oil-gas industry in 2009 is the education of the American people about energy security.

The American Petroleum Institute and various industry speakers are conducting seminars and polling Americans, dispelling long-held myths that have led to legislation in conflict with the development of energy supply.

As people become better informed about what is required for the US to gain energy security, they will be better prepared to inform their representatives in Congress what is needed in 2009. ✦

US shale gas surge stimulating construction of processing plants

Leena Koottungal
Survey Editor/News Writer

Rising production of natural gas will stimulate construction of gas processing plants in the US this year.

Companies are focusing on expanding and building gas processing plants, with new capacity totaling 920 MMcfd to come online this year, according to Oil & Gas Journal's latest Worldwide Construction Update (OGJ Online, Subscriber Surveys, Nov. 17, 2008).

Unconventional gas

The boost in construction comes from increased gas production from shale gas plays such as Barnett in Texas, Haynesville in northwestern Louisiana and East Texas, and Marcellus in the Appalachian basin.

The Barnett shale has been the single biggest driver in US gas production growth, said Mark Papa, chairman and chief executive officer of EOG Resources at the Independent Petroleum Association of America's annual meeting Nov. 11 (OGJ, Nov. 17, 2008, p. 32). According to Papa, Barnett shale production is about 4.4 bcfd today, compared with 1 bcfd 4 years ago.

The Haynesville and Marcellus shales also are expected to increase US production. Chesapeake Energy Corp. believes Haynesville will become the largest discovery of natural gas in the US and the fourth largest in the world. Chesapeake currently is using 17 operated rigs to further develop its 480,000 net acres of Haynesville shale leasehold and anticipates operating 35 rigs by yearend 2009.

Chesapeake is also the largest leasehold owner in the Marcellus play, which spans an area extending from West Virginia to southern New York, with 1.8 million prospective net acres. It plans to increase its Marcellus drilling in 2009.

Construction projects

The first phase of Anadarko Petroleum Corp.'s Chapita gas processing plant in the Uinta basin of eastern Utah was completed at the end of 2007. The facility added 250 MMcfd of processing capacity, nearly doubling what was previously available in the basin. The company currently is expanding Chapita to 500 MMcfd with a planned start-up in first-quarter 2009. The plant could be further expanded to 750 MMcfd.

Williams is building a 450-MMcfd processing plant in western Colorado's Piceance basin, where the company has most of its gas production, reserves, and development activity. It will be in Rio Blanco County, Colo. Start-up is scheduled for third-quarter 2009.

In late 2007, MarkWest Energy Partners LP announced that it will invest $60 million to expand nearly all of its plants in the Appalachian region. The expansion includes replacing its existing Boldman and Cobb processing plants with cryogenic processing facilities. The work will increase the combined processing capacity at the two locations to 95 MMcfd from 75 MMcfd and will increase the production of natural gas liquids to over 180,000 gpd from 70,000 gpd. Completion is scheduled for early 2009.

In April, Enogex LLC, a subsidiary of OGE Energy Corp. announced it

will provide gas gathering, processing, and transportation services for Chesapeake in the Colony Granite Wash play in Custer and Washita counties in the Anadarko basin of western Oklahoma. To accommodate the expected production growth in the Colony Granite Wash area, Enogex plans to invest more than $55 million in a combination of additional gathering and transportation pipelines and a gas processing plant near Clinton, Okla. The plant is expected to be in service in 2009 and will process up to 120 MMcfd of gas.

Quicksilver Gas Resources LP signed a contract with Exterran Energy Solutions to construct a third gas processing plant with capacity of 125 MMcfd to serve Barnett shale gas producers in the Fort Worth basin of North Texas. The plant is expected to come online during the first quarter of 2009. ✦

US gives gas extra attention as output grows from shales

Paula Dittrick
Senior Staff Writer

US natural gas, particularly shale gas, will receive increasing attention in 2009 because crude oil is becoming increasingly difficult and expensive to find and produce.

Natural gas also is becoming more attractive for investors given worries about greenhouse gas emissions. Although the future direction of climate policy remains unclear, it's likely US President-elect Barack Obama will push for better energy efficiency and for lower GHG emissions.

Natural gas has an advantage among fossil fuels, pending the development of alternative energy, because of its low carbon-to-hydrogen ratio. Gas also appears to be a practical and perhaps one of the most immediate ways for the US to increase energy production.

The fastest growing gas production has come from shale plays through the advancement of horizontal drilling and hydraulic fracturing.

Barnett slowing

Now, the dynamics of the shale gas boom are evolving with a definite move toward emerging plays and gradually away from the first gas shale formation to widely receive attention—the Barnett shale in North Texas.

During 2008, companies slowed their Barnett shale drilling, creating the potential for declines in overall production starting in early 2009. Continued drilling cuts are likely, given the sluggish economy and price volatility.

Drilling in the Barnett will not come anywhere near to a halt, but well completions could slow to the point of stalling production growth there. Barclays Capital reports that the Barnett shale accounted for more than 5% of total Lower 48 gas production in 2007. This contrasts with nominal production from Barnett just 10 years ago.

Producers report that Barnett shale horizontal wells remain economical but that the proliferation of these wells is apt to slow during overall drilling spending constraints as companies reduce their budgets.

Emerging plays

The US contains more than 20 shale basins spread across that many states. Emerging plays include the Fayetteville shale of north-central Arkansas, the Haynesville shale of northwestern Louisiana, and the Marcellus shale in the Appalachians.

EOG Chairman and Chief Executive Officer Mark Papa calls horizontal drilling a "game changer" for US land operations. He notes that the technology is migrating to Canada, and EOG has expressed optimism about the potential of British Columbia's Horn River basin.

Papa expects that horizontal drilling and fracing techniques developed in the US eventually will be used in other parts of the world on similar shale deposits.

In the Fayetteville play, Chesapeake Energy Chief Executive Officer Aubrey McClendon wants to keep over 20 rigs busy despite the company's plans to reduce drilling elsewhere.

Chesapeake plans to trim the number of rigs running to 110-115 companywide by the first quarter of 2009. McClendon told listeners on a recent conference call that the Fayetteville shale region is one of the least expensive drilling areas in the nation.

Marcellus shale

In the Marcellus, Range Resources Corp. Chief Executive Officer John Pinkerton expects exploration to increase during 2009. Range, Exco-North Coast Energy, and Chesapeake are among active Marcellus operators.

The Marcellus is found under much of Ohio, West Virginia, Pennsylvania, and New York. It's a potentially rich supply close to New Jersey, New York, and New England that awaits investment in pipelines and processing plants.

One disadvantage for the Marcellus is that companies are sorting out permitting delays. The Pennsylvania Senate Majority Policy Committee held a public hearing on the subject in November.

Marcellus drilling is in its infancy, Ray Walker, junior vice-president of Range Resources Appalachia LLC, said at that hearing. He estimates 50-60 horizontal wells and about 200 vertical wells have been drilled in the Marcellus in 2 years.

"More than $2 billion has already been invested in Pennsylvania during the past year for lease acquisition and drilling," Walker said. "A similar amount may be invested in 2009, probably with less emphasis on lease

acquisition and more on drilling, which means more jobs and economic growth."

Walker and representatives of other oil companies asked Pennsylvania for a streamlined, predictable regulatory environment to make the Marcellus competitive with drilling opportunities in other states.

It seems likely that the Pennsylvania legislature will work to ensure development of the Marcellus shale. One issue of interest will be how permitting unfolds for water needed for fracing. ✦

Downturn will spur M&A activity as operators cut spending in '09

Steven Poruban
Senior Editor

What the oil and gas industry didn't see much of in 2008 was consolidation. The US economic crisis and falling oil and gas prices will change that in 2009.

The multibillion-dollar merger and acquisition (M&A) deals common during the late 1990s and early 2000s—the last major economic slump—became scarcer once oil and gas prices began steadily to climb in 2002.

M&A activity

Most notable M&A transactions initiated in 2008 in the US involved independents. Among the largest deals:

- Fort Worth independent XTO Energy Inc. in April snatched up 55,631 net acres of Fayetteville shale leasehold acreage, including producing properties, from Southwestern Energy Co. for $520 million (OGJ Online, Apr. 7, 2008). Later that month XTO acquired producing properties, pipeline, and leasehold acreage from Linn Energy LLC for $600 million (OGJ Online, Apr. 15, 2008).
- Stone Energy Corp., Lafayette, La., in May acquired and then merged with Bois d'Arc Energy Inc. of Houston in a cash-stock deal valued at $1.65 billion (OGJ Online, May 1, 2008).
- XTO in May purchased producing properties and undeveloped acreage in the Williston basin Bakken shale from privately held Headington Oil Co. LP of Dallas for $1.85 billion in a cash-stock deal (OGJ Online, May 28, 2008).
- XTO then made a move in June to acquire privately held Hunt Petroleum Corp., Dallas, for $4.2 billion in a cash-stock deal (OGJ Online, June 10, 2008).
- Plains Exploration & Production Co. agreed to acquire in July a 20% interest in Chesapeake Energy Corp.'s Jurassic Haynesville shale play leasehold for $1.65 billion in a new joint venture (OGJ Online, July 3, 2008).
- Quicksilver Resources Inc. entered into agreements with various private parties to acquire Barnett shale assets for $1.3 billion (OGJ Online, July 8, 2008).
- BP America and Chesapeake Energy established a joint venture in September after signing a letter of intent outlining BP's payment of $1.9 billion for a 25% interest in Chesapeake's Fayetteville shale assets (OGJ Online, Sept. 2, 2008).

As the economic crisis in the US continues to limit producers' abilities to borrow money and extend bank debt into the new year, executives will look to M&A as a way for their companies to survive. And if oil and gas prices remain at $50-60/bbl or below through much of 2009, companies that budgeted projects based on much higher commodity prices may become acquisition targets for larger, financially stronger firms.

Spending plans cut

Many operators are lowering their 2009 capital spending plans, proceeding with caution in an uncertain year.

A company not cutting spending is XTO Energy, which in November set its 2009 development budget at $3.3 billion, compared with the $2.6 billion of spending it planned for 2008. XTO also plans to spend an additional $500 million for midstream systems including pipelines and processing facilities.

The increased budget, XTO said, will "take advantage of organizational efficiencies and falling costs," which will benefit XTO with a projected 18% growth in production during 2009. ✦

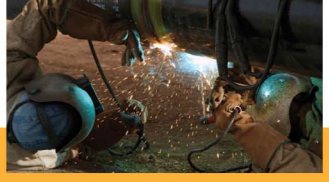
View from London: Price swings change industry on many fronts

Uchenna Izundu
International Editor

What a difference a year makes in the oil industry—or perhaps in this case 5 months.

In July, crude oil prices peaked at $147/bbl and at this writing had plummeted to below $40/bbl. Questions have switched from How high can they go? to What is the new floor? Oil exporting countries such as Nigeria are reporting plunges in revenue, which have major repercussions for investments in health, education, and infrastructure.

Who remembers that oil product prices based on $40/bbl crude was unacceptably high to consumers a few years ago? Now operators complain that prices that low are unsustainable

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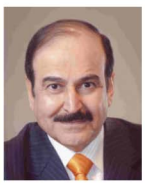

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because operating costs have risen and that $70-80/bbl is necessary if they are to develop unconventional hydrocarbon and deepwater resources.

Spending cuts

Companies in 2009 are likely to slash capital spending, drill fewer wells, and delay or cancel investment decisions. Several companies, such as StatoilHydro and Royal Dutch Shell PLC, have postponed Canadian heavy oil projects, for example, because of price volatility. The worrying consequence of this is underinvestment that will limit future supply and possibly produce another violent price cycle.

Distinguishing features of the current slowdown are the drying up of finance and the extreme volatility of oil and gas prices, both of which hamper financing of projects and operations.

Companies that survive will be those that control costs, focus on core businesses, and respond quickly to opportunities. Operators considered mergers and acquisitions too expensive when oil prices were high. Now, as commodity prices fall, independents such as Tullow Oil PLC, Dana Petroleum, and Cairn Energy will become targets for companies able to finance deals.

Many new companies on the Alternative Investment Market (AIM) in London, particularly those that concentrate on exploration and lack cash flow from production, could cease to exist by this time next year. Deal financing, however, is difficult.

Under the Ernst & Young Oil & Gas Eye Index, which tracks AIM companies on the basis of revenue and fund-raising activity, companies saw a 44% fall over the third quarter of 2008. This was the most severe quarterly fall since the index's inception in 2004.

European gas

Liberalization of gas markets in Europe continues to trouble companies, which complain about complexity and a lack of regulatory certainty. The European Commission's third package offered European Union governments the choice of full ownership unbundling or introduction of independent system operators for electricity and natural gas.

Competing objectives regarding security of supply and carbon reduction are issues for policymakers and operators, particularly as Europe's dependence on gas imports is likely to increase through its commitment to the EU trading system for carbon emissions.

In Europe, gas demand is falling due to the previous spate of high prices and the weak economic outlook. But the region also faces a potential of oversupply of gas with an unprecedented level of LNG projects coming on stream in the next 3 years, according to energy consultancy Wood Mackenzie. Between now and 2011, as much as 110 bcm of LNG will enter the market. Whether all planned projects come to fruition, however, remains uncertain.

During this weak economic period, relationships between national oil companies and the international majors will change. NOCs reduced their dependency on the IOCs during the period of high prices, but now many of them find themselves needing new participation from abroad. ✦

Lower E&P spending ends 6-year global rally

Sam Fletcher
Senior Writer

Global spending for exploration and production is expected to decline 12% to $400 billion in 2009—"a reversal after 6 years of global growth," said analysts at Barclays Capital Resources, New York.

Based on a semiannual survey of 357 oil and gas companies, Barclays Capital analysts said, "Budgets are being cut in response to the significant decline in commodity prices, constrained cash flow, and the tight credit markets." The surveyed companies based their 2009 budgets on average prices of $58/bbl for oil and $6.35/Mcf for gas. The most frequently cited prices that would trigger budget cuts were $50/bbl for West Texas Intermediate and $5/Mcf for natural gas on the Henry Hub, La., spot market.

"However, given the recent fall in prices, these price assumptions may prove to be overstated," analysts said. Among the surveyed companies, 74% said their E&P spending will be equal to or less than their total cash flow in 2009. Only 26% of the operators expect 2009 spending to exceed cash flow, compared with 43% in the prior year.

Barclays Capital analysts reported, "The sharpest decline in spending is expected to be in the US, where 2009 E&P expenditures are indicated to drop 26% to $79 billion," ending a 4-year upturn. They expect Canadian budgets to fall 23% to $22 billion in 2009, with reductions to be broad-based across all company budget sizes. Canadian capital spending has lagged behind the US and internationally over the past 2 years. However, analysts look for North American E&P spending to pick up in 2010.

"North American independents are highly sensitive to natural gas prices and cash flow, and adjust budgets quickly as industry conditions warrant. Many independent E&P firms were also outspending cash flow using debt, and credit market issues will likely limit this activity in 2009," analysts said.

Although gas prices remain the leading driver of 2009 E&P budget decisions, 49% of respondents listed oil prices among key determinants, an increase of 10%. Cash flow also ranked highly among respondents (at 48%), while the importance of prospect availability of those surveyed fell dramatically—to 23% from 45% last year.

"While the largest companies typically respond less quickly to changing industry conditions, given the severe nature of this correction, companies of all sizes are reacting with significant budget reductions," the financial firm reported. Of the 245 surveyed companies operating in the US, 62% plan to cut spending more than 10% in 2009. Just 13% plan to increase spending by 10% or more, while 25% anticipate spending to be flat.

Escalating oil and gas prices through mid-2008 funded a 22% increase in global E&P capital expenditures this year, up from projected increases of 20% in Barclays Capital's 2008 midyear survey and 11% at the start of this year.

Although 53% of those surveyed said US drilling economics look good for 2009 (up from 49% in the prior year), 8% of operators said domestic drilling economics are poor (up from 4% the prior year). Internationally, the percentage of operators who said drilling economics were either "good" or "excellent" for the coming year declined to 55% from 65% in 2008.

Most of the surveyed producers said well stimulation, including hydraulic fracturing, is the most important technology, overtaking 3D and 4D seismic, which slipped to No. 3. Horizontal drilling was No. 2. Also frequently mentioned were directional drilling, reservoir recovery optimization, and drill bit technology.

Company budgets

The larger companies estimated by Barclays Capital to have the greatest US budget cuts in 2009 include Chesapeake Energy (down 51%), Devon Energy (down 44%), EOG Resources (down 34%), Sandridge Energy (down 78%), Hess Corp. (down 62%), Anadarko Petroleum (down 32%), and ConocoPhillips (down 23%)—"all of which have budget cuts of at least $1 billion. No companies are making sizable additions to their budgets," analysts said. However, they look for North American E&P spending to pick up in 2010.

The larger companies with the greatest budget cuts in Canada are Husky Energy (down 47%), Devon Energy (down 71%), Talisman Energy (down 47%), EnCana (down 16%), Canadian Natural Resources (down 23%), ConocoPhillips (down 14%), Penn West Petroleum (down 20%), EOG Resources (down 50%), Nexen (down 47%), Royal Dutch/Shell (down 7%), Imperial Oil (down 13%), Murphy Oil (down 25%), Crew Energy (down 56%), and Apache (down 13%).

"Given the longer-term nature of international projects and the dominance of the majors and national oil companies, E&P capex budgets outside North America are showing more moderate declines—down 6% in 2009 to $300 billion … by the 100 companies in our survey. This would end a 9-year upturn," analysts said.

Budget trends are mixed internationally, with several companies expected to increase E&P spending in 2009. "The super majors have flattened their international E&P spending, with the big six estimated in the aggregate to have a decline of 2%. We forecast that BP is reducing spending by 4%, with Royal Dutch Shell and Total also anticipated cutting expenditures by 6% and 5%, respectively, while Chevron is estimated to maintain its 2008 budget into 2009. We believe that ConocoPhillips and ExxonMobil will likely boost expenditures by 5% and 3%, respectively," said Barclays Capital analysts.

"Independents based in North America invest the bulk of their capital in their home countries, but in recent years, these companies have shifted funds from domestic to international operations," analysts noted. "These companies are showing mixed plans for international investments in 2009, with some companies showing growth, but others are showing big cuts in expenditures leading to an overall 22% decline in spending."

Russian companies are making some of the biggest budget reductions after leading spending growth for several years. "Specifically, Lukoil is expected to reduce its 2009 capex by 50%, and Surgutneftegaz, Gazprom Neft, Rosneft, and TNK by 20–26%. Only Gazprom is expected to spend more in 2009 compared to 2008—up a modest 2%," the analysts reported. "We believe that pressure on cash flows, financial market issues, and disappointment over tax reform are all leading to the turnaround in Russia."

Among the largest companies in Latin America, Barclays Capital estimates Petroleum Co. of Trinidad & Tobago Ltd. (Petrotrin) will increase its budget 27% and Petroleos Mexicanos (Pemex) to be up "a modest 5% as spending in the Chicontepec and Cantarell areas is partially offset by a slowdown in Burgos and southern Mexico."

Budget declines are forecast for Pan American Energy (down 5%), Petroleos de Venezuela SA (PDVSA) (down 15%), and Petroleo Brasileiro SA (Petrobras) (down 6%). "Latin America on balance is forecast to be modestly lower," analysts said.

Average spending by nine surveyed companies in the Middle East-Africa region is expected to decline 2% in 2009. Company projections include Abu Dhabi National Oil Co. (up 22%), Kuwait Oil Co. (up 15%), National Oil Corp. (up 20%), Sonangol (up 3%), and Sonatrach (up 10%), offset by declines at Saudi Aramco (down 15%), Nigerian National Petroleum Corp. (down 13%), and Petroleum Development Oman (down 5%).

"European-based companies are taking a deep slice out of their 2009 E&P expenditures, with the top six companies in aggregate showing declines of 11%. All of these companies are showing declines, except for a flat budget for BG Group," analysts reported. "Trends for state-owned and international oil companies based in Asia are also mixed. Companies such as CNOOC (down 13%), Pertamina (down 11%), PTT E&P (down 16%), and Reliance Industries (down 15%) are showing budget cuts, while others are forecasting gains—Inpex (up 13%), ONGC (up 7%), and Petronas (up 10%)." ✦

CERA: 'Recession shock' shakes world oil market

Sam Fletcher
Senior Writer

The world oil market is being shaken by "a recession shock" that affects all conventional, alternative, and renewable energy," said the chairman of Cambridge Energy Research Associates (CERA).

In a report released at the London Energy Meeting in the UK, Daniel Yergin, also executive vice-president of the IHS information solutions group, said, "The oil price today is the barometer measuring a progressively weaker global economy."

Oil prices have been volatile "on an unprecedented scale" in 2008. "The oil price was driven to its oxygen-short heights last summer by the 'demand shock' that came from 5 years of strong economic growth and was fueled further by geopolitics, oil field costs, financial markets and trading, and psychology," said Yergin.

US demand for gasoline peaked in 2007 and was beginning to decline before the economic crisis broke, but "demand responses were discounted or ignored" in markets where oil is traded, he said. Nevertheless, demand decreased in the face of higher energy prices, "except in those parts of the world where retail fuel prices are controlled or subsidized," CERA reported. The analysts expect total US oil demand in 2008 to be at least 1 million b/d less than in 2007.

At the start of this year, some analysts estimated global demand growth as high as 2.1 million b/d. CERA's current global demand estimate for 2008 is a 300,000 b/d decline and for 2009, an additional 660,000 b/d drop. "The last time demand dropped this much was in the deep recession of 1981," it said.

Supply capacity

The report goes on to say that notwithstanding the weakness in oil demand and prices, oil supply capacity—the difference between total liquids production capacity and actual output—will expand as new supplies, already under development, come to market. That surplus in spare capacity will be a "defining factor" for the oil market," it said.

"Spare capacity will increase significantly in the next few years due to falling oil demand and as supply materializes from investments already under way," said Yergin. "As low as 1 million b/d in 2005 and 2.4 million b/d in 2008, it could reach 7-8 million b/d in 2010-12."

However, he said, "In the medium term, low prices and financial constraints will hinder new investment added. Consequently, as the economy picks up, spare capacity will start to erode and the oil market could begin to tighten again, in the reference case, by 2013, taking the world into a new cycle."

Yergin said, "Another era of strong global economic growth could also accelerate tightness. Conversely, if prices are supported at too high a level, long-term spare capacity will grow to levels that could result in a period of prolonged low oil prices." Among other key factors that the report notes is the potential impact from increased emphasis by governments on greater energy efficiency and alternative fuels.

Meanwhile, he said, "The fall in oil prices is a sort of de facto tax cut—an automatic stimulus package that does not need to be paid for from consumer nation public funds." Yergin said, "If one compares the average US gasoline price in July ($4.14/gal) with October ($2.26) on an annualized basis, the savings to American consumers are $282 billion."

The report concludes that occasional shocks to the global economy and volatility in the oil market are inevitable, but the extremes of price movements from peak to trough can be moderated. Volatility may be an unintended side effect of periods of "consensus about expected future oil prices," and such periods are characteristic of the industry worldwide.

Less future volatility

Greater transparency of market information and data about supply and demand, production and investment, and inventory levels represent key initiatives for limiting future volatility in prices and ensuring a more appropriate match over time between supply and demand—and thus the timely investment that the world economy will need once demand starts growing again.

The report was commissioned by the UK Department of Energy and Climate Change and Saudi Arabia's Ministry of Petroleum and Mineral Resources. The London Energy Meeting was convened by British Prime Minister Gordon Brown, bringing energy ministers and other leaders from around the world together for a summit on the global economy and oil markets. It follows a similar meeting in June at Jeddah, Saudi Arabia. ✦

Economy, season, other factors reduce rig count

Sam Fletcher
Senior Writer

US drilling fell for the fifth consecutive week, down by 26 rotary rigs to 1,764 still working during the week ended Dec. 19, compared with a rig count of 1,809 in the same period last year, said Baker Hughes Inc.

This was the lowest US rig count since Feb. 1 when 1,763 rigs were drilling. It also was the second consecutive week since Jan. 18 that the count fell below year-ago levels.

As usual, the biggest decline was in the biggest category, land rigs, down 28

to 1,688 still working. Inland water activity was unchanged with 9 active rigs. Offshore drilling increased by 2 rigs to 64 in the Gulf of Mexico and 67 in US offshore waters.

Seasonal impact

The Christmas holidays have always been "a reasonable excuse to lay down more rigs and give the crews time off," said analysts at Pritchard Capital Partners LLC, New Orleans. But this year, they said, "Given the economic crisis, the sharp decline in oil and gas prices, and sharply lower drilling activity forecasts, it may be timely to lay more rigs down and leave them down."

The analysts noted, "It's typical to see 10-15% seasonal rig count declines in December-January, but we are down 12% before normal seasonality kicks into high gear." Evidence from producers "seems overwhelming that they will be cutting back activity materially until service costs come down 15-20% or oil and gas prices recover to at least $60/bbl and $6/Mcf," they said.

Day rates falling

Analysts at Barclays Capital Resources, New York, said, "Day rates for jack up rigs in the Gulf of Mexico are falling quickly." They cited two recent contracts signed by Hercules Offshore Inc. for commodity rigs working with Chevron Corp. at rates 26% lower than their previous contracts. "These are the first in a series of lower day rates that will likely be revealed as the shallow water Gulf of Mexico corrects," the analysts said.

They reported, "The inland barge market is also getting more difficult. Utilization has declined, with several additional barges now stacked." In a separate report, analysts said, "Last month, 13 of Hercules' barges were working, with an average contract backlog of 21 days. Today, 8 barges are working, with an average contract backlog of 17 days."

Moreover, they said, "Activity levels and pricing for well service rigs are deteriorating at a rapid pace, and we expect this deterioration to continue into the first half of 2009. Rig hours are falling on a weekly basis due to both seasonal factors and reduced demand, and pricing has recently turned down."

In addition, they said, "There is a negative mix shift occurring in the well servicing market as higher-margin workover activity is being delayed while lower-margin maintenance activity continues. Well completions have been moving forward, however, providing well servicing operators with a backlog of completion work in the near term."

Barclays Capital analysts forecast 2009 global spending for exploration and production will contract 12% to $400 billion—"a reversal after 6 years of global growth." Based on a semiannual survey of 357 oil and gas companies, they said, "Budgets are being cut in response to the significant decline in commodity prices, constrained cash flow, and the tight credit markets."

US projections

Barclays Capital analysts continued, "The sharpest decline in spending is expected to be in the US, where 2009 E&P expenditures are indicated to drop 26% to $79 billion," ending a 4-year upturn. They expect Canadian budgets to drop 23% to $22 billion in 2009.

However, Barclays Capital expects North American E&P spending to pick up in 2010.

The surveyed companies based their 2009 budgets on average prices of $58/bbl for oil and $6.35/Mcf for gas. "However, given the recent fall in prices, these price assumptions may prove to be overstated," analysts said. ✦

Two bidders disrupt BLM lease sale in Utah

Nick Snow
Washington Editor

US Bureau of Land Management special agents detained two registered bidders after a Dec. 19 oil and gas lease sale in Utah was delayed briefly.

The sale was completed. Agents are investigating and coordinating with the US Attorney's office in Salt Lake City to determine whether the bidders broke federal laws by apparently trying to impede the bidding process, the Utah BLM office said in a statement.

Some groups had called for the sale's cancellation, saying the lease sale included tracts in and near areas that the groups said were previously protected.

One of the detained individuals, Tim DeChristopher, a University of Utah economics student and environmental activist, submitted $1.8 million of bogus bids.

"I don't want to have to look back at 2008 and know that there was still a slight chance that we could have done something to make a difference, and I didn't have that chance," he told the Salt Lake Tribune.

DeChristopher apparently showed up for the lease sale and received a bidding paddle after showing his driver's license, according to other media reports.

Federal regulations say bidding for oil and gas leases is open to any US citizen over 21, but successful bidders must accept and pay for what they acquire, a spokesman in BLM's Washington headquarters said.

A spokeswoman for the US Attorney's office in Salt Lake City confirmed that the matter has been brought to its attention.

"We are getting investigative reports from the BLM special agents that we will look at and determine if there were violations of federal law," she told OGJ on Dec. 23. "We have been in close contact and are discussing the situation. The process should take a couple of weeks."

2008 in review

Happy New Year! This year promises to be a challenging and exciting year for oil and gas in Washington. Before getting very far into it, however, let's take a look at some of 2008's more entertaining moments in government. We do this early each year with "Watchies," which get their name from this column.

The first of this year's citations, a "What Were They Thinking" Watchy, goes to employees of the US Minerals Management Service's royalty-in-kind program in Denver, who gave new meaning to the phrase "government service" in 2004-06.

Reports prepared for Department of the Interior Insp. Gen. Earl E. Devaney's investigation described instances where RIK employees helped representatives from producers prepare bids, held outside paying jobs while still on MMS's payroll, and promoted private enterprises within the office.

Devaney suggested that problems began when the program's administrators decided to adopt a "business model" approach under which RIK marketers began to act more as if they were part of the private sector, including "effectively opting out of the Ethics in Government Act." Other current and former MMS employees as well as members of Congress reacted with disgust to a situation an already controversial program simply didn't need.

Effective lawmakers

A second Watchy is shared by US Sen. Pete V. Domenici (R-NM) and Rep. John E. Peterson (R-Pa.) for their accomplishments before each retired at yearend 2008. Domenici, the top Republican on the Senate Energy and Natural Resources Committee, worked hard not only on the 2005 Energy Policy Act but also on the 2006 bill which opened significant new Gulf of Mexico acreage to leasing.

Despite not having a comparable leadership position in the House, Peterson kept bringing Outer Continental Shelf leasing bans to the foreground as oil and gas prices climbed. Gasoline prices breaking the $4/gal barrier last summer probably did more to sway public sentiment.

House Speaker Nancy Pelosi (D-Calif.) and Natural Resources Committee Chairman Nick J. Rahall (D-W. Va.) may have passed one of the most restrictive OCS access bills ever in response, but the moratoriums still expired on Sept. 30, a prospect inconceivable 3 years earlier to nearly everyone but Peterson.

A clear signal

Finally, an "Unmistakable Signal" Watchy goes to Tim DeChristopher, the University of Utah graduate student and environmental activist who disrupted the US Bureau of Land Management's Dec. 19 oil and gas lease sale in Salt Lake City by submitting $1.8 million of bids he had no intention of paying.

It's still not clear if BLM intends to prosecute, or if it can. The agency probably will require prospective bidders to do more than show a picture identification proving they're at least 21 years old at future sales.

But environmental organizations already have said they intend to press for more stringent oil and gas regulation. DeChristopher's stunt showed how far some individuals will go. Obama administration appointees will be hard-pressed to reach workable compromises. ✦

Utah's BLM office said 116 of the 131 offered parcels were sold, totaling 148,598 acres of federal land in Carbon, Duchesne, Emery, Garfield, Grand, San Juan, and Uintah counties. Revenues totaled more than $7.4 million, including $7.2 million in bonus bids, $222,951 in rental fees and $16,240 in administrative fees, it indicated.

Enduring Resources LLC of Denver submitted the highest total bid per acre ($270) and per tract ($592,640) on Parcel 137 containing nearly 2.2 million acres in the Vernal area, the Utah BLM office said.

Meanwhile, 58 US House Democrats sent a letter on Dec. 22 to President-elect Barack H. Obama's transition team urging the new administration to either halt leasing of federal land in Utah that have been proposed for wilderness designation or, in cases where leases have been issued already, to cancel them and refund what bidders have paid. ✦

Salazar to lead 'deeply troubled' Interior department

Nick Snow
Washington Editor

Barack Obama formally nominated US Sen. Ken Salazar (D-Colo.) on Dec. 17 to lead what the president-elect termed a "deeply troubled" Department of the Interior. He praised Salazar's ability to bring groups with opposing viewpoints together to reach solutions.

He also named former Iowa Gov. Tom Vilsack as agriculture secretary. "Tom understands that the solution to our energy crisis will be found not in oil fields abroad but in our farm fields at home," Obama noted and said the two men would "work with others to develop a new US energy economy that relies more on domestic alternative and renewable resources and less on foreign oil."

Saying he wants "a more proactive

Interior Department," Obama said Salazar has extensive experience on issues the new administration will confront in both traditional and new sources of energy.

"If there's going to be a debate about oil shale, I want Ken at the table," Obama said. Salazar has opposed efforts to lease western lands for oil shale development and in late September said that when Congress reconvened, he would try to extend a moratorium on the Bureau of Land Management's proposed oil shale regulations (OGJ Online, Sept. 26, 2008). He also has opposed drilling in the Arctic National Wildlife Refuge.

Oil, gas properly managed

Saying he would do everything he could to reduce US dependence on foreign oil and to develop "the new energy economy," Salazar said he also would ensure that traditional resources, including oil, gas, and coal are properly managed.

The presidents of two leading independent oil and gas producers' associations applauded Salazar's selection. "Sen. Salazar knows better than most the importance of the job he is about to take on," said Barry Russell of the Independent Petroleum Association of America in Washington. During Salazar's US Senate tenure, he demonstrated that he's willing to listen to all sides and viewpoints and find common ground on complicated and contentious energy issues, Russell added.

"He is also a life-long advocate of a multiuse approach to managing our public land and accessing safely the resources that lie beneath it. The livelihoods of thousands of independent oil and gas operators across the country remain inextricably linked to that access, and that's a point we intend to make early, often, and with purpose as this new administration begins to take shape," he said.

Marc W. Smith of the Independent Petroleum Association of Mountain States said the Denver-based organization had worked with Salazar for years and is confident that he views natural gas development in the area as an important long-term element in national and regional energy supplies.

"As a Westerner, Sen. Salazar knows that green jobs in the natural gas industry are important to state and local economies. Since many states increasingly look to gas to complement and enable renewable energy technologies, there is a strong rationale for consistent and responsible development on federal lands in the Intermountain West," Smith indicated.

Gas production from the region will become more important as Obama tries to carry out his campaign promises to make the country less dependent on foreign energy sources while reducing greenhouse gas emissions, Smith said. Ninety-seven percent of the gas the US consumes is produced domestically (with 27% coming from the West) and, since gas emits just over half the carbon dioxide of coal, it will become even more significant, he said.

Environmentalists

Western business leaders who commended Salazar's nomination decried attempts by some environmentalists to derail it. Although the group Earthworks applauds the nomination, some others—the Center for Biological Diversity, WildEarth Guardians, and Western Watersheds Project—want to derail it.

"Ken Salazar listens to all sides of an issue," said Roundtable executive director Britt Weygandt. "It's unfortunate that there are extremist groups in the West that don't admire that quality in our government leaders. We do."

Urging the senate to approve Salazar, Waygandt said, "We look forward to continuing to find areas of agreement with the Obama administration and particularly with our new secretary of the Interior on water, public lands, energy policy, and endangered species regulation," she said. "We know that we will get a fair hearing even on those issues where we disagree." ✦

BMI: US to see further oil, gas supply shortfalls

Eric Watkins
Oil Diplomacy Editor

Analyst Business Monitor International (BMI) predicts that the US will account for 89.87% of North American regional oil demand by 2012, while contributing 65.63% to its supply.

In North America, overall oil consumption reached 23 million b/d in 2007 and is set to increase to 23.04 million b/d by 2012, BMI said.

In 2007 North America also consumed 747 billion cu m (bcm) of natural gas, with demand of 826 bcm targeted for 2012—a 10.6% growth.

Production of 730 bcm in 2007 should rise to 733 bcm in 2012, which implies net imports rising to some 93 bcm by the end of the period.

The US share of North American gas consumption in 2007 was 87.42%, while it provided 74.82% of production. By 2012 US share of gas consumption is forecast to be 87.26% and production to be 74.35%.

Price increase over 1Q

In second-quarter 2008, BMI estimates that the OPEC basket price averaged just under $115/bbl—up 24% from the first quarter 2008 level.

The OPEC basket price exceeded $127/bbl on May 22, slipping back towards $121/bbl later in the month.

In June BMI assumed an average of around $120/bbl for a quarterly estimate of $114.98/bbl.

Estimated second-quarter average prices for the main marker blends are

Japan and China

Should anyone be concerned about the continuing rivalry between Japan and China over pursuit of the world's oil and gas? It may be well to remember some history.

It could be worth recalling that Japanese Prime Minister Eisaku Sato asked the US in 1965 to use its nuclear weapons against China in immediate retaliation in case the two Asian nations went to war against each other.

As it turned out, the Japanese request never had to be seriously contemplated by the US. But it shows, nonetheless, just how deeply Japan felt about China at the time. Of course, those feelings still run deep on both sides.

An example of that arose about a week ago when the two Asian rivals each decided to send warships to the Gulf of Aden in an effort to reduce the risk of attacks on oil shipping off the pirate-infested coast of Somalia.

Chinese set sail

Chinese warships set off on Dec. 26, 2008, on a mission to help combat piracy off the coast of Somalia, according to state media, with two destroyers and a supply vessel leaving from a port on the southern Chinese island of Hainan.

It marks the first time the Chinese navy has been deployed outside Asia on a military mission since the formation of the People's Republic of China in 1949, according to military officials quoted in state-run media.

China said the deployment is in response to United Nation's resolutions calling for tougher international action to tackle rampant piracy off the east African coast.

The Chinese fleet heading for Somalia and the Gulf of Aden will carry 800 crew, including 70 troops from the navy's special forces, the New China News agency said, quoting mission commander Rear-Adm. Du Jingchen.

"The fleet's warships will primarily safeguard vessels passing through the waters. The fleet's helicopters will be responsible for the fleet's own safety, material delivery as well as rescue tasks," said Du. "The fleet will protect and escort Chinese ships carrying strategic cargo such as crude oil."

Japanese to follow

The Chinese will protect only Chinese ships, right? The Japanese are, perhaps, not so sure. In fact, the day after the Chinese dispatched their fleet, the Japanese government began exploring ways to dispatch its Maritime Self-Defense Force (MSDF) ships.

A long-term antipiracy mission by the MSDF would be highly unusual and largely impracticable under current SDF law. To begin with, the law does not allow the MSDF to take action to protect the ships of foreign nations.

In a word, the Japanese will be protecting only Japanese ships.

Still, one wonders if there is room for mischance here. Is there any possibility that the two Asian rivals might tangle? And if that were the case, should the rest of the oil and gas industry be concerned?

That's merely a matter for theoretical speculation, of course. Still, one wonders. ✦

now $118.63 for Brent, $119.61 for West Texas Intermediate, and $115.89/bbl for Russian Urals (Mediterranean delivery).

"Our projections for 2008 as a whole have been revised upwards from the last quarterly report," the analyst said.

"We are now assuming an OPEC basket price average of $106/bbl for 2008, compared with the $81 estimate provided by our last quarterly report," BMI said.

Based on recent price differentials, this implies Brent at $109.71, WTI averaging $110.64/bbl, and Urals at $106.88/bbl.

BMI estimates that US real gross domestic product growth is at 1.2% for 2008, down from 2.2% in 2007.

"We are assuming an average annual 2.5% growth in 2008-12," it said. "Average US oil and liquids production is now estimated at 7.08 million b/d in 2008."

Projections for 2012

By 2012, BMI forecasts US oil-liquids output of 7.35 million b/d. Its estimate for 2008 US oil demand is now a lower 20.2 million b/d, because of the impact of higher prices on consumption.

"We now see US oil consumption hitting 20.71 million b/d by 2012," the analyst said. "This would require crude imports of 13.36 million b/d."

During 2007-18, BMI is forecasting that US oil production will increase 14.1% and output will peak at 7.92 million b/d in 2017.

Given that oil consumption is forecast to increase only 4.5%, imports ease from 13.82 million b/d in 2007 to 13.79 million b/d during the forecast period.

Gas production is expected to rise to 570 bcm in 2018 from the 2007 level of 546 bcm.

Demand is forecast to rise to 747 bcm from 653 bcm, requiring an increase of net imports to 177 bcm, in the form of pipeline volumes and LNG. ✦

Nongas-phase hydrocarbon sampling aids detection of seepage anomalies

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It has been established that subsurface hydrocarbon reservoirs leak and that escaping gases cause numerous detectable alteration anomalies.[1,2] The detection methods most often used require the capture and analysis of low molecular weight (C_1-C_5) gas phase hydrocarbons from near surface soils.[1]

Capturing soil gas hydrocarbons requires special sampling equipment and handling, does not allow for the proper integration of sampling at each location, and can be expensive to analyze. Methods are now available that directly detect hydrocarbons but do not require gas capture or special sampling tools, allow for adequate sample integration, and are competitively priced.

A previous article suggested that hydrocarbon analysis by ultraviolet-visible light spectroscopy offers an alternative to the capture and analysis of soil gas.[3] A similar outcome to the analysis of soil gas hydrocarbons is obtained by measuring the amount of light absorbed by soluble hydrocarbons found in altered soil organic matter (SOM).

This article discusses the nongas-phase hydrocarbon sampling method and gives an example of its use at Big Red oil field, Rice County, Kan. (Fig. 1).

Additional methods

Additional hydrocarbon detection methods have been developed that use just visible light. These measure the hydrocarbons extracted by an alkaline solvent and detect color changes related to the chemical reactions between analytical reagents and reactive hydrocarbon functional groups.

Advantages to these techniques are numerous. Variables that can affect soil gas methods are depth, moisture, temperature, and physical and chemical changes in the samples after acquisition. These variables are eliminated when using nongas-phase hydrocarbon techniques.

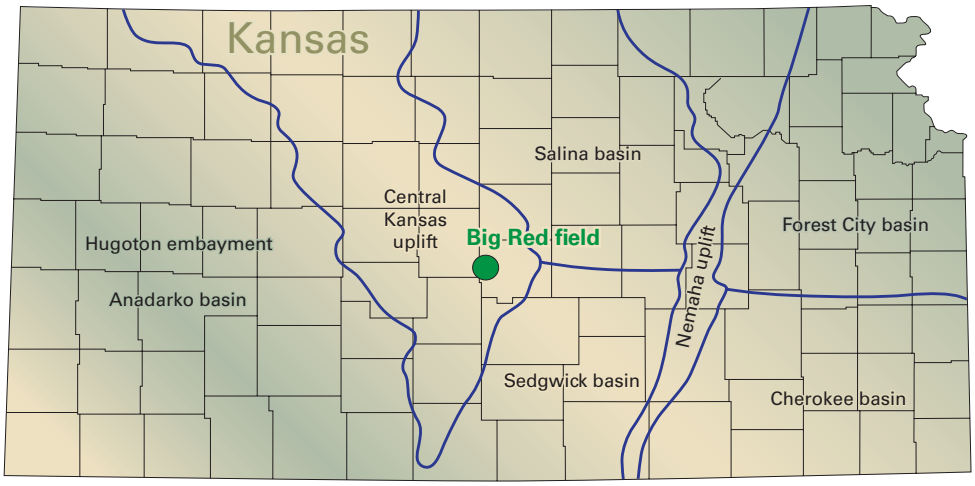
For instance, it is often suggested that samples be taken at depth to avoid hydrocarbons that have been degraded by oxidation. This requires special sampling equipment. Also, changes in the soil profile are not observed, and the sometimes extreme physical and chemical variations that can occur between sample locations may not be adequately addressed in the interpretation.

Taking the sample from the very near surface eliminates the need for auguring or special tools and allows for greater sample consistency.

Sechman and Dzieniewicz[4] cite the

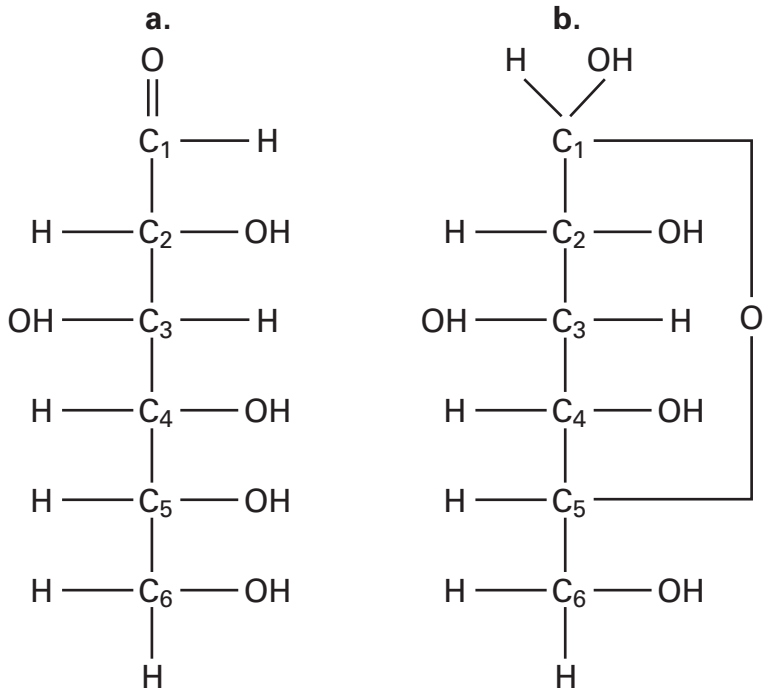
BIG RED (ARBUCKLE) FIELD, RICE COUNTY, KAN.

Fig. 1



RING SUGARS IN SOIL ORGANIC MATTER

Fig. 2



Open carbohydrate (monosaccharide) configuration showing the carbonyl group that reduces the CU(II) ion. b: Closed carbohydrate (monosaccharide) configuration showing the carboxyl group of a nonreducing sugar. These two configurations occur in equilibrium with each other as well as being able to alternate between configurations.

problems associated with soil moisture when sampling soil gas in dry and wet sediments and discuss the necessity of leveling such data. Drying and sieving soil samples prior to analysis alleviates the need for data leveling due to changes in moisture content and yields more consistent survey to survey comparisons.

Temperature changes can enhance or degrade the hydrocarbon gas signature. Putting the samples under stress while auguring can increase the hydrocarbon concentration by frictional heat, yielding an artificially high background.

Many methods require elevated temperature to separate the gas phase from the soil matrix which can alter the character of the analyzed hydrocarbons. Methods using the soluble hydrocarbon fraction of the soil organic material can be run at ambient temperature and without the need for thermal desorption. The salting out of gas phase headspace hydrocarbons due to excess inorganic salts in the soil sample is also avoided using nongas-phase hydrocarbon techniques.[5]

Sufficient long-term data on the use of the nongas-phase hydrocarbon methods is not available to determine whether reservoir depletion will affect the near surface alteration signature. Due to the degree of assimilation of the seeping hydrocarbons into the SOM, if there is a depletion signature, it will manifest at a slower rate than when measured using standard gas chromatography.

Detecting hydrocarbons

There is no doubt that measurable quantities of hydrocarbons are found in soil gas.

However, nongas-phase hydrocarbons associated with the alteration anomalies that occur as a result of chemical reactions between SOM and seeping oil and gas hydrocarbons can also be used as seepage indicators.

Soil is a dynamic and diverse self-regulating medium of complex biological activity and chemical reactions featuring the elements C, H, O, and N. Not being static, seeping hydrocarbons from oil and gas reservoirs have ample opportunity to interact with SOM and take part in these reactions. The interactions might take the form of condensation and addition reactions in the complexation of humic substances, electrostatic interactions with existing humic substances, or be a component in the integration of carbohydrates into the soil environment by soil biotic processes.

Humic substances are formed by a series of complex biotic and abiotic reactions in which a variety of organic compounds are resynthesized to form large complex polymers. Peripheral pores in the polymers are capable of accommodating organic chemicals in its lattice as a clathrate compound.[6,7] Typical components of humic substances are polysaccharides, fatty acids, polypeptides, lignins, and various combinations of benzene and aliphatic compounds. Humic substances are arbitrarily categorized based on solubility in water adjusted to different pH levels.[7]

Two physical condensation processes explain the production of humic substances. An amino acid reacts with a phenol derived from either the partial degradation of lignin or nonlignin carbon sources (possibly seeping hydrocarbons) used in microbial processes. These form aminoquinone intermediates, which can condense to form brown, nitrogenous humates.

The second pathway involves sugars reacting with an amino compound. The resulting addition compounds rearrange and fragment to form three intermediates (1) three carbon aldehydes and ketones, (2) reductones, and (3) furfuals. These intermediates react readily with amino compounds to form dark colored end products.[6,7]

In normally oxygenated soils, lignin may be broken down into low molecular weight products prior to humus synthesis. The products may be representative of the type seeping from reservoirs. Because these are condensation

and not polymerization reactions, no two resultant molecules are identical.

Overall structure is a function of pH, ionic strength, and chelated metals. It is assumed that a higher than normal concentration of hydrocarbons will result in greater soil humification.

Fulvic acid contains less carbon and more nitrogen and oxygen than humic acids, and while its structure is generally similar to that of humic acid it has a smaller proportion of aromatic units and greater number of peripheral aliphatic chains. Carboxyl functional groups appear to be more evident in fulvic acid than humic acid and are probably heavily substituted on the aliphatic chains.[8]

Hydrocarbon anomalies

Fulvic and humic acids regulate many of the processes associated with soil development, and these same processes are also associated with the development of near surface hydrocarbon alteration anomalies.

The processes include movement of halogens, fragmentation and integration of aliphatic and aromatic hydrocarbons, pH buffering, oxidation and reduction reactions, cation exchange capacity, carbonate deposition, and the presence and growth of soil flora and fauna.[9]

While carbohydrates are not part of the core humic substances of soil, they are the second most abundant organic component in SOM. Carbohydrates are also the most abundant class of organic compounds found in living organisms. They originate as products of photosynthesis and are a source of metabolic energy, both for plants and animals that depend on plants for food. Additionally, carbohydrates also make up cellulose, the structural material in plants. In soils, carbohydrates participate in aggregation.[14]

Carbohydrates are by definition polyhydroxy aldehydes, ketones, or substances that yield one of these compound by hydrolysis. Glucose and fructose are examples of an aldose and a ketose, respectively. Acid hydrolysis is usually employed to release the monosaccharides from polysaccharides. Hydrolysis by water releases monosaccharides from disaccharides.[10]

Many simple sugars can exist in a chain form or a ring form. The ring form is favored in aqueous solution, and the mechanism of ring formation is similar for most sugars. The glucose ring forms when the oxygen on carbon number 5 links with the carbon comprising the carbonyl group (carbon number 1) and transfers its hydrogen to the carbonyl oxygen to create a hydroxyl group (Fig. 2).

CORRELATIONS WITH VARIOUS INDEPENDENT GEOCHEMICAL TOOLS

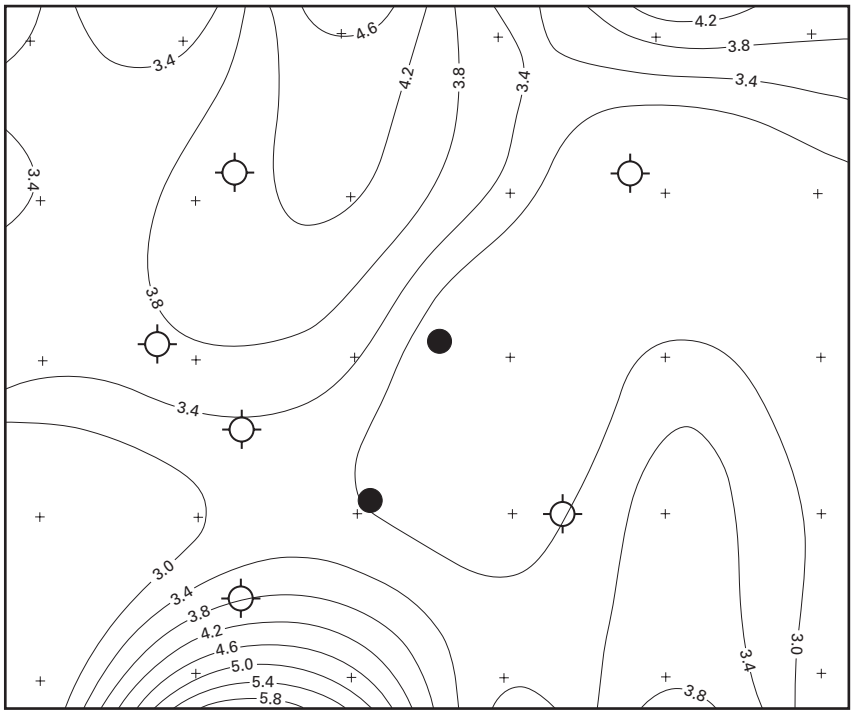
Fig. 3

Method	UV-Vis HC	Extracted HC	Reduced HC
Electromagnetics	+	–	–
Magnetic susceptibility	– –	–	+
Iodine	++	–	– –
Microbial	++	+	–
Carbonate analysis	++	– –	– –
Conductivity	++	– –	– –
++Strong positive correlation	+Weak positive correlation	–Weak negative correlation	– –Strong negative correlation

All three hydrocarbon methods are strongly correlated, positively and negatively, to carbonate concentration and ionic activity represented by conductivity. The strength of the correlations between the UV-Vis hydrocarbons and the other methods is related to the reactivity of the fulvic acids. The data are specific to the Big Red field analog, so trends may not be consistent with surveys from different locales, regions, or provinces.

UV-VIS HYDROCARBON ANALYSIS

Fig. 4



UV-Vis hydrocarbon results exhibit a well-defined halo. The two productive wells are within the hallow low encircled on at least three sides by the hydrocarbon highs. The dry holes are located within the halo highs. Wells in the halo highs have a higher probability of not being productive.

A reducing sugar is any sugar that, in basic solution, forms some aldehyde or ketone. Since sugars occur in a chain as well as a ring structure, it is possible to have an equilibrium between these two forms. When the aldehyde or ketone group is free (not linked to another sugar molecule), it is available for reducing Copper(II) ions. When a sugar is oxidized, its carbonyl group (aldehyde or ketone) is converted to a carboxyl group.

Carbohydrate levels depend largely on total organic matter content, so those factors that influence inputs of organic matter and rates of decomposition will also be those controlling total carbohydrate levels in soil.[11] As excess seepage hydrocarbons in near surface soils are integrated into SOM, they will be acted upon by the same factors. A portion of these will become reducing sugars.

The nongas-phase hydrocarbons discussed are related to the analysis of fulvic acids (UV-Vis hydrocarbon analysis), humic acids (extracted hydrocarbon analysis), and soil carbohydrates (reduced hydrocarbon analysis).

Big Red field analog

Nongas-phase hydrocarbon methods have been used over prospects and analog fields from Wyoming to Tennessee, Texas to Ohio.

The surveys range from small to large (30 to 1,000 samples) on 100-m to 200-m grids. The analog presented in the article is Big Red field in Rice County, Kan. (Fig. 1). Production is from Cambrian age Arbuckle dolomites at an average depth of 3,600 ft.[12]

It is a survey of moderate size consisting of 173 samples covering 2.5 sq miles on a 200-m grid. The examples will focus on the 30 samples around the Big Red-3 and Big Red-4 wells. The field was chosen as an analog due to availability of 3D seismic and the probability that additional wells would be drilled.

Postsurvey drilling has resulted in one dry hole and a producer.

The dry hole was drilled between two producing wells and within the halo of a weak to moderate geochemical anomaly. Geologically the structure was there, but the top 9 ft of the Arbuckle was tight, leaving a thin zone of reservoir quality rocks. Though oil was present, the show was uneconomic and the well was plugged and abandoned.

The second well was drilled in a moderate to strong geochemical anomaly. Pipe has been set in the Arbuckle, and the well is being equipped for production.

UV-Vis hydrocarbon analysis

Because they are soluble through a large pH range, water extracted altered fulvic acids (AFA) are placed in solution and measured using UV-Vis spectroscopy.

AFAs are located in the halo position due to preferential binding of calcium to the oxygen containing carboxylic and phenolic groups in fulvic acids. Forming Ca-humates renders AFAs resistant to further decomposition by enveloping them in a carbonate film. The complexes formed are predominately electrostatic in nature.[13] Calcium is the limiting factor in halo formation relative to the pervasive nature of CO_2 in the soil environment.

Analysis of AFAs by UV-Vis spectroscopy yields very high correlations when compared to hydrocarbon analysis by standard gas chromatography. Correlation coefficients of 0.96 have been obtained when comparing gas phase homologs to hydrocarbon absorbance values of UV-Vis spectra (Table 1). It is also possible to apply hydrocarbon characterization methods similar to those used for data acquired using gas chromatography.[3 14] The UV-Vis hydrocarbon analysis of the fulvic acid portion of the SOM yields the greatest number of correlations with other geochemical methods due to a large pH range and number of reactive functional groups (Fig. 3).

The map of the UV-Vis hydrocarbon analysis shows the two productive wells within the halo low and the dry holes located within the halo itself. This well-defined halo encompasses about

CORRELATION MATRIX*

Table 1

Wavelength	Methane	Ethane	Propane	N-Butane	N-Pentane	I-Butane	I-Pentane	Ethylene	Propene	Butene
NM_230	0.73462	0.89385	0.80497	0.86465	0.49558	0.34798	0.20730	0.69492	0.51680	0.69673
NM_240	0.78547	0.93462	0.88179	0.93002	0.58993	0.44596	0.29171	0.79330	0.64014	0.79148
NM_250	0.79172	0.94253	0.88696	0.93743	0.58651	0.44702	0.28639	0.80894	0.64808	0.80761
NM_260	0.80004	0.93779	0.88166	0.92915	0.56470	0.43135	0.27056	0.78914	0.61899	0.78690
NM_270	0.80294	0.92566	0.87351	0.91730	0.54768	0.42193	0.26395	0.76580	0.58813	0.76119
NM_280	0.80522	0.92483	0.87098	0.91501	0.53979	0.41589	0.25814	0.75776	0.57575	0.75462
NM_290	0.80752	0.92750	0.87049	0.91536	0.53431	0.40997	0.25053	0.75592	0.57195	0.75361
NM_300	0.80925	0.92418	0.86936	0.91242	0.52989	0.40934	0.24880	0.75467	0.57095	0.75112
NM_310	0.80907	0.92149	0.86315	0.90664	0.51657	0.39801	0.23735	0.74253	0.55489	0.74028
NM_320	0.80761	0.92179	0.86344	0.90811	0.51994	0.40005	0.24084	0.74136	0.55209	0.73897
NM_330	0.80890	0.91790	0.86455	0.90701	0.52091	0.40526	0.24531	0.74177	0.55483	0.73675
NM_340	0.80928	0.91598	0.86069	0.90182	0.51137	0.39721	0.23638	0.73791	0.55175	0.73438
NM_350	0.80879	0.91349	0.85846	0.89856	0.50728	0.39449	0.23309	0.73712	0.55184	0.73317

Hydrocarbon	Mean (ppm)	Minimum (ppm)	Maximum (ppm)
Methane	175	54.5	538
Ethane	11.2	3.9	40.5
Ethylene	76.9	45	129
Propane	15.4	4.0	44.7
Propene	136	60	211
I-Butane	10.2	1.4	39.0
N-Butane	6.8	1.7	24.6
Butene	94	32.6	171
I-Pentane	5.1	0.5	21.0
N-Pentane	3.3	1.4	8.4

*Of hydrocarbon homologs and UV-Vis hydrocarbons. Red numbers indicate significant positive correlations. The table on the left indicates high hydrocarbon concentrations. Methane, ethane, propane, n-butane, ethylene, and butene show correlation.

three-quarters of the seepage anomaly (Fig. 4).

Extracted hydrocarbon analysis

Altered humic acids (AHA) are soluble only at high pH and are therefore present in the high pH halo position of a seepage anomaly.

These are larger molecules containing more C and less O than fulvic acid. Due to structural similarities to fulvic acid, humic acid will follow many of the same physical and chemical models. The extracted hydrocarbon analysis (EHA) exhibits low to moderate correlation with other geochemical methods which may be related to the limited pH range (Fig. 3).

The map of the EHA shows the two productive wells centered inside the halo low and the dry holes located near or in the halo highs. As with the UV-Vis hydrocarbon halo, the EHA high values are present on at least three sides (Fig. 5).

Reduced hydrocarbon analysis

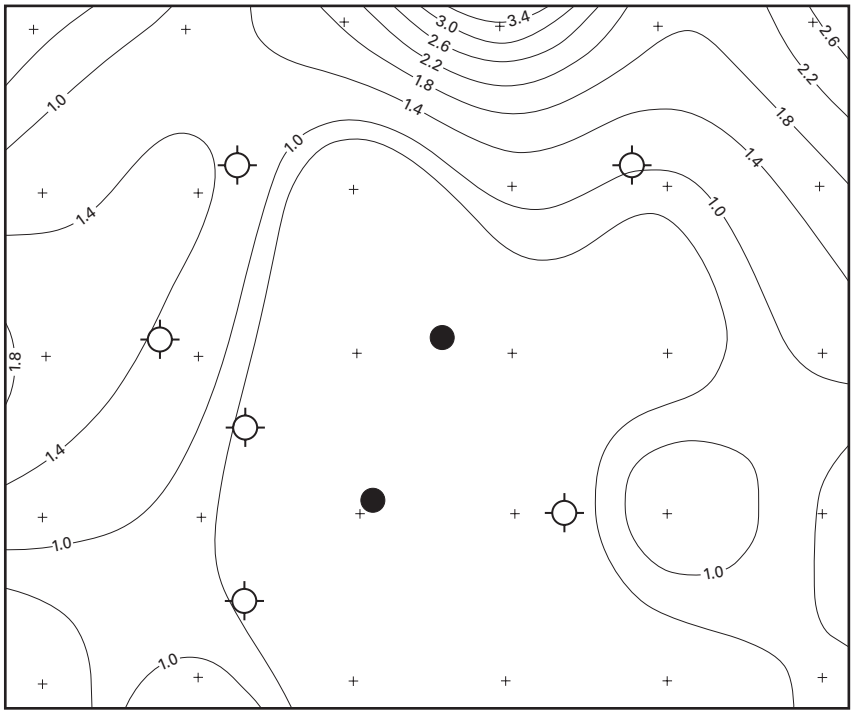
The monosaccharide portion of the SOM is water soluble and easily put into solution.

The open aldehydes and ketones are subsequently converted to carboxyls with the reduction of copper. The resulting colored solution is measured spectrophotometrically and an absorbance value is obtained. A high absorbance value is analogous to a high concentration. The RHA hydrocarbons exhibit low to moderate correlations related to the solubility differences between monosaccharides, disaccharides, and water insoluble polysaccharides (Fig. 3).

The map of the reduced hydrocarbon analysis (RHA) shows the two productive wells located on a narrow hydrocarbon high, or in an apical orientation, with the dry holes located in the hydrocarbon lows. Though not the normal configuration for geochemical anomalies, apical signatures do occasionally occur (Fig. 6).

EXTRACTED HYDROCARBON ANALYSIS

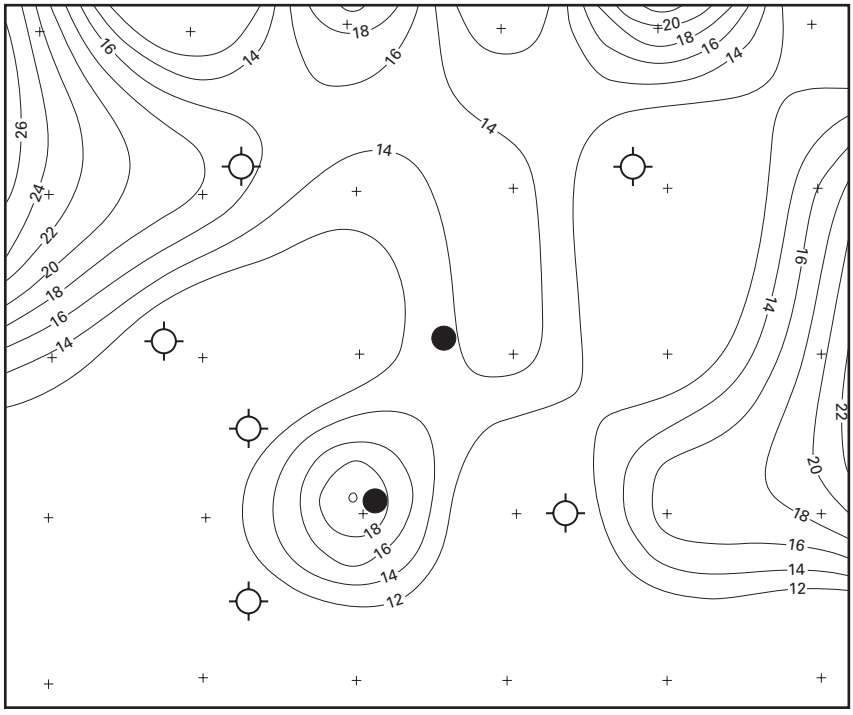
Fig. 5



EHA shows the two productive wells centered inside the halo low with the dry holes located near or in the halo highs. As with the UV-Vis halo, the EHA halo is present on at least three sides, yielding a well-defined anomaly.

REDUCED HYDROCARBON ANALYSIS

Fig. 6



Carbohydrate anomaly that appears to be in an apical position. The two productive wells are located on a narrow hydrocarbon high (apical anomaly) with the dry holes located in the hydrocarbon lows. Though not the normal configuration for geochemical surveys, apical anomalies do occasionally occur.

Overall advantages

Soil gas sampling for hydrocarbon detection has been a valuable exploration tool for many years, but with the advent of these new hydrocarbon detection methods the acquisition and analysis has become simpler and more cost effective. The advantages are:

- Sample depth, moisture content, and temperature increases at sample acquisition, sample preparation, and at the time of analysis, are variables that have been eliminated, resulting in more consistent survey to survey comparisons.
- A larger range of hydrocarbons is employed. Rather than using the standard homologous sequence provided by gas chromatography, a larger set of hydrocarbons with distinct characteristics can mapped and interpreted. AFAs provide concentration data over a range of wavelengths that can also be used to characterize anomalies. AHAs provide a look at the heavier ringed hydrocarbon, and the carbohydrates yield anomalous concentrations that occur with increased microbial activity that can be associated with hydrocarbon microseepage.
- The correlation of the UV-Vis, EHA, and RHA hydrocarbon methods with other geochemical tools is moderate to good. Analysis of AFAs by UV-Vis spectroscopy yields very high correlations when compared to hydrocarbon analysis by standard gas chromatography. Correlation is in part, related to pH range, number of reactive hydrocarbon functional groups, and hydrocarbon solubility.
- Sample cost is significantly reduced due to decreases in field time, operation and maintenance of extra field vehicles, and special handling of samples. In the laboratory samples can be processed more rapidly by spectroscopy, eliminating the long elution times of standard gas chromatography.

Acknowledgments

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References

1. Abrams, Michael A., "Significance of hydrocarbon seepage relative to petroleum generation and entrapment," Marine and Petroleum Geology, Vol. 22, 2005, pp. 457-477.

2. Schumacher, Dietmar, "Hydrocarbon induced alteration of soils and sediments," in "Hydrocarbon Migration and Its Near Surface Expression," Shumacher, D., and Abrams, M.A., eds., AAPG Memoir 66, 1996, pp. 71-89.

3. Fausnaugh, J.M., "Method is alternative to soil gas for detecting seepage anomalies," OGJ, May 19, 2008, pp. 37-42.

4. Sechman, Henryk, and Dzieniewicz, M., "Influence of soil moisture on the results of surface geochemical surveys applied to petroleum exploration," Journal of Petroleum Science and Engineering, Vol. 56, 2007, No. 4, pp. 267-282.

5. Fausnaugh, J.M., "The effect of high soil conductivity on headspace gas sampling techniques," APGE Bull., Vol. 5, No. 1, 1989, pp. 96-115.

6. Paul, E.A., and Clark, F.E., "Soil Microbiology and Biochemistry," Academic Press Inc., 1989.

7. Pettit, Robert, "Organic matter, humus, humate, humic acid, fulvic acid, and humin: Their importance in soil fertility and plant health," http://www.humate.info, CTI Research, 2007.

8. Cresser, Malcolm, Killham, Ken, and Edwards, Tony, "Soil Chemistry and its Application," Cambridge Environmental Chemistry Series (No. 5), Cambridge University Press, 1993.

9. Allard, B., Boren, H., and Grimval, A., eds., "Humic Substances in the Aquatic and Terrestrial Environment," Lecture Notes in Earth Sciences, Springer-Verlag, 1991.

10. Sposito, G., "The Chemistry of Soils," Oxford University Press, 1989.

11. Schnitzer, M., and Khan, S.U., "Soil Organic Matter," Developments in Soil Science 8, Elsevier Scientific Publishing Co., 1978.

12. Higley, D., "Cambridge Arch/Central Kansas Uplift Province," National Oil and Gas Assessment of 1995, http://geo-nsdi.er.usgs.gov/catalog/.

13. Schaetzl, R., and Anderson, S., "Soils: Genesis and Geomorphology," Cambridge University Press, 2005.

14. Fausnaugh, J.M., "Techniques characterize reservoirs," American Oil & Gas Reporter, Vol. 39, No. 12, 1996, pp. 75-82.

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Madagascar

Niko Resources Inc., Calgary, took a farmout from Enermad Corp., Calgary, on the 4.1 million acre Grand Prix block in the Mozambique Channel in Madagascar's Morondava basin.

Niko will become operator and fund 100% of multiyear exploration to earn a 75% interest. Work will start with a multibeam bathymetric survey in mid-2009 and later a 3,000 sq km 3D seismic survey. The rest of the commitment will go for exploratory drilling.

The partnership ran a 31,000 line-km aeromagnetic survey in mid-2008 and is reprocessing 7,600 line-km of 2D seismic.

The block extends from tidal high-water mark to more than 1,500 m of water and is downdip of the Bemolanga and Tsimiroro multibillion barrel heavy oil deposits.

China's low-permeability gas resources await development

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China has large volumes of low-permeability natural gas resources with unique characteristics that could be exploited with appropriate technologies. At present, lack of development and management technologies has hindered effective exploitation of these resources.

The low-permeability gas resources are distributed widely in the Ordos, Sichuan, Tarim basins, as well in other basins.

Resource estimates

In China, exploration efforts to date have yielded the discovery of more than 30 large and medium-sized, low-permeability gas reservoirs. Proved reserves are greater than 2 trillion cu m (about 70.6 tcf), accounting for more than half the total proved natural gas reserves in China.[1]

In Ordos basin, five large-scale low-permeability gas fields (Sulige, Daniudi, Jingbian, Yulin, and Wushenqi) have proved reserves of more than 100 billion cu m each (see table). Xinchang and Luodai are two large-scale, low-permeability gas fields discovered in Sichuan basin.[2]

The latest national oil and gas resource evaluation (NOGRE) released in August 2008 shows that China has 56 trillion cu m of prospective natural gas resources, 35 trillion cu m of geological resources (including proved reserves and reserves not yet proved but that could be produced with current technology), and 22 trillion cu m of recoverable resources.[3]

By applying a 20/80 rule,[4] our rough estimate is that the low-permeability portions of these resources are 44.8 trillion cu m, 28 trillion cu m, and 17.6 trillion cu m, respectively.

Fig. 1 shows the resource triangular for natural gas in China. In 2007, low-permeability gas production was more than 20% of all natural gas produced in China. Gas production in China during 2007 was 69.3 billion cu m, of which 13.9 billion cu m was from low-permeability reservoirs.[5]

Low-permeability gas resources in China have unique characteristics in geology, development, and economics. Understanding these characteristics is essential for determining the best technical and economic strategies for successful exploitation.

Resource characteristics

Most low-permeability gas reservoirs in China have a sedimentary facies and include fluvial, delta, or volcanic rock.

The physical property and distribution of reservoirs are the most important geological factors influencing development of low-permeability gas reservoirs. Pores and fractures in low permeability reservoirs always have irregular distribution and are poorly connected by very narrow capillaries.

Fig. 2 compares the microscopic sections of high permeability and low-permeability sandstone.

Geological characteristics of low-permeability gas reservoirs in China include low porosity, deep depth, thin reservoirs, and much heterogeneity.[6]

Due to the geological characteristics mentioned previously, the low-permeability gas reservoirs in China are characterized as followed:

- Well production capacity generally is low and distributed unevenly.
- Producing pressure drop is always large for stabilized production.
- Maintenance of stable production

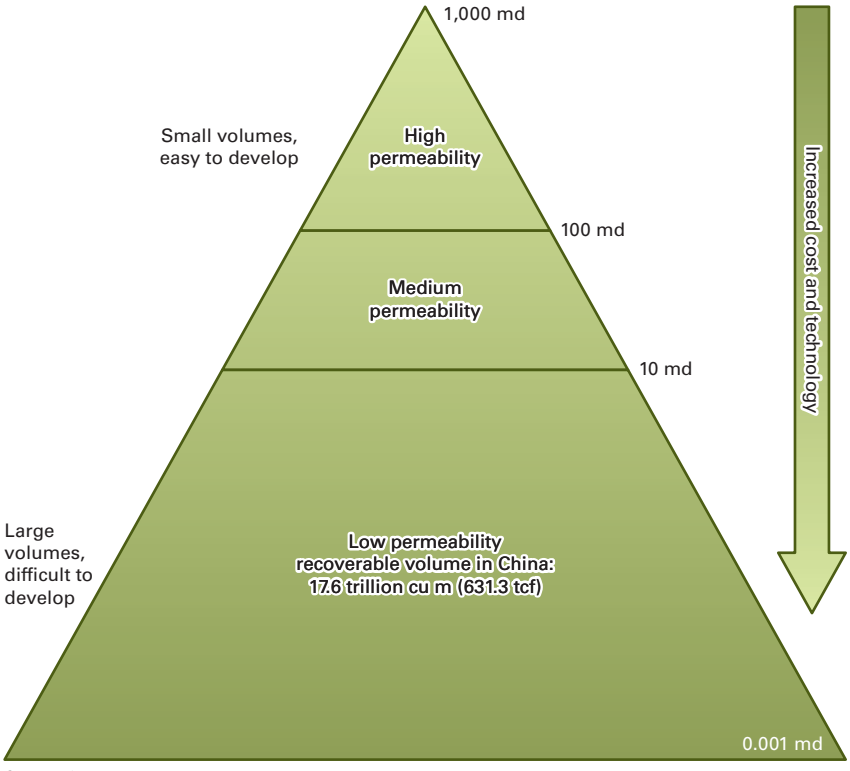
MAJOR LOW-PERMEABILITY GAS FIELDS

Field	Proved reserves, billion cu m	Year reserves updated	Average permeability, md	Basin
Sulige	1,100.0	2008	0.50	Ordos
Daniudi	261.6	2004	0.196	Ordos
Jingbian	291.0	2000	3.50	Ordos
Yulin	112.6	1999	8.00	Ordos
Wushenqi	101.2	2002	1.12	Ordos
Xinchang	65.2	2004	0.177	Sichuan
Luodai	38.0	2004	0.40	Sichuan

Source: Reference 2 and pubic data

RESOURCE TRIANGLE

Fig. 1



Source: After Holditch

is difficult because reservoir pressure declines quickly.[7]

Development of a low-permeability gas reservoir depends on its economic viability. These projects are often marginally economic, have long payback periods, and have risks that derive from the uncertainty from such factors as resource quantity, geological conditions, technology, and gas price.

Key technologies

During recent decades, technology has played an important and crucial role in producing these gas resources. With advanced and compatible key technologies, China's low-permeability natural gas resource can be developed effectively and economically.

An important factor for developing these resources is reservoir characterization for quantifying fracture systems and their variability.[8] This information along with other data can identify the prospective reservoir areas, reduce risks, and improve the viability of low-permeability reservoirs development projects.

Because of their complex geological characteristics, it is difficult for engineers to obtain an objective and systematical understanding of low-permeability gas reservoirs. Detailed reservoir characterization technology, however, can reveal such properties as flow distribution, fracture network distribution, water and gas distribution, reservoir connectivity, and sequence division to help engineers understand better and optimize gas field development programs.[9]

With this information, engineers can determine sweet spots in low-permeability reservoirs for prioritizing development.

Reservoir characterization has played an important role in developing Sulige gas field, at this time the largest low-permeability gas field in China.

Low-cost and efficient drilling technology tailored for low-permeability reservoirs is indispensable for successful development.

Horizontal drilling has helped oil and gas field development in North America. For low-permeability reservoirs, horizontal drilling increases well productivity and improves recovery factors because of a larger drainage area. The technology also reduces the number of production wells needed and the cost per unit of produced gas.[10]

Currently in China, the cost of drilling a horizontal well nearly equals the cost of drilling a conventional vertical well. The production from a horizontal well, however, is several times more than from a conventional vertical well.

During the past decade, Chinese oil and gas companies have accumulated experiences in applying horizontal drilling in Ordos basin low-permeability gas fields.

Underbalanced drilling also is becoming common for developing low-permeability oil and gas fields in the world. Underbalanced drilling can reduce reservoir formation damage and increase gas recovery. At the same time, it can increase the bit penetration rate, shorten the drilling cycle, and reduce drilling costs. Both horizontal and multilateral drilling hold promise for drilling more cost-effective wells.[11]

The overall level of underbalanced drilling technology in China lags behind that of the world. The technology has been successfully tested in Sulige gas field, and it is believed that the technology will be used widely in development of low-permeability gas fields in China.

Slimhole drilling technology is another low-cost and efficient technology tailored for low-permeability reservoirs. Worldwide experiences on the application of slimhole drilling technology in Europe and the US show that it can reduce drilling costs. Compared to conventional drilling, slimhole drilling can lower drilling costs by 20% on average.

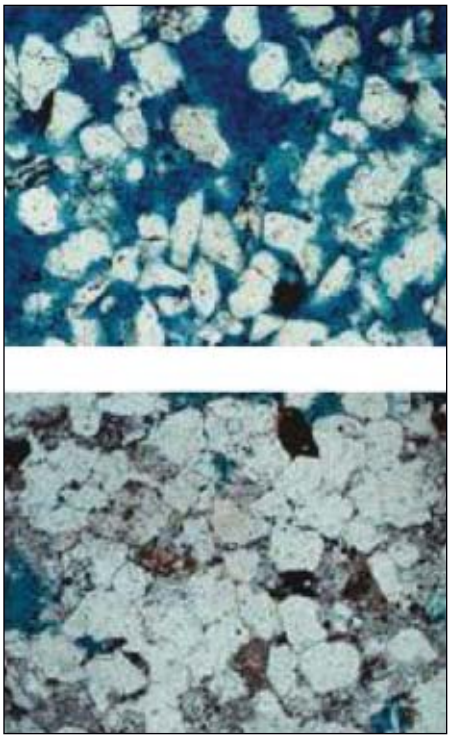
If the gas fields are in remote areas or areas where the natural environment is poor or the transportation is inconvenient, slimhole drilling can reduce

drilling cost by up to 50-70%.[12]

Economic production of natural gas from low-permeability reservoirs requires reservoir stimulation, such as hydraulic fracturing, to obtain adequate producing rates.[13,14] In China, fields that have hydraulic fractured wells include Bajiaochang, Xinchang, and Luodai gas fields in the Sichuan basin and Sulige, and Daniudi gas fields in the Ordos basin.

Operators also have applied high-energy gas fracturing in developing the tight sandstone gas reservoirs in west of Sichuan.[15]

Overall, Chinese oil and gas companies have mastered a variety of effective reservoir stimulation technologies; however, a gap with the world's advanced technology still exists. In particular, key equipment and assorted technologies for fracturing need improvements before development of many low-permeability reservoirs can proceed. ✦



The microscopic sections show the difference in high permeability (top photo) and low-permeability (bottom photo) sandstones (Fig. 2). Photo from US Department of Energy National Energy Technology Laboratory.

References

1. Dong Zhenzhen, et al., "A discussion on the boundary of low-permeability gas field capacity-building investment," Natural Gas Technology Journal (Translated from Chinese), Vol. 2, No. 2, 2008, pp. 76-77.

2. Dai Jinxing, et al., "The geochemical features of natural gas fields with reserves more than one hundred billion cubic meters in China," Petroleum Exploration and Development Journal (Translated from Chinese), Vol. 32, No. 4, 2005, pp. 16-17.

3. http://www.sinooilgas.com/NewsShow.asp?NewsID=10639.

4. Stephen A. Holditch, "Tight Gas Sands," JPT, Vol. 58, No. 6, 2006, pp. 83-96.

5. BP Statistical Review of World Energy 2008, http://www.bp.com/statisticalreview.

6. Gu Li, et al., "A discussion on geologic features and genesis of low-efficiency gas reservoirs," Oil & Gas Geology Journal (Translated from Chinese), Vol. 25, No. 5, 2004, pp. 577-80.

7. Wu Zhijun and He Shunli, "A discussion on the geologic characteristics and offtake strategy of low permeability sandstone gas reservoirs," Drilling & Production Technology Journal (Translated from Chinese), Vol. 27, No. 4, 2004, pp.103-04.

8. Jenkins, C.D., "Technology: catalyst for coalgas growth," Paper No. SPE 87358, SPE Applied Technology Workshop on Coal Bed Gas Resources of Utah, Salt Lake City, Oct. 24-25, 2003.

9. Yuan Shiyi, Hu Yongle, and Luo Kai, "State of the art, challenges and countermeasures of natural gas development in China," Petroleum Exploration and Development Journal (Translated from Chinese), Vol. 32, No. 6, 2005, pp. 1-6.

10. Chen Zhiyong and Ju Mancheng, "Research and application of horizontal drilling techniques in Sulige gas field," Natural Gas Industry Journal (Translated from Chinese), Vol. 22, No. 6, 2002, pp. 65-67.

11. Wang Haige, et al., "Using underbalanced drilling technology to economically develop low permeability Reservoirs," Drilling & Production Technology Journal (Translated from Chinese), Vol. 24, No. 3, 2001, pp. 1-3.

12. Ju Mancheng, Chen Zhiyong, and Ouyang Yong, "Application of slim hole drilling techniques in Sulige gas field," Natural Gas Industry Journal (Translated from Chinese), Vol. 25, No. 4, 2005, pp. 74-76.

13. Zhang Ningsheng, "Key production technologies of low-permeability gas reservoirs and their development trend," Natural Gas Industry Journal (Translated from Chinese), Vol. 26, No. 12, 2006, pp. 38-41.

14. Ammer, J.R., et al., "Technology for Increased Production from Low-Permeability Gas Reservoirs: An Overview of U.S. DOE's Gas Program—Successes and Future Plans," Paper No. SPE 60310, SPE Rocky Mountain Regional Low-Permeability Reservoirs Symposium and Exhibition, Denver, Mar. 12-15, 2000.

15. Kang Yili and Luo Pingya, "Current status and prospect of key techniques for exploration and production of tight sandstone gas reservoirs in China," Petroleum Exploration and Development Journal (Translated from Chinese), Vol. 34, No. 2, 2007, pp. 242-43.

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Modeling optimizes casing points in Persian Gulf wells

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GENERAL STRATIGRAPHIC COLUMN

Fig. 1

Qatar/Emirates, stratigraphic names				Iranian stratigraphic nomenclature now in use	
Period	Epoch	Group	Formation/member	Group	Formation/member
Tertiary	Olig-Miocene	Fars		Fars group	Recent Sedim/Bakhtiyari
					Aghajari
					Mishan
					Gachsaran
		Asmari			Asmari
	Eocene	Dammam			Jahrum
		Rus			Sachun
		Umm Er Radhuma			Pabdeh
Oretaceous	Upper	Aruma group	Simsima		Gurpi
			Shargi		
			Halul	Bangestan group	Ilam
			Laffan		Laffan
	Middle	Wasia group	Mishrif		Sarvak
			Khatiyah		
			Nahr Umr		Kazhdumi
	Lower	Thamama group	Shuaiba	Khami group	Dariyan
			Hawar		
			Khariab		Gadvan
			Yamama		Fahliyan
			Sulaiy		
Jurassic	Upper Jurassic		Hith		Hith
			Arab A, B, C		Surmeh
			Darb (Arab D)		
			Diyab		
		Areaj	Upper Araej		
			Uwainat		
	M. J.		Lower Araej		
			Izharu		
	L. J.		Neyriz		Neyriz
Triassic			Gulailah	Kazerun group	Dashtak
			Khail		
			Sudair		
					Aghar shale
					Kangan
Permian			Khuff	Dehram group	Upper Dalan
					Nar Mem
					Lower Dalan
			Pre Khuff		Faraghan

Researchers modeled casing-point setting depths in National Iranian Oil Co.'s RSH field using various tools and scenarios to save as much as 15%.

RSH field is in the central Persian Gulf, to the east of the Qatar/Fars Arch. The RSH structure, although not affiliated prominently with salt, lies where salt tectonics dominates development of structures,

many of which have major oil and gas accumulations.

Qatar/Fars Arch divides the Persian Gulf Precambrian salt basin into northern and southern salt basins. The RSH structure is in the southern basin, which has more eminent exposed salt plugs as the Persian Gulf Islands, and many unexposed plugs and swells that have formed four-way dip closures suitable for hydrocarbon entrapment.

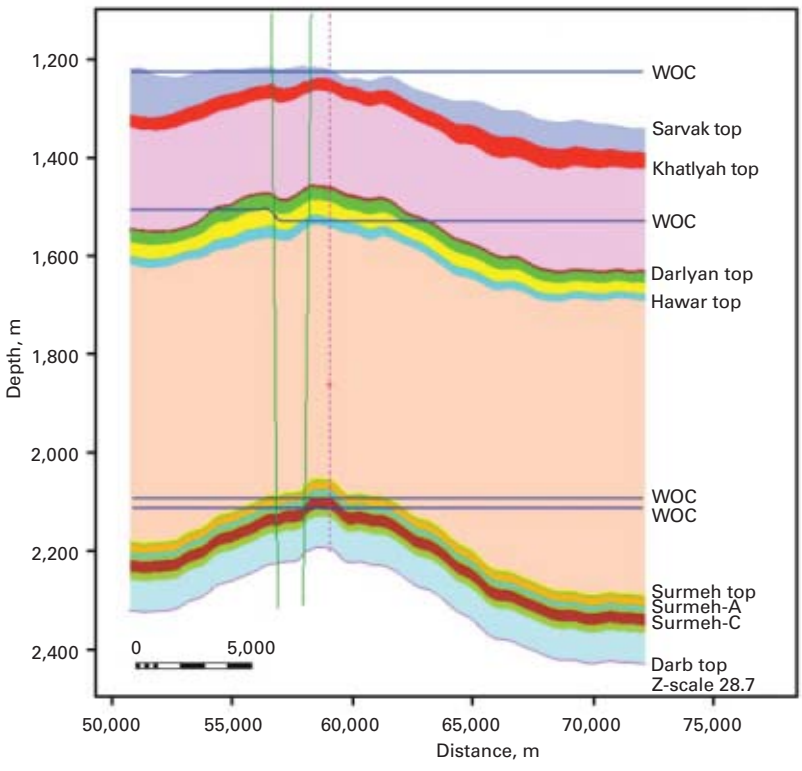
General stratigraphy

The following is a brief description of the general geological sequences encountered in a typical RSH well, as shown in Fig. 1:

• *Sarvak (Mishrif) formation.* The Sarvak formation is a limestone. Some cherty limestone beds may also be present in the middle parts of the sequence. The Mishrif member of the Sarvak formation constitutes a major oil-producing reservoir in the RSH field. The "Sarvak

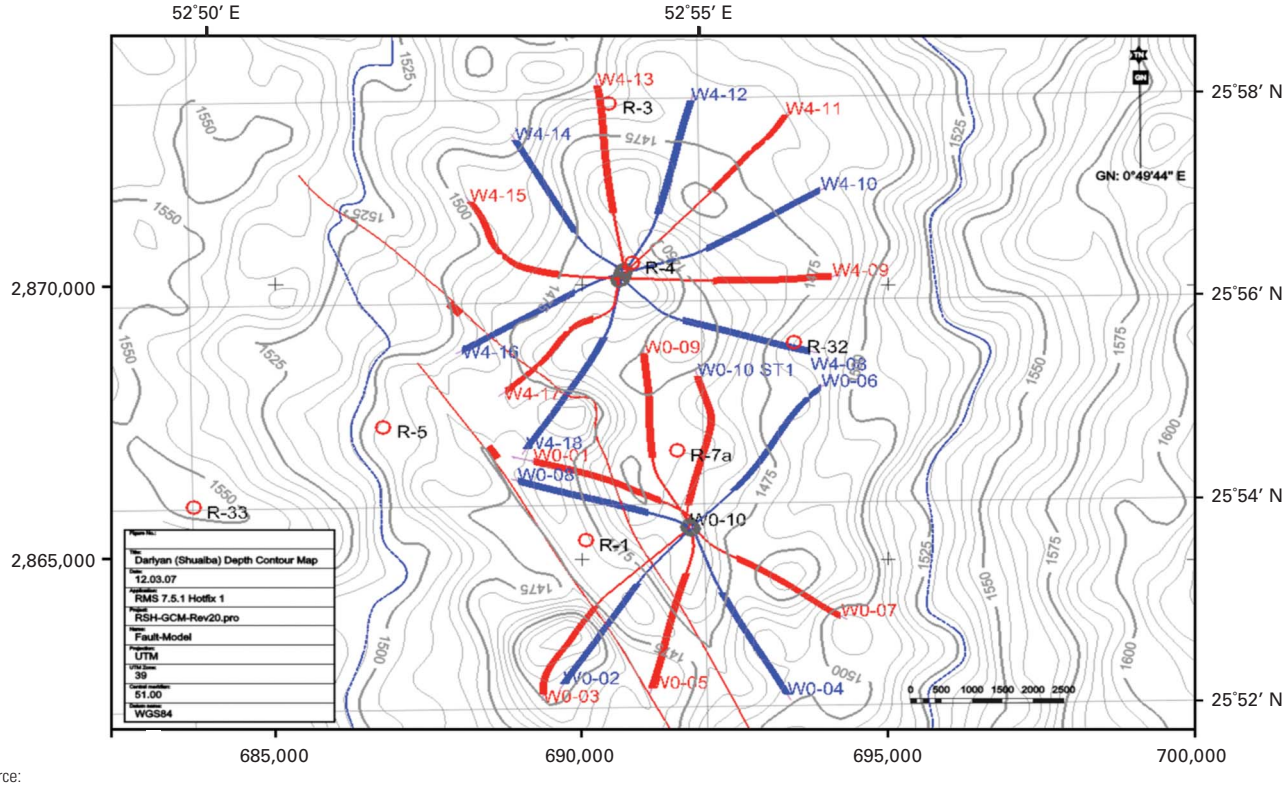
Typical east-west cross-section, RSH oil field

Fig. 2



Plan view, RSH oil field

Fig. 3



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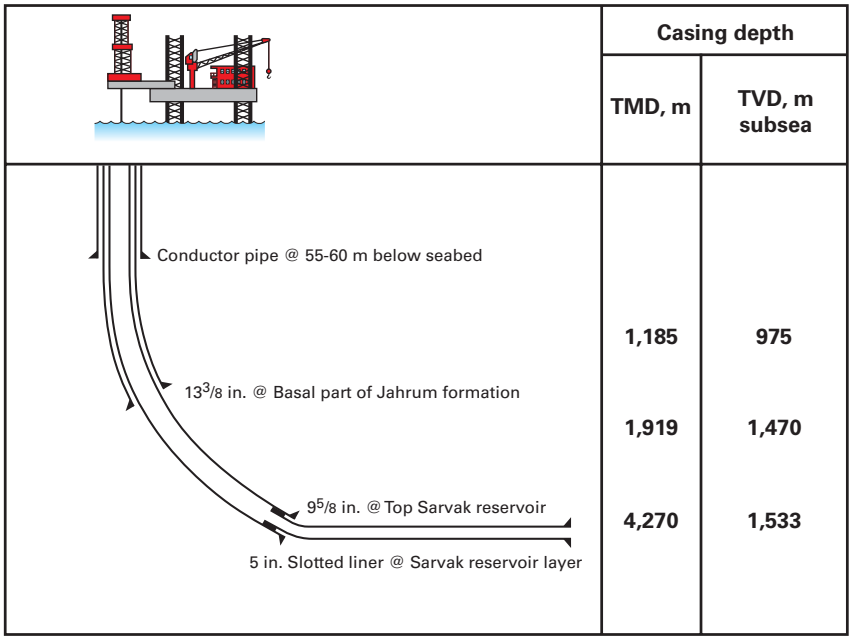
OPTIMIZATION PLAN, WELL WO-02

Fig. 4



(Mishrif)" reservoir refers to the upper part of the Sarvak formation, equivalent to the Mishrif formation in the southern Persian Gulf.

• *Kazhdumi formation.* The Kazhdumi formation consists of layers of green and brown shales with some limestone. Few sand layers have also been noted in the sequence. Kazhdumi shales have been considered the main seal for hydrocarbons in the Dariyan carbonate reservoir.

• *Dariyan (Shuaiba) formation.* The Dariyan (Shuaiba) formation is a major oil-bearing reservoir in the RSH field and consists of light-colored, cream limestones, fine-grained, tomicritic, and microcrystalline, and slightly pyritic at the base.

• *Gadvan (Kharaib) formation.* The Gadvan (Kharaib) formation consists of interbedded limestone and gray brown shales. In nearby fields, such as Salman, limestone bands in the Gadvan formation are oil-bearing reservoirs.

• *Fahliyan (Yamama, Sulaiy members) formation.* The Fahliyan formation and its equivalent in the RSH field include light-colored limestones and dolomites. The Fahliyan formation has been divided into the Yamama and the Sulaiy members. The Yamama member generally consists of fine-grained, light-colored to cream limestones, becoming brownish and dolomitic toward the base. Beds of fine-grained to sugary, and occasionally cherty, dolomites are also present. The Sulaiy member consists of alternating layers of dolomites and limestones, becoming glauconitic towards the base.

• *Hith anhydrite.* The Hith anhydrite in the RSH field consists of thick layers of massive anhydrite with beds and bands of dolomites.

• *Surmeh formation (Arab reservoir units).* The Surmeh formation consists of an alternating

CALCULATION METHODOLOGY, OPTIMIZED CASING POINTS IN WO-2 WELL

Fig. 5

		Trajectory 1			Trajectory 2			Trajectory 3		
	Scenario	A	B	C	A	B	C	A	B	C
	Optimum condition	78,999	67,000	68,890	78,903	76,055	56,790	48,790	49,980	50,876
r = –1	Utility	0.701	0.556	0.578	0.700	0.664	0.446	0.367	0.378	0.387
	U*P	0.238	0.211	0.162	0.238	0.252	0.125	0.125	0.144	0.108
	Expected value	0.611			0.615			0.377		
r = –2	Utility	0.605	0.443	0.466	0.603	0.561	0.332	0.260	0.270	0.278
	U*P	0.206	0.168	0.130	0.205	0.213	0.093	0.088	0.103	0.078
	Expected value	0.504			0.511			0.269		
r = –3	Utility	0.510	0.341	0.363	0.508	0.463	0.237	0.176	0.184	0.190
	U*P	0.173	0.129	0.102	0.173	0.176	0.066	0.060	0.070	0.053
	Expected value	0.405			0.415			0.183		
r = 0	Utility	0.790	0.670	0.689	0.789	0.761	0.568	0.488	0.500	0.509
	U*P	0.269	0.255	0.183	0.268	0.289	0.159	0.166	0.190	0.142
	Expected value	0.7161			0.7163			0.4983		
r = 1	Utility	0.864	0.772	0.787	0.700	0.664	0.446	0.367	0.378	0.387
	U*P	0.294	0.293	0.220	0.238	0.252	0.125	0.125	0.144	0.108
	Expected value	0.807			0.805			0.620		
r = 2	Utility	0.918	0.853	0.864	0.917	0.903	0.784	0.719	0.730	0.737
	U*P	0.312	0.324	0.242	0.312	0.343	0.219	0.245	0.277	0.206
	Expected value	0.878			0.875			0.728		
r = 3	Utility	0.953	0.910	0.918	0.953	0.944	0.860	0.807	0.816	0.822
	U*P	0.324	0.346	0.257	0.324	0.359	0.241	0.274	0.210	0.230
	Expected value	0.927			0.924			0.815		

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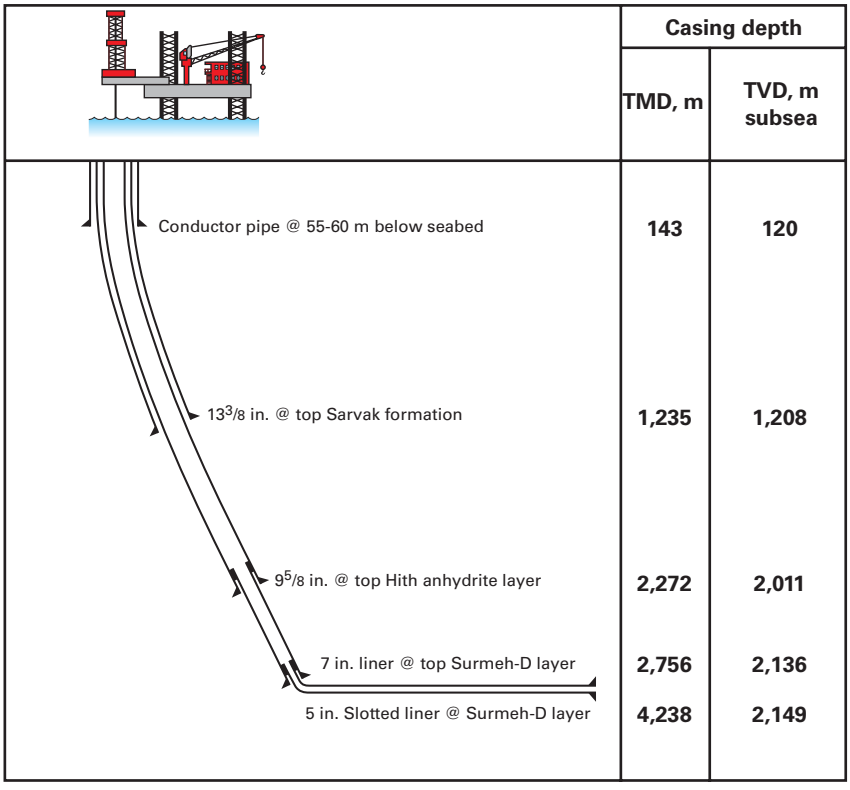
OPTIMIZATION PLAN, WELL W4-07

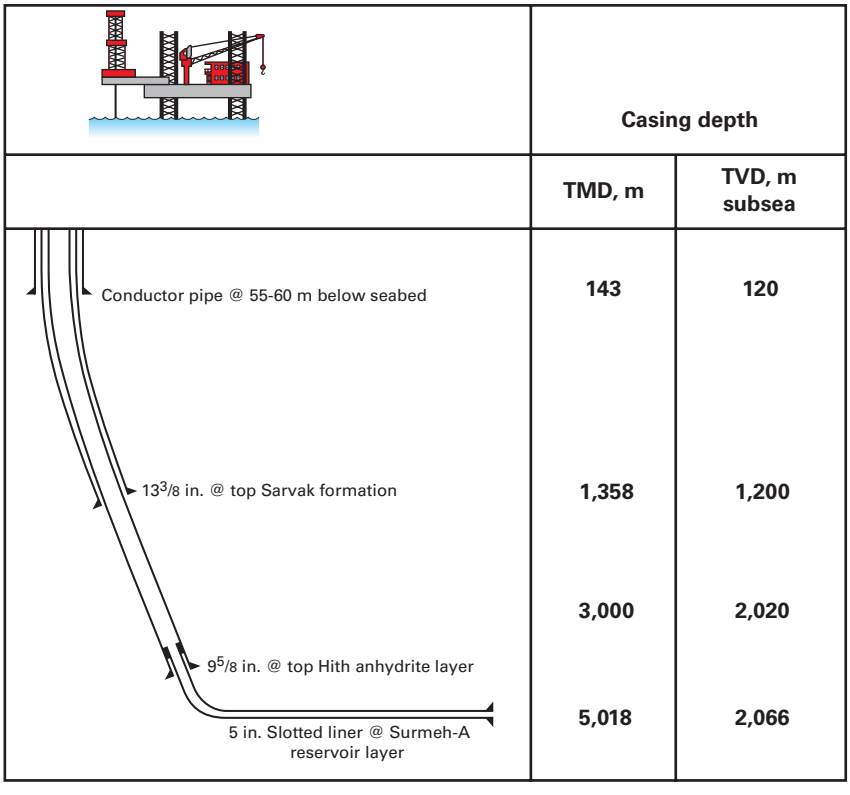
Fig. 6



	Casing depth	
	TMD, m	TVD, m subsea
Conductor pipe @ 55-60 m below seabed	143	120
13 3/8 in. @ top Sarvak formation	1,235	1,208
9 5/8 in. @ top Hith anhydrite layer	2,272	2,011
7 in. liner @ top Surmeh-D layer	2,756	2,136
5 in. Slotted liner @ Surmeh-D layer	4,238	2,149

OPTIMIZATION PLAN, WELL W4-19

Fig. 7



	Casing depth	
	TMD, m	TVD, m subsea
Conductor pipe @ 55-60 m below seabed	143	120
13 3/8 in. @ top Sarvak formation	1,358	1,200
9 5/8 in. @ top Hith anhydrite layer	3,000	2,020
5 in. Slotted liner @ Surmeh-A reservoir layer	5,018	2,066

sequence of dolomites, anhydrites, and minor limestones. In RSH field, the Arab part of the Surmeh conformably overlies the Darb-equivalent unit and is overlain by the anhydrites of the Hith formation.

The Surmeh (Arab) is divided into five lithologic units: Arab A, A1, B, C, and D, of which Arab D is the thickest and Arab A the thinnest. Lithologically, the Arab units consist of dolomites and anhydrites.

Based on the description of general stratigraphic column, Fig. 2 presents one of the possible scenarios of east-west cross-section for optimization casing points in RSH oil field.

Drilling plan, RSH oil field

National Iranian Oil Co. plans for the drilling contractor to use two jack up drilling rigs to perform drilling activities. The satellite platform (W0) houses only one rig at a time, but the main (W4) platform can accommodate two rigs at opposite sides of the platform if required. Table 1 shows the wells proposed to be drilled.

Well trajectory profile

After geologists and reservoir engineers identify drilling targets, it is the drilling engineer's job to design the wellbore trajectory for these targets. For the case of drilling wells in RSH oil field, engineers must consider many factors, such as collision, trajectory geometric shape, true vertical depth and horizontal departure, inclination and azimuth, buildup rate, tortuosity, and torque and drag.[1] All these factors should be evaluated together during trajectory design.

The objective of this article is not to optimize the well trajectory. Three optimized well trajectory profile are proposed for CPS problem and casing points should be optimized for these.

Fig. 3 shows W0-1 with trajectory profile II, III for optimizing casing points in W0-1:

- *Drilling 17.5-in. hole, 13⅜-in. casing.* This hole drilled to 900-1,000 m to provide support to the wellhead and

casing and allow for installation of the first BOP stack (or diverter) to ensure safe drilling of the next hole section. A 13⅜-in. casing string will be run to surface and single stage cement job will be performed.

• *Drilling 12¼-in. hole, 9⅝-in. casing.* This section drilled from 13⅜-in. casing shoe to set 9⅝-in. casing at the selected reservoir with casing shoe about 5 m inside the formation. This casing will allow installation of the 5,000 psi BOP stack to ensure safe drilling of the next hole section.

• *Drilling 8½-in. hole, 5-in. slotted liner.* The 8½-in. diameter hole section drilled horizontally from the 9⅝-in. casing shoe to the planned section with TD at about 4,200 m within the selected formation. The setting depth may vary depending on reservoir target, actual conditions, and completion.

This horizontal section of the hole will be cased with 5-in. slotted liner in the hydrocarbon-bearing zone and will not be cemented. The 5-in. diameter slotted liner will be run with the liner hanger set about 100 m inside the 9⅝-in. casing.

Optimization procedures

We demonstrate the accuracy and efficiency of the proposed methodology and model and apply it in a case study at RSH oil field, using the previous information and data available from NIOC.

The starting point is the three optimized trajectory plans. Due to some uncertainty in geology such as thickness of layers, we can propose three different geological scenarios with specific probability of occurrence for A, B, and C. Each scenario poses new constraints to the mathematical modeling, especially in lower and upper bound of casing points.

Finally, we select the maximum expected value of trajectories as the best trajectory. One of the outcomes of this study is to determine the optimum casing points and to find the best trajectory. We analyze the W0-2 well in Fig. 4 under different risk attitudes (Fig. 5).

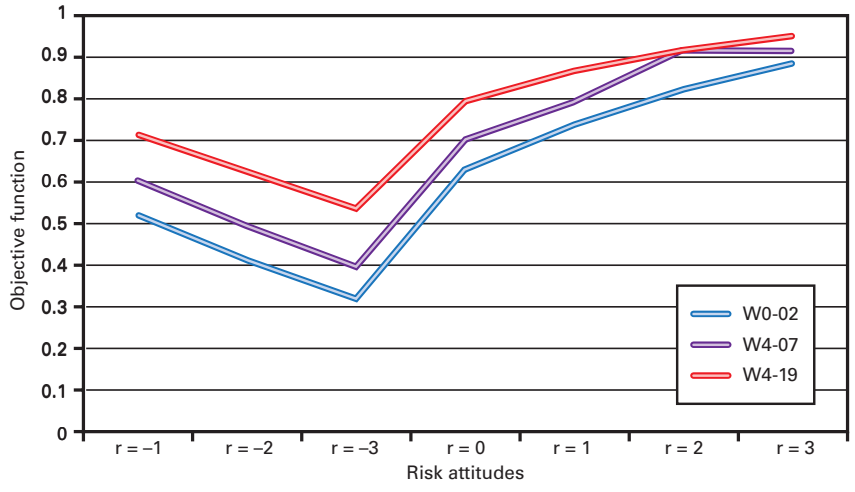
In Fig. 5 we show risk attitudes ranging from r = −3 to r = 3, with different optimal solutions that depend on decision maker. For each r the highest expected value is the optimum solution of trajectory and casing points.

For example, where r = −1, the best trajectory has the maximum expected value 0.615, meaning that trajectory II is the best. This amount is the sum of three expected subvalues from three scenarios.

To determine the best casing points, we select expected subvalues with the highest U*P value (0.252). Finally, we find that for r = −1, the best trajectory is profile II and the best scenario for selection casing point is scenario A.

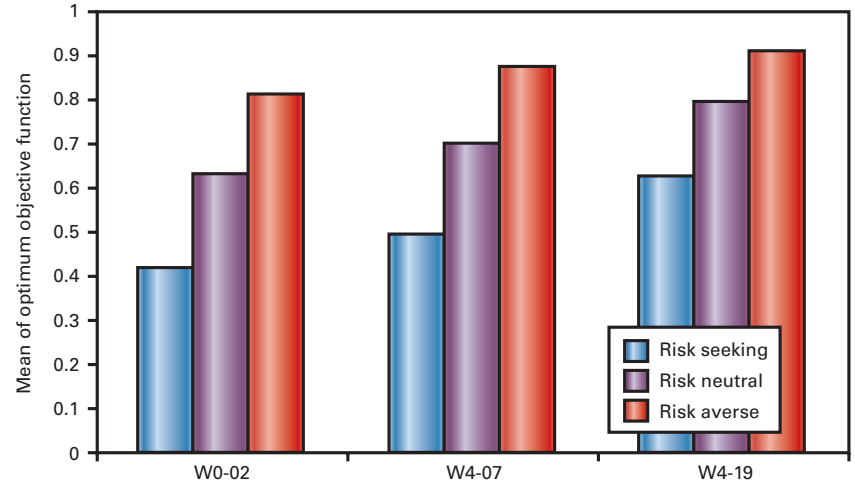
Objective function under different risk attitudes

Fig. 8



Best solutions under different risk attitudes

Fig. 9



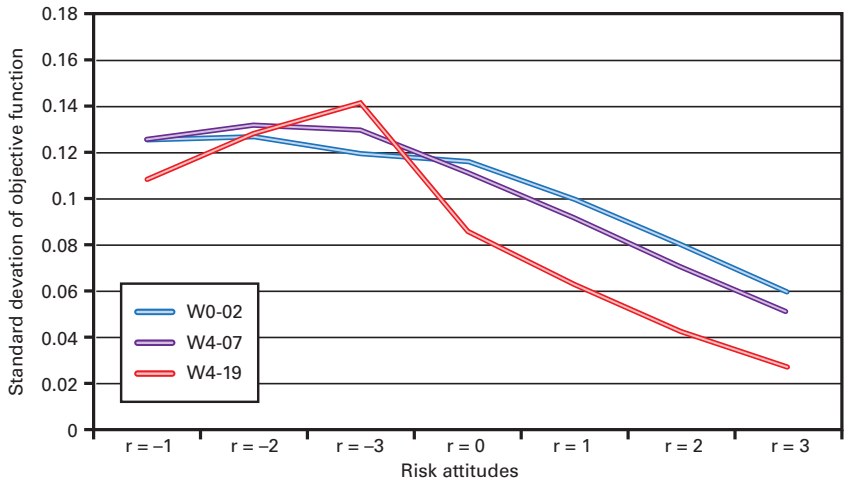
Proposed drill wells

Table 1

Drilling	W0 platform	W4	Total wells
Producing wells	6	11	17
Water injection wells	4	6	10
Gas injection wells	1	1	1
Water disposal wells	—	1	1
Total wells	**11**	**19**	**29**

VARIABILITY IN UTILITY, WITH RISK

Fig. 10



OPTIMIZATION PLAN, CASING POINTS FOR RSH OIL FIELDS

Table 2

Well name	– 13⅜-in. diameter – TMD	TVD	– 9⅝-in. diameter – TMD	TVD	– 7-in. diameter – TMD	TVD	– 5-in. diameter – TMD	TVD
W0-02	1,185	975	1,919	1,470	—	—	4,270	1,533
W4-07	1,235	1,208	2,272	2,011	2,756	2,136	4,238	2,149
W4-19	1,358	1,200	3,000	2,020	—	—	5,018	2,066

OPTIMIZATION PERFORMANCE UNDER DIFFERENT RISK ATTITUDES

Table 3

Well name	Risk seeking (r = –1, r = –2, r = –3) Mean objective function	Standard deviation	Risk neutral (r = 0) Objective function	Risk averse (r = 1, r = 2, r = 3) Mean objective function	Standard deviation
W0-02	0.6496	0.0841	0.4377	0.2485	0.0826
W4-07	0.5312	0.1789	0.2208	0.1043	0.0457
W4-19	0.5491	0.1506	0.2445	0.1176	0.0503

CASING SETTING INTERVALS

Table 4

Well name	Casing setting depth, m — 13⅜-in. Top	Bottom	9⅝-in. Top	Bottom	7-in. Top	Bottom	5-in. Top	Bottom
W0-02	1,045	1,125	1,770	1,942	—	—	4,256	4,542
W4-07	1,290	1,426	2,164	2,380	2,657	2,855	4,123	4,353
W4-19	1,255	1,461	2,879	3,121	—	—	4,897	5,139

For r = –2, r = –3, and r = 0, the same condition is found as for r = –1.[2 3]

If we consider other values of r, we observe the optimum solution shifting to other trajectories and scenarios. For example, in r = 1, r = 2, and r = 3, the best trajectory becomes trajectory I and casing points set on scenario A for r = 1, instead of Scenario B.

Fig. 4 shows the optimization plan for W0-02. We calculated the points from an average of points among risk seeking, neutral, and risk averse. We conclude from Fig. 5 (W0-2 well) that 57% profile II is the best trajectory and 43% profile I is the best trajectory.

To optimize other wells, we selected another two wells from the case study using Lingo 8. The results obtained from solving the model for the W4-07 and W4-19 wells are discussed below using the same procedure as used for the W0-2 well.

W4-07 is a well with three casing points for 13⅜-in., 9⅝-in., and 5-in. diameter casing. The results appear in Figs. 6 and 7. The next step was to run the model using data gathered from RSH oil field for the other wells. Table 2 summarizes the optimization plan for different wells.

Analysis of results

We performed a sensitivity analysis for various cases. In this case study, we investigate the sensitivity of the optimization result to the varying risk attitudes and the effect of varying risk attitudes in the optimization of casing points (Table 3).

There were three different runs performed for a risk-averse (r = 1, r = 2, r = 3), risk-neutral (r = 0), and risk-seeking (r = –1, r = –2, r = –3) decision maker with the aim of finding the optimum objective function under the different risk attitudes. Fig. 8 shows the optimum objective functions under different risk scenarios.

When the decision maker moves from r = –1 to r = –3 (i.e., allows more risk) the objective function decreases. This is expected because the utility amount that decision maker earned decreases as well. When we move from neutral to averse risk (i.e., allows less risk), the objective function increases.

Fig. 9 shows the average of the best solution under different risk attitudes. As expected, the objective function of the optimal solution found under risk-seeking conditions is the lowest, while the solution under risk-averse conditions is the highest. The result for the risk-neutral case lies between those of the risk-seeking and risk-averse solutions.

PROFIT INCREASE, THREE WELL SCENARIOS Table 5

Well	Trajectory, % I	II	III
W0-02	15.2	3.6	2.4
W04-07	9.3	3.6	7.3
W04-19	3.8	3.0	8.7

The expected value for the risk-averse case has the highest amount but also displays the least variability (standard deviation) of utility across the three risks in Fig. 10.

Table 4 shows optimum intervals for casing points in each section, the selection in these intervals depends on the decision maker. We select the average of upper and lower range of this interval as final optimum points.

After a complete analysis of results about objective function, we can define an optimum interval to set casing points, depending on decision-maker risk attitude and different scenarios. The worst-case and best-case geologic scenarios determine the upper and lower bounds.

If we define other cases, we will find an optimal solution between upper and lower points. Points outside of this interval are not optimum; therefore, they do not represent economical conditions.

Now we can calculate percentage savings when the optimum solution moves between two optimum points (Table 5).

For example, in Well W0-02 we have three different scenarios: A, B, C. The optimum solution in this scenario had a maximum 15.2% savings compared with other scenarios for profit saving in trajectory I.

Observations

In this study, to optimize casing point selection under geological uncertainty, we observed that:

- Using multiple scenarios in the RSH field provides better decisions to determine the best casing setting points in wells, with predicted savings of 2.4% to 15.2%.
- The casing point planning (CPS problem) extension to the uncertainty environment is a good tool to determine casing setting depths of wells.
- The more data available, the smaller the uncertainty and the better the resulting decisions.[4]

Acknowledgment

The authors gratefully acknowledge the cooperation of National Iranian Oil Co. for its support in preparing data from RSH oil field. ✦

References

1. Liang, Q.J., "Trajectory Risk index—An engineering method to measure risks of multiple-well complex trajectories," Paper OTC 18508, Offshore Technology Conference, Houston, Apr. 30-May 3, 2007.

2. Yeten, B., Durlofsky, L.J., and Aziz, K., "Optimization of Nonconventional Well Type, Location and Trajectory," paper SPE 77565, SPE Annual Technical Conference and Exhibition, San Antonio, Sept. 29-Oct. 2, 2002.

3. Guyaguler, B., and Horne, R., "Uncertainty assessment of well placement optimization," paper SPE 71625, SPE ATCE, New Orleans, Sept. 30-Oct. 3, 2001.

4. Paulo Sergio da Cruz, "Reservoir management decision making in the presence of geological uncertainty," PhD thesis, Stanford University, Stanford, Calif., March 2000.

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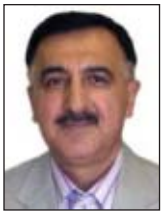

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Study examines effect of cetane improvers

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An investigation of the effect of cetane improvers on diesel cetane number showed that diesel fuels have a low sensitivity to the additives.

Hydrotreated straight-run gas oils from Ural crudes, and their blends with hydrotreated secondary gas oils like light cycle oil (LCO), heavy cycle oil (HCO), and visbreaker gas oil (VBGO), exhibited an increase of 0.28 cetane numbers at a 100-ppm cetane improver (2-ethyl hexyl nitrate) treating rate. This was typical for these diesel blends.

Diesel cetane

According to the European diesel standard EN-590, diesel in the European Union must have a cetane number no lower than 51 and a cetane index no lower than 46. Cetane index is a correlation that predicts cetane number of diesel that does not contain cetane-improving additives.

According to ASTM D-4737, the cetane index is calculated using the density at 15° C., T10, T50, and T90 from the ASTM D-86 distillation of the diesel fuel. There is therefore a limit for the minimum cetane number of the base diesel fuel that could be treated with cetane improvers to achieve the specified value of 51. Production of automotive diesel in a refinery consists of blending of hydrotreated straight-run and secondary middle distillates.[1] Unlike straight-run diesel fractions, secondary gas oils have lower cetane numbers.

Continuing dieselization in Europe is forcing refiners to look for ways to extend the feed base for production of automotive diesel.[2] The relative share of secondary diesel fractions in the refinery diesel pool will therefore increase because straight-run middle distillate fractions are limited by the processed crude.

Typically, refiners cannot achieve a cetane number of 51 for the diesel pool due to the presence of hydrotreated secondary diesel fractions; therefore, refiners use cetane improvers. The most widely used cetane improvers are those based on 2-ethyl hexyl nitrate (2EHN).

The effect of cetane improver treating rate depends on the base diesel fuel cetane and composition (OGJ, Dec. 3, 2007, p. 58). Different sources, however, have indicated different dependence rates.[3]

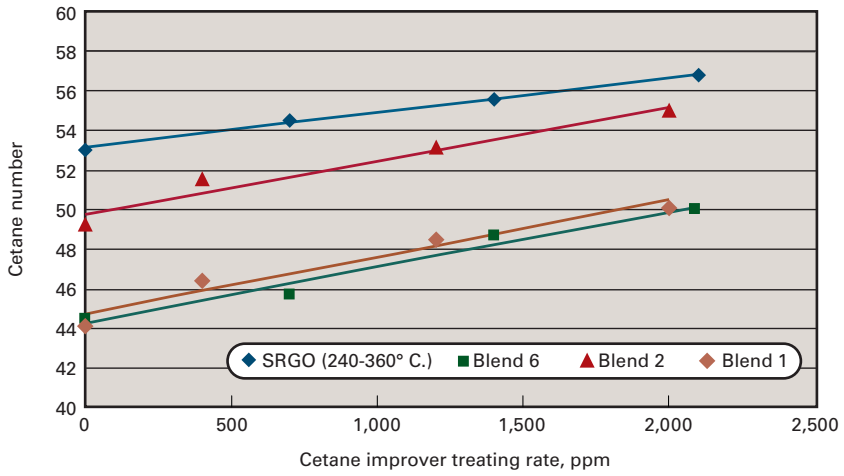
Keeping in mind the increasing share of secondary gas oils in the diesel pool, we carried out a study to determine the dependence of base diesel composition and cetane number on the efficiency of cetane improvers. This article discusses results of our study.

MIDDLE DISTILLATE PROPERTIES

Table 1

	HT-1	HT-2 hydrogenate	HT-3 hydrogenate	HT-4 hydrogenate	FCC LCO	FCC HCO	LCO:HCO, 2:1	SRGO
Density at 15° C., g/cc	0.8011	0.8441	0.8416	0.8341	0.9427	1.0130	0.9667	0.8554
Distillation, ASTM D-86, °C.								
IBP	161	217	210	167	197	279	191	202
5 vol %	172	237	236	180	212	296	211	253
10 vol %	179	243	250	185	220	300	228	268
20 vol %	186	255	260	194	229	307	241	276
30 vol %	191	264	268	200	235	312	248	283
40 vol %	195	272	277	208	240	317	258	292
50 vol %	200	282	284	214	246	322	268	300
60 vol %	206	292	291	222	251	327	278	308
70 vol %	211	303	300	230	256	332	291	318
80 vol %	219	317	311	240	264	338	307	327
90 vol %	229	335	324	254	273	348	328	341
FBP	246	363	348	283	295	262	353	359
Recovery, vol %	98		98	98	98.5	98.5	98.5	98.0
Cetane index	45.6	54.4	56	37.8	15	13	19	55
Cetane number	41.5	53	53.5	35.5	12	10	14	53
Total aromatics, %	18.4	25.4	27.1	42.9	87	87.0	87	27.8
Polynuclear aromatics, %	1.4	4.5	5.2	10.4	57	74.3	63	9.4

DIESEL CETANE



Experimental

We used hydrotreated middle distillate fractions from the Lukoil Neftochim Bourgas (LNB) hydrotreating units, unhydrotreated straight-run gas oil (SRGO) from one of the LNB crude distillation units, and unhydrotreated LCO and HCO from the LNB FCC unit in this study.

Table 1 shows the physical and chemical properties of the middle distillates studied. We analyzed the total aromatics and polynuclear aromatics in the gas oils according to EN-12916.

We determined diesel cetane number in accordance with ASTM D-613. Cetane index was calculated in accordance with ASTM D-4737. We used a commercial sample of 2EHN as the cetane improver.

Cetane improvers

Cetane number increases with higher molecular weights and lower aromatics content of the diesel fuel studied. The diesel fractions we studied vary considerably in term of distillation range; therefore, we used hydrocarbon composition in this study.

Cetane number of the investigated diesel fractions varied between 12.0 and 53.5, the total aromatics content varied in the range 18.4-87.0%, and the polynuclear aromatics varied between 1.4% and 74.3%. We prepared six blends of these diesel fractions (Table 2).

We obtained hydrogenates from the four LNB middle distillate hydrotreating units by hydrotreating these middle distillate fractions:

- HT-1 = SRGO (180-240° C.).
- HT-2 = SRGO (240-360° C.), SRGO (200-300° C.), VBGO.
- HT-3 = SRGO (240-360° C.), light vacuum gas oil (LVGO).
- HT-4 = SRGO (180-240° C.), SRGO (200-300° C.), FCC LCO.

We obtained SRGO from crude distillation units that were feeding Ural crude. Properties of the hydrogenates from the four LNB hydrotreaters in Table 1 indicate that the hydrogenate from HT-4 had the lowest cetane number. This hydrogenate had the lowest cetane number because the HT-4 unit processes a feed that contains about 25% FCC LCO.

The same hydrogenate also had the highest aromatics content. This can explain why the blend containing the most HT-4 hydrogenate had the lowest cetane number, 44.1, while the blend that contained the

DIESEL BLEND PROPERTIES

Table 2

Blend	1	2	3	4	5	6
Constituents	47% HT-3, 53% HT-4	47% HT-3, 53% HT-1	75% HT-3, 20% HT-1, 5% HT-4	45% HT-3, 22% HT-1, 33% HT-4	35% HT-3, 14% HT-1, 24% HT-4, 27% HT-2	80% SRGO (240-360° C.), 20% (LCO + HCO)
Density at 15° C., g/cu cm	0.8409	0.8209	0.8421	0.8332	0.8361	0.8773
Distillation, ASTM D-86, °C.						
IBP	173	167	173	165	175	205
5 vol %	195	189	200	187	194	239
10 vol %	200	196	209	193	202	252
20 vol %	214	208	229	204	218	265
30 vol %	224	217	246	214	232	276
40 vol %	235	229	260	229	243	284
50 vol %	245	239	275	242	259	290
60 vol %	255	249	290	257	275	300
70 vol %	269	265	302	272	289	310
80 vol %	285	287	318	297	307	320
90 vol %	311	315	337	324	332	336
FBP	340	340	361	353	357	357
Recovery, vol %	98	98	98	98	98	98.0
Total aromatics, %	35.5	22.5	26.2	30.4	29.2	39.8
Polynuclear aromatics, %	8.0	3.2	4.7	6.1	5.7	21.2
Cetane index	45	51	51	47	50	43
Cetane number	44.1	49.2	51.0	45.8	47.4	44.5
Cetane improver treating rate, ppm	Cetane number					
400	46.4	51.5			49.3	
600	46.2	52.1				
700						44.9
850	46.8	51.7	51.3 (1,000 ppm)		51.6	
1,200	48.5	53.1				
1,400						49.5
1,600	50.00	53.1				
2,000	50.1	55		51	53.1	
2,100						50

least HT-4 hydrogenate had the highest cetane number, 51.0.

Table 2 shows how the cetane number of the six blends reacts to an increase in the cetane improver's treating rate. These data show that the diesel cetane number of studied blends is not highly sensitive to cetane improvers.

All the investigated diesel blends exhibited the same rate of increase in cetane number with more cetane improver used.

The figure shows that the slope is 0.0028 for all blends, which means that a cetane increase of 0.28 will result with every 100-ppm cetane improver added.

Unhydrotreated SRGO (240-360° C.) with a base cetane number of 53.0 exhibited the least sensitivity to the cetane improver: a cetane increase of 0.18 at 100 ppm additive rate.

These results differed considerably from those reported by Morris (OGJ, Dec. 3, 2007, p. 58). He reported a cetane number increase of 1.2 at 100-ppm cetane improver 2EHN treating rate for a diesel with a base cetane of 43.0.

Adding 25% LCO to the same base diesel fuel reduced its cetane number to 36.9 from 43.0 and reduced the diesel sensitivity to the cetane improver to 0.5 from 1.2 cetane numbers.

The difference in observations is probably due to the type of crude processed. Obviously, middle distillate fractions from Ural crudes exhibit a lower sensitivity to treatment with a cetane improver and this sensitivity does not change when treating a highly aromatic FCC LCO.

This can explain some curious results—for example, adding 1,000-ppm cetane improver to Blend 4 had no effect. According to other results, Blend 4 should have increased 2.8 cetane numbers.

In accordance with ASTM D-613, the repeatability of cetane number measurements was 0.9 and the reproducibility was between 3.3 and 4.8 for the range of cetane numbers studied. In some cases, cetane numbers of the studied blends were measured in different laboratories; therefore, a difference in the cetane number less than 3.3 may not have been recorded.

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cetane numbers of diesel fuels used in this article. ✦

References

1. Petrov, S., Stratiev, D., Stratiev, G., and Minkov, D., "Production of environmental friendly fuels in Lukoil Neftochim Bourgas," Oxidation Communication, Vol. 28 (2005), No. 1, pp. 47-55.

2. "Europe's Market for Premium Fuels Grows," Hydrocarbon Processing, January 2005, p. 7.

3. "Cetane Improver for Diesel," 2005 Baker Hughes Inc., PET-05-9584 BP-0274, November 2005.

NELSON-FARRAR COST INDEXES

Refinery construction (1946 Basis)
(Explained on p.145 of the Dec. 30, 1985, issue)

	1962	1980	2005	2006	2007	Sept. 2007	Aug. 2008	Sept. 2008
Pumps, compressors, etc.	222.5	777.3	1,685.5	1,758.2	1,844.4	1,853.1	1,966.5	1,976.0
Electrical machinery	189.5	394.7	513.6	520.2	517.3	514.1	517.3	517.3
Internal-comb. engines	183.4	512.6	931.1	959.7	974.6	980.8	992.2	992.2
Instruments	214.8	587.3	1,108.0	1,166.0	1,267.9	1,282.4	1,356.6	1,364.0
Heat exchangers	183.6	618.7	1,072.3	1,162.7	1,342.2	1,374.7	1,374.7	1,374.7
Misc. equip. average	198.8	578.1	1,062.1	1,113.3	1,189.3	1,201.0	1,241.5	1,244.8
Materials component	205.9	629.2	1,179.8	1,273.5	1,364.8	1,357.7	1,779.8	1,689.9
Labor component	258.8	951.9	2,411.6	2,497.8	2,601.4	2,628.7	2,695.7	2,742.8
Refinery (Inflation) Index	237.6	822.8	1,918.8	2,008.1	2,106.7	2,120.3	2,329.3	2321.7

Refinery operating (1956 Basis)
(Explained on p.145 of the Dec. 30, 1985, issue)

	1962	1980	2005	2006	2007	Sept. 2007	Aug. 2008	Sept. 2008
Fuel cost	100.9	810.5	1,360.2	1,569.0	1,530.7	1,264.3	2,228.4	1,921.1
Labor cost	93.9	200.5	201.9	204.2	215.8	220.5	237.4	292.9
Wages	123.9	439.9	1,007.4	1,015.4	1,042.8	1,061.4	1,094.3	1,157.9
Productivity	131.8	226.3	501.1	497.5	483.4	481.3	460.9	395.3
Invest., maint., etc.	121.7	324.8	716.0	743.7	777.4	782.4	859.5	856.7
Chemical costs	96.7	229.2	310.5	365.4	385.9	388.7	544.0	534.8
Operating indexes								
Refinery	103.7	312.7	542.1	579.0	596.5	576.8	717.9	709.3
*Process units**	103.6	457.5	787.2	870.7	872.6	782.5	1,152.0	1,060.1

**Add separate index(es) for chemicals, if any are used. See current Quarterly Costimating, first issue, months of January, April, July, and October.*

These indexes are published in the first issue of each month. They are compiled by Gary Farrar, Journal Contributing Editor.

Indexes of selected individual items of equipment and materials are also published on the Costimating page in the first issue of the months of January, April, July, and October.

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How refinery fuel indexes have varied

Gary Farrar
Contributing Editor

Refinery fuels costs have endured an unsteady course since 2005.

As shown in the accompanying table, most of the Petroleum Administration Defense District (PADD) residual fuels' increases in cost occurred during 2005 and 2007 for all of the five districts. PADD 4 experienced the least variance while PADD 5 incurred the highest variance in price over the period.

The cost for natural gas for refinery usage increased a fair amount through 2005 and then varied during 2006 and decreased in 2007. These conclusions are based on costs of an average refinery fuel consisting of 1 bbl each of PADDs 1-5 and an average US cost of 4.4 MMscf natural gas (a 1 bbl equivalent on a BTU content basis).

Raw residual fuel oil and natural gas prices come from publications put out by the US Department of Labor.

Biggest variations occurred in PADDs 1, 3, and 5. PADD 4 increased over the period in yearly average to 1,857.9 from 933.1.

While PADD 1's 3-year averages started with 1,185.4, they increased to 2,113.7 and then to 2,247.2.

All indexes shown are based on 1956 = 100, the basis of the Nelson-Farrar Operating Index for an average US refinery. ✦

INDEXES FOR REFINERY FUELS

Quarter	PADD 2	PADD 3	PADD 1 Residual fuels	PADD 5	PADD 4	Natural gas
2005						
1st	1,185.4	1,005.1	1,228.0	1,534.2	933.1	5,333.6
2nd	1,570.1	1,385.0	1,403.0	1,921.1	1,200.0	5,986.1
3rd	1,772.2	1,622.3	1,766.7	2,123.3	1,324.1	6,554.3
4th	2,013.6	1,901.2	1,760.7	2,187.5	1,638.6	10,168.3
Year	**1,635.3**	**1,478.4**	**1,539.6**	**1,941.5**	**1,274.0**	**7,010.6**
2006						
1st	2,113.7	1,822.7	1,833.7	2,352.8	1,557.9	6,756.4
2nd	2,274.7	1,859.5	1,893.0	2,580.3	1,742.1	5,781.9
3rd	2,050.9	1,882.0	1,957.0	2,506.4	1,737.9	6,040.8
4th	1,656.4	1,498.9	1,666.3	1,993.1	2,025.5	6,647.0
Year	**2,023.9**	**1,765.8**	**1,837.5**	**2,358.2**	**1,765.9**	**6,306.5**
2007						
1st	1,526.9	1,425.1	1,500.4	2,045.6	2,025.5	6,672.2
2nd	1,905.7	1,904.4	1,937.2	2,502.5	2,025.5	6,423.9
3rd	2,192.2	2,093.6	2,124.3	2,774.7	1,638.6	5,203.1
4th	2,247.2	2,763.7	2,705.7	3,494.2	1,857.9	6,175.5
Year	**1,968.0**	**2,046.7**	**2,066.9**	**2,704.3**	**1,886.9**	**6,118.7**

ITEMIZED REFINING COST INDEXES

The cost indexes may be used to convert prices at any date to prices at other dates by ratios to the cost indexes of the same date. Item indexes are published each quarter (first week issue of January, April, July, and October). In addition the Nelson Construction and Operating Cost Indexes are published in the first issue of each month of Oil and Gas Journal.

Operating cost (based on 1956 = 100.0):	1954	1972	2005	2006	2007	Aug. 2008	*References	Index for earlier year in Costimating and Questions on Technology issues
Power, industrial electrical	98.5	131.2	771.3	850.2	897.3	981.7	Code 0543	No. 13, May 19, 1958
Fuel, refinery price	85.5	152.0	1,288.9	1,523.6	1,497.0	2,120.7	OGJ	No. 4, Mar. 17, 1958
Gulf cargoes	85.0	130.4	1,635.4	2,023.9	1,968.0	3,636.7	OGJ	No. 4, Mar. 17, 1958
NY barges	82.6	169.6	1,539.6	1,837.5	2,066.9	3,764.8	OGJ	No. 4, Mar. 17, 1958
Chicago low sulfur	—	—	1,478.4	1,765.8	2,046.7	3,752.7	OGJ	July 7, 1975
Western US	84.3	168.1	1,941.5	2,358.1	2,704.2	5,146.9	OGJ	No. 4, Mar. 17, 1958
Central US	60.2	128.1	1,274.0	1,765.9	1,886.9	2,726.9	OGJ	No. 4, Mar. 17, 1958
Natural gas at wellhead	83.5	190.3	7,010.6	6,306.5	6,118.7	8,206.6	Code 531-10-1	No. 4, Mar. 17, 1958
Inorganic chemicals	96.0	123.1	562.9	686.8	743.6	1,135.9	Code 613	Oct. 5, 1964
Acid, hydrofluoric	95.5	144.4	414.9	414.9	414.9	414.9	Code 613-0222	Apr. 3, 1963
Acid, sulfuric	100.0	140.7	397.4	397.4	397.4	397.4	Code 613-0281	No. 94, May 15, 1961
Platinum	92.9	121.1	819.3	1,344.5	1,557.8	1,621.5	Code 1022-02-73	July 5, 1965, p. 117
Sodium carbonate	90.9	119.4	357.3	452.4	490.1	748.5	Code 613-01-03	No. 58, Oct. 12, 1959
Sodium hydroxide	95.5	136.2	529.6	620.1	671.6	1,025.5	Code 613-01-04	No. 94, May 15, 1961
Sodium phosphate	97.4	107.0	733.7	733.7	733.7	733.7	Code 613-0267	No. 58, Oct. 12, 1959
Organic chemicals	100.0	87.4	666.5	764.5	799.9	1,128.0	Code 614	Oct. 5, 1964
Furfural	94.5	137.5	961.9	1,103.1	1,174.1	1,627.8	Chemical Marketing Reporter	No. 58, Oct. 12, 1959
MEK, tank-car lots	82.6	87.5	625.0	625.0	625.0	625.0	Reporter	
Phenol	90.4	47.1	411.3	374.9	413.0	500.3	Code 614-0241	No. 58, Oct. 12, 1959

ITEMIZED REFINING COST INDEXES

Operating cost (based on 1956 = 100.0):	1954	1972	2005	2006	2007	Aug. 2008	*References	Index for earlier year in Costimating and Questions on Technology issues
Operating labor cost (1956 = 100)								
Wages & benefits	88.7	210.0	1,007.0	1,015.4	1,042.8	1,094.3	Employ & Earn	No. 41, Feb. 16, 1969
Productivity	97.2	197.0	501.1	497.5	483.4	460.9	Employ & Earn	No. 41, Feb. 16, 1969
Construction labor cost (1946 = 100)								
Skilled const.	174.6	499.9	2,170.8	2,240.7	2,344.4	2,423.9	Eng. News Record	No. 55, Nov. 3, 1949
Common labor	192.1	630.6	2,863.5	2,971.7	3,083.0	3,200.4	Eng. News Record	No. 55, Nov. 3, 1949
Refinery cost	183.3	545.9	2,411.6	2,497.8	2,601.4	2,695.7	OGJ	May 15, 1967
Equipment or materials (1946 = 100):								
Bubble tray	161.4	324.4	1,409.4	1,484.0	1,561.4	1,859.2	Computed	July 8, 1962, p. 113
Building materials (nonmetallic)	143.6	212.4	886.4	969.6	1,003.2	1,095.4	Code 13	No. 61, Dec. 15, 1949
Brick—building	144.7	252.5	1,301.7	1,408.6	1,429.1	1,430.4	Code 1342	No. 20, Mar. 3, 1949
Brick—fireclay	193.1	322.8	1,441.1	1,540.5	1,616.2	1,748.2	Code 135	May 30, 1955
Castings, iron	188.1	274.9	1,290.0	1,351.3	1,414.3	1,677.2	Code 1015	Apr. 1, 1963
Clay products (structural, etc.)	159.1	342.0	893.8	951.6	963.2	973.3	Code 134	No. 20, Mar. 3, 1949
Concrete ingredients	141.1	218.4	985.5	1,092.0	1,172.2	1,236.4	Code 132	No. 22, March 17, 1949
Concrete products	138.5	199.6	841.3	921.1	961.6	1,000.6	Code 133	Oct. 2, 1967, p. 112
Electrical machinery	159.9	216.3	513.6	520.2	517.3	517.3	Code 117	May 2, 1955
Motors and generators	157.7	211.0	839.2	880.3	917.1	975.4	Code 1173	May 2, 1955
Switchgear	171.2	271.0	1,090.0	1,147.3	1,212.2	1,253.9	Code 1175	May 2, 1955
Transformers	161.9	149.3	537.1	612.5	696.9	805.3	Code 1174	No. 31, May 19, 1949
Engines (combustion)	150.5	233.3	931.1	959.7	974.6	992.2	Code 1194	No. 36, June 23, 1949
Exchangers (composite)	171.7	274.3	1,072.3	1,162.7	1,342.2	1,374.7	Manufacturer	Mar. 16, 1964
Copper base	190.7	266.7	992.1	1,059.4	1,201.8	1,241.9	Manufacturer	Mar. 16, 1964
Carbon steel	156.8	281.9	1,080.2	1,162.1	1,344.7	1,396.5	Manufacturer	Mar. 16, 1964
Stainless steel (304)	—	—	1,119.3	1,174.8	1,322.1	1,365.0	Manufacturer	July 1, 1991
Fractionating towers	151.0	278.5	1,157.2	1,207.2	1,274.3	1,428.1	Computed	June 8, 1963, p. 133
Hand tools	173.8	346.5	1,722.1	1,792.5	1,830.6	1,937.7	Code 1042	June 27, 1955
Instruments (composite)	154.6	328.4	1,108.0	1,166.0	1,267.9	1,356.6	Computed	No. 34, June 9, 1949
Insulation (composite)	198.5	272.4	2,228.6	2,257.4	2,258.6	2,207.4	Manufacturer	July 4, 1988, p. 193
Lumber (composite):	197.8	353.4	1,359.6	1,309.8	1,204.1	1,162.0	Code 81	No. 7, Dec. 2, 1948
Southern pine	181.2	303.9	998.6	984.3	846.4	814.4	Code 81102	No. 7, Dec. 2, 1948
Redwood, all heart	238.0	310.6	2,057.9	1,948.1	1,744.3	1,678.1	Code 811-0332	July 5, 1965, p. 117
Machinery								
General purpose	159.9	278.5	1,163.6	1,213.7	1,271.8	1,358.3	Code 114	Feb. 17, 1949
Construction	165.9	324.4	1,499.2	1,559.7	1,594.4	1,650.9	Code 112	Apr. 1, 1968, p. 184
Oil field	161.9	269.1	1,454.8	1,599.1	1,715.8	1,898.8	Code 1191	Oct. 10, 1955
Paints—prepared	159.0	231.8	975.3	1,040.8	1,078.5	1,174.3	Code 621	May 16, 1955
Pipe								
Gray iron pressure	195.0	346.9	2,580.2	2,687.9	2,730.8	2,918.6	Code 1015-0239	Jan. 3, 1983
Standard carbon	182.7	319.9	2,217.3	2,306.9	2,299.2	3,203.3	Code 1017-0611	Jan. 3, 1983
Pumps, compressors, etc.	166.5	337.5	1,685.5	1,758.2	1,844.4	1,966.5	Code 1141	No. 29, May 5, 1949
Steel-mill products	187.1	330.6	1,409.1	1,527.5	1,620.0	2,287.0	Code 1017	Jan. 3, 1983
Alloy bars	198.7	349.4	1,146.8	1,311.8	1,239.7	1,678.0	Code 1017-0831	Apr. 1, 1963
Cold-rolled sheets	187.0	365.5	1,462.5	1,658.4	1,916.6	2,093.0	Code 1017-0711	Jan. 3, 1983
Alloy sheets	177.0	225.9	760.3	862.4	996.7	1,088.9	Code 1017-0733	Jan. 3, 1983
Stainless strip	169.0	221.2	811.6	920.7	1,064.2	1,162.5	Code 1017-0755	Jan. 3, 1983
Structural carbon, plates	193.4	386.7	1,654.5	1,766.6	1,945.3	2,810.7	Code 1017-0400	Jan. 3, 1983
Welded carbon tubing	180.0	265.5	2,246.8	2,337.3	2,329.6	3,245.3	Code 1017-0622	Jan. 3, 1983
Tanks and pressure vessels	147.3	246.4	974.4	1,014.3	1,076.4	1,189.7	Code 1072	No. 5, Nov. 18, 1949
Tube stills	123.0	125.3	540.5	579.9	612.0	798.3	Computed	Oct. 1, 1962
Valves and fittings	197.0	350.9	1,738.2	1,839.6	1,943.9	2,072.0	Code 1149	No. 46, Sept. 1, 1940
Nelson-Farrar Refinery (Inflation Index)								
(1946)	179.8	438.5	1,918.8	2,008.1	2,106.7	2,329.3	OGJ	May 15, 1969
Nelson-Farrar Refinery Operation								
(1956)	88.7	118.5	542.1	579.0	596.5	717.9	OGJ	No. 2, Mar. 3, 1958
Nelson-Farrar Refinery Process								
(1956)	88.4	147.0	787.2	870.7	872.6	1,152.0	OGJ	No. 2, Mar. 3, 1958

*Code refers to the index number of the Bureau of Statistics, US Department of Labor, "Wholesale Prices" Itemized Cost Indexes, Oil & Gas Journal.

CASPIAN NATURAL GAS—1

Kazakh export plans affect regional producers, buyers

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How Kazakhstan—the second largest oil and gas producer in the former Soviet Union after Russia—chooses to develop its gas resources and export infrastructure will affect both gas exports from other energy-producing countries of the FSU and European and Chinese plans for diversifying its natural gas supplies.

This first part of two articles examines the various land pipeline projects designed to export Kazakh supplies. The concluding article next week will look at the Trans-Caspian Gas Pipeline, competing proposals, and the legal status of the Caspian Sea.[1]

CAC Pipeline

The deterioration of the Central Asia-Center (CAC) gas pipeline network and projected increases in gas output from Turkmenistan, Uzbekistan, and Kazakhstan require expansion of the CAC to 100 billion cu m/year (about 3.5 tcf) from the current level of 54.8 billion cu m/year. CAC capacity before refurbishment started measured 47 billion cu m/year.

Bateman Engineering NV concluded a feasibility study in 2004 on the reconstruction and modernization of the Central Asia-Center gas pipeline network from 2004 to 2020. By 2012-15, seven stages of the CAC upgrade should be complete (capacities represent end-of-stage levels):

- Stage 1 (51.5 billion cu m/year), KazTransGaz reconstructs some sections and compressor stations along CAC-4 segment.
- Stage 2 (59.4 billion cu m/year), CAC-4 pipeline looping and new compression at Compressor Station (CS) Opornaya.
- Stage 3 (66.5-80 billion cu m/year), looping CAC-2 pipeline and building five new compressor stations.
- Stage 4 (86.3 billion cu m/year), modernizing remaining compressors along CAC-4.
- Stage 5 (92.5 billion cu m/year), new compression at CS Makat.
- Stage 6 (98 billion cu m/year), new compression at CS Opornaya, Beyneu, and Sai-Utes.
- Stage 7 (100.2 billion cu m/year), new pipeline construction within CAC.[2]

Kazakhstan intends to upgrade CAC on its own (via Kazmunaigaz's subsidiary, KazTransGaz) so long as transit volumes of Turkmen and Uzbek gas do not exceed 60 billion cu m/year. KazTransGaz has already completed Stage 1 of the CAC modernization.

Kazakhstan may form a joint venture between KazTransGaz and Gazprom to increase CAC capacity beyond 60 billion cu m/year. The companies would be equally represented in the new consortium, which could also become operator of the expanded CAC sections. The new joint venture, however, would not control any of KazTransGaz's existing assets, including the CAC gas pipeline network.

Preliminary estimates put costs of expanding CAC to 80 billion cu m/year at more than $2 billion. Increasing CAC throughput to 100 billion cu m/year will cost an additional $1.1-1.5 billion. These estimates are highly sensitive to steel prices and final costs will also depend on the subcontractors and suppliers selected.

Caspian Littoral

Russia, Turkmenistan, and Kazakhstan intend to build a new 1,700 km Caspian Littoral gas pipeline running from Turkmenistan (more than 500 km), along the eastern shore of the Caspian Sea into Kazakhstan (nearly 1,200 km), then parallel to the upgraded CAC-3 pipeline (Fig. 1).[3] Initial cost estimates for this pipeline stand at $1 billion.

Caspian Littoral pipeline construction will occur in two stages. The initial stage (2009-10) will have capacity of 20 billion cu m/year, split evenly between Kazakhstan and Turkmenistan. Participants could increase capacity depending on availability of additional

gas volumes.

Gazprom, Kazmunaigaz, and Turkmenneftegaz will build and operate the pipeline. Turkmenistan and Kazakhstan will be responsible for construction of pipeline sections within their territories. Russia will expand the CAC pipeline connection point at Alexandrov Gai to accommodate new gas volumes.

The Russian gas transport system's ability downstream of the connection to receive additional volumes (40-50 billion cu m/year) of Central Asian gas by 2010-15 remains uncertain. The Russian Ministry of Economic Development says the existing Russian gas transport system is inadequate even for exporting larger volumes of domestically produced gas.

Valery Yazev, chairman of the Russian Natural Gas Association and chairman of the Energy, Transport, and Communications Committee of the State Duma, however, remains confident Russia will expand its gas transport system in time, suggesting a future 90 billion cu m/year limit for Central Asian gas supplies to and via Russia.[4]

CAC, CASPIAN LITTORAL PIPELINES Fig. 1

Source: JSC Gazprom

Trans-Asian Pipeline

Kazakhstan and China reached agreement Aug. 18, 2007, to build and operate a new gas pipeline to China. An additional agreement followed in November 2007 between Kazmunaigaz and CNPC.

Provisional agreements envisioned a Trans-Asian Gas pipeline network consisting of two trunk lines. The first (running through Southern Kazakhstan) will be the Kazakh section of the Turkmenistan-China gas pipeline. This pipeline will rely on gas from Turkmenistan, while the second will deliver gas from western Kazakhstan to western China (Fig. 2).

China is currently expanding its first West-East Gas Pipeline to 17 billion cu m/year. This 4,000-km pipeline carries gas from China's Tarim basin in Lunnan, Xinjiang province, to Shanghai. China plans to build the second West-East Pipeline (6,500 km) from Xinjiang to Guangdong province, with a capacity of 30 billion cu m/year. The Turkmenistan-China and Kazakhstan-China pipelines will feed into China's second West-East Gas Pipeline.

The Kazakh section of the Turkmenistan-China gas pipeline will run from the Uzbek-Kazakh border to the border between China and Kazakhstan via the Kazakh city of Chimkent, ending in Khorgos, in China's Xinjiang Uygur Autonomous Region. The Kazakhstan-China pipeline is the part of the Turkmenistan-China gas pipeline project running from Turkmenistan (188 km) via Uzbekistan (530 km) through southern Kazakhstan (1,333 km) to western China.

The Turkmenistan-China trunk will consist of two parallel 1,067-mm OD pipelines and five compressor stations capable of transporting 30 billion cu m/year. Cost estimates in 2007 totaled more than $6.5 billion. CNPC will provide 100% financing for the pipeline and hopes to start building the Chinese section by 2010.

China has also taken a number of steps to secure gas volumes (from Turkmenistan) adequate to fill the 30 billion cu m/year pipeline and ensure safe transit through Uzbekistan and Kazakhstan.

CNPC and Turkmenistan's state committee for oil and gas resources signed a production sharing agreement in July 2007 to develop estimated 1.3 trillion cu m gas reserves at Bagtyyarlyk on the right bank of Amu-Darya River in northeastern Lebap province, Turkmenistan.

Turkmenistan granted CNPC a license in August 2007 to develop new gas reserves at Bagtyyarlyk and supply 17 billion cu m/year of gas to China starting in 2009. Two older gas fields, Samandepe and Altyn Asyr, in Turkmenistan's southeastern Mary province, will

TRANS-ASIAN, KAZAKHSTAN-CHINA PIPELINES

Fig. 2

likely supply the remaining 13 billion cu m/year. Turkmenistan's president, Gurbanguly Berdimuhamedov says the two fields will yield additional volumes of gas after new processing facilities are installed.[5]

Gas fields in the Mary province have traditionally been used to supply gas to Russia and Europe. Gazprom's main resource base for these supplies, however, is Daulatabad-Sovetabad field and not Samandepe and Altyn Asyr fields, which will feed the pipeline to China.

Turkmenistan's plan to connect Mary's gas fields to a potential Turkmenistan-Afghanistan-Pakistan-India gas pipeline, however, could intensify international competition for Turkmen gas resources, despite the relatively recent discovery of the giant South Yolotan, Osman, and Yashlar fields.[6]

To ensure additional gas supplies from Central Asia, Beijing has continued to develop energy relations with Uzbekistan and Kazakhstan. China and Uzbekistan agreed in May 2007 to develop jointly Mingbulak field in the Fergana valley.

KazTransGaz and Trans-Asia Gas Pipeline Ltd. (owned by China National Oil and Gas Exploration and Development Corp., a subsidiary of CNPC) formed a joint venture in February 2008 to be sole operator of the Kazakh section of the Turkmenistan-China pipeline. Trans-Asia Gas Pipeline Ltd. formed similar joint ventures with relevant Uzbek and Turkmen gas companies to operate their respective sections of the gas pipeline.

Kazakhstan-China Pipeline

The Western Kazakhstan-Western China (Beyneu-Bozoy-Kyzylorda-Chimkent) gas pipeline will be 1,480 km long and have a 1,016-1,067-mm OD and a projected annual capacity of 10 billion cu m/year. This pipeline project, first initiated in 2005, has undergone a number of changes including its route and annual capacity.

Kazakhstan and China initially planned to build the pipeline along a central route—Atyrau (Makat-Aktobe (Zhanazhol)-Chelkar-Atasu-Dostyk-Alashankou—with a capacity of 30 billion cu m/year, projected to reach 40 billion cu m/year by 2015. The countries have since cut capacity to 10 billion cu m/year due to economics.

Complications and delays regarding development of Kazakhstan's Caspian hydrocarbon resources (especially Kashagan) initially cut into forecasts regarding Kazakh gas output, affecting the planned pipeline's capacity. A preliminary cost estimate of $3.84 billion recouped over 30 years also caused Chinese investors to pause, particularly in light of additional estimates that gas transported via this pipeline would cost almost three times as much as gas imported from Uzbekistan.

Two factors have likely driven the change from the central route to the current one: access to a larger number of gas resources and the need to deliver gas to southern Kazakhstan. Beyneu, part of the CAC network and close to Caspian hydrocarbon fields, provides a better starting point than Atyrau. Beyneu is also a connecting point to the Okarem-Beyneu gas pipeline (473 km), with access to the Caspian resources of Turkmenistan.

Petronas modernized the Beyneu pipeline, feeding into CAC-3 at a rate of 10 billion cu m/year.

KazTransGaz and Petronas Carigali (Turkmenistan), an affiliate of Malaysia's Petronas Carigali Overseas, signed a memorandum of understanding in June 2006 covering transportation of natural gas from Turkmenistan via Kazakhstan.

Petronas is developing hydrocarbon fields in the Turkmen part of the Caspian having an estimated resource base of 1 trillion cu m and recoverable gas reserves as large as 545 billion cu m.

Petronas intends to produce 5 billion cu m of gas from these fields in 2009 and build an offshore gas terminal by 2010 feeding into the Okarem-Beyneu line at a rate of 10 billion cu m/year. Kazmunaigaz intends to buy Turkmen gas from Petronas and transport it to southern Kazakhstan and possibly China.

Bozoy, on the Aral Sea, sits as another strategic point on the proposed Western Kazakhstan-Western China pipeline. Uzbek Aral gas reserves measure 0.5-1 trillion cu m. Uzbekistan signed a production sharing agreement in August 2006 between its state natural gas holding company Uzbekneftegaz (Uzbekistan), Lukoil (Russia), Petronas (Malaysia), CNPC (China) and two Korean companies, KNOC and steel manufacturer POSCO. All companies have an equal share of 20% in the consortium, except for Korea's 20% stake which is divided between KNOC (10.2%) and POSCO (9.8%).

CNPC and Petronas's participation in the consortium could secure gas supplies from the Aral fields for the new pipeline, an idea also backed by Uzbekistan. Aral Sea gas production is scheduled to start by 2012, eventually reaching a peak of about 25 billion cu m/year. Kazakhstan's own gas from fields in Aktobe province could also travel through the new pipeline. China's main gas asset in Kazakhstan, Zhanazhol field, also lies in Aktobe province.

Running the pipeline through Kyzylorda could connect potential gas output from Kumkol hydrocarbon fields at Akshabulak to market. Russian Lukoil and CNPC are jointly developing these resources, with gas production reaching 119 million cu m in 2006. Lukoil and CNPC signed a strategic partnership agreement in September 2007 to bring gas to China from Kumkol.

Apart from potential exports to China, the pipeline will improve supplies to the central, eastern, and southern parts of Kazakhstan; particularly Kyzylorda, South Kazakhstan, Zhambyl, and Almaty provinces. Domestic consumption in this area will reach 6-7 billion cu m/year by 2015, 8.5 billion cu m/year by 2020, and as much as 10 billion cu m/year if a gas pipeline network is constructed in Almaty province. This plan will turn the main gas routes of central Kazakhstan into a unified system and provide the country with greater flexibility in supplying gas to different markets and making location swaps.

Kazakhstan will first connect the CAC and Bukhara-Ural gas trunklines. It will then, according to an agreement with Russia to send gas from Karachaganak to the Orenburg gas processing plant, build an interconnector pipeline between the Soyuz, Orenburg-Novopskov, and CAC trunk pipelines, supplying Caspian gas to the industrial and urban centers in the southern part of the country.

Kazakhstan views the pipeline to China as an energy security project, ensuring its domestic gas demand can be met without relying on imports. Prime Minister Karim Masimov says the government is examining three options for financing the project: full state financing; soliciting a loan to Kazmunaigaz, guaranteed by the state; and a state-private partnership.[7]

CNPC and Kazmunaigaz signed a preliminary agreement in early November 2008 covering construction of the Western Kazakhstan-Western China gas pipeline, with 5 billion cu m/year of gas to be sent to China and roughly 5 billion cu m/year for use in southern Kazakhstan.[8]

Previous agreements call for pipeline construction to begin in 2010 and be completed in two stages by 2015. Initial Kazakh gas exports to China will rely on gas produced by CNPC at Zhanazhol field.[9] ✦

References

1. This series is based in part on "Kazahkstan's Gas: Export Markets and Export Routes," Oxford Institute for Energy Studies, 2008.
2. www.kmg.kz/.
3. www.gazprom.com/eng/articles/article29535.shtml.
4. Kirill, M., "Costs of Victory," Kommersant, June 29, 2007.
5. "Turkmenistan to start supplies of natural gas to China according to schedule," Turkmenistan.ru, Sept. 19, 2008.
6. "Turkmenistan Gas Production and Export: the next 10 years," Oxford Institute for Energy Studies, 2009.
7. Kazakhstan-Segodnya, Feb. 26, 2008.
8. "Kazmunaigaz i CNPC dogovorilis' sotrunichat' po proektu stroitel'stva gazaprovoda Kazakhstan-Kitai," Oil of Russia, Nov. 5, 2008.
9. "Kazakhstan and China signed an agreement on the expansion of cooperation in the gas sector," Xinhua News Agency, Nov. 2, 2008.

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ABS,

Houston, has appointed a global materials engineering team headed by Michael Wheatcroft. Formation of the team comes in response to the proliferating introduction of new materials within the structure and components of offshore units and vessels. The team will also provide in-field support to the society's surveyors attending the significant growth in the number of equipment suppliers. ABS veteran Wheatcroft has been promoted to the new position of assistant chief engineer for materials and chief metallurgist. He leads a team of specialist material engineers who have been assigned to ABS engineering offices in the US, Europe, and Asia. The global materials team will be supported by the ABS corporate technology department so that the innovative value of its ongoing research in the application of new materials can be practically and consistently applied to both vessel structures and equipment components. The materials team is also expected to play a hands-on role in the review and acceptance of traditional elements of the ship, principally castings and forgings, which are being manufactured by newer entities.


Wheatcroft

Founded in 1862, ABS is a leading international classification society devoted to promoting the security of life, property, and the marine environment through the development and verification of standards for the design, construction, and operational maintenance of marine-related facilities.

GulfMark Offshore Inc.,

Houston, has promoted three executives to key positions in the company's accounting, finance, and internal audit/compliance functions. Quintin V. Kneen has been named senior vice-president, finance and administration. He will be responsible for all finance functions of the company, including accounting, finance, and treasury, as well as tax and investor relations. He will transition to the role of CFO subsequent to the company's filing of its 2008 10-K in February 2009, as Ed Guthrie, currently executive vice-president and CFO, moves into the role of assisting Gulfmark CEO and Pres. Bruce Streeter prior to his retirement in 2009. Kneen joined GulfMark in June 2008. Previously, he was vice-president, finance and investor relations, for Grant Prideco Inc. Prior to joining Grant Prideco, he held executive finance positions at Azurix Corp. and was an audit manager with the Houston office of Price Waterhouse LLP. He holds an MBA from Rice University and a BBA in accounting from Texas A&M University and is a CPA and CFA. Samuel R. Rubio has been appointed vice-president, controller, and chief accounting officer. He will be responsible for all accounting functions of the company and for all regulatory filings of the company with the SEC and compliance with current accounting standards. Rubio has been with GulfMark since 2005, when he joined the group as assistant controller, and was promoted to controller in 2007. With more than 25 years of accounting experience, Rubio has a BBA from Sul Ross State University and is a CPA. Anthony L. White has been promoted to vice-president, internal audit, and chief compliance officer. He will coordinate the company's internal audit function and compliance with Sarbanes Oxley in addition to monitoring and improving internal control processes throughout the company. White has been responsible for developing the internal audit function at GulfMark since 2005, when he joined the company as director, internal audit. He has a BS and an MBA from the University of Kentucky and had more than 15 years of financial and audit experience prior to joining GulfMark in 2005.

Meanwhile, Carla S. Mashinski, has resigned her position as vice-president, accounting, and chief accounting officer to pursue other interests.

GulfMark provides marine transportation services to the energy industry worldwide through a fleet of 93 offshore support vessels.

Seismic Micro-Technology,

Houston, has announced that it is now an independent software vendor (ISV) partner with Hewlett-Packard (Canada) Co. Through this ISV partnership, HP Canada will supply PC-based hardware, workstations, high-end graphics cards, and high-end mobile workstations to SMT customers to maximize the performance of KINGDOM, SMT's seismic interpretation software. SMT KINGDOM operates on all 64-bit and 32-bit Windows-based platforms available through HP Canada. Customers who wish to migrate to a 64-bit environment also have the ability to simultaneously run 32- and 64-bit applications.

SMT is a market leader for Windows-based geoscientific interpretation. SMT software enables intuitive interpretation, validation, risk reduction, and data management in one integrated executable.

HP, the world's largest technology company, simplifies the technology experience for consumers and businesses with a portfolio that spans printing, personal computing, software, services, and IT infrastructure.

Swagelok Co.,

Solon, Ohio, has appointed Deric Wallace regional director, Europe. He will be responsible for all aspects of business development and sales and service support within the region. Wallace joined Swagelok in 1996 as a project manager. In 1999, he was appointed manager of the European technical center at Swagelok AG in Switzerland. In 2003, he was promoted to business development manager for the European region. His role expanded in 2007, when Wallace was named regional manager for Europe, Middle East, and Africa. His work focused on the development and execution of the strategic goals of the region. Wallace attended the University of Akron in Ohio and the University of Regensburg in Germany. He holds a BS in international business and German.


Wallace

Swagelok is a major developer and provider of fluid system solutions, including products, assemblies, and services for the research, instrumentation, pharmaceutical, oil and gas, power, petrochemical, alterna-

tive fuels, and semiconductor industries.

CGGVeritas,

Paris, has marked milestones on two acquisitions. Its subsidiary Sercel has entered into a private transaction to purchase all existing shares in Quest Geo Solutions Ltd., a UK-based software company, for cash. The acquisition continues to broaden Sercel's product offering and comes as a logical extension to the existing partnership between the two companies, whereby Sercel distributes Quest navigation software such as Triggerfish and Geometis. It also provides Sercel with increased development and support resources for its navigation software division and its newly released SeaPro Nav product.

Meanwhile, CGGVeritas has announced the success of its voluntary exchange tender offer made for all the shares of Wavefield Inseis ASA that closed on December 12, 2008, and declared the offer unconditional effective Dec. 19, 2008. More than 90 million Wavefield shares, representing 69.7% of the share capital and the voting rights of Wavefield, have been tendered to the offer. CGGVeritas will issue one newly issued share for seven Wavefield shares, corresponding to 9.4% of CGGVeritas share capital and 8.9% of voting rights. CGGVeritas is required to launch a mandatory offer for all remaining Wavefield shares its does not own. In the event that CGGVeritas owns more than 90% of the shares of Wavefield upon completion of the mandatory offer, the company will launch a compulsory acquisition of the remaining Wavefield shares, which is expected to be completed by the end of February 2009.

CGGVeritas is a leading international pure-play geophysical company delivering a wide range of technologies, services, and equipment.

Transocean Inc.,

Houston, has completed its change of place of incorporation from Cayman Islands to Switzerland. In the transaction, each outstanding ordinary share of Transocean Inc. was exchanged for one share of Transocean Ltd. The shares of Transocean Ltd. will be listed on the New York Stock Exchange under the trading symbol "RIG," the same symbol under which the ordinary shares of Transocean Inc. were listed.

Transocean is the world's largest offshore drilling contractor and the leading provider of drilling management services worldwide.

With a fleet of 136 mobile offshore drilling units plus 10 announced ultradeepwater newbuild units, the company's fleet is considered one of the most modern and versatile in the world due to its emphasis on technically demanding segments of the offshore drilling business. The company owns or operates a contract drilling fleet of 39 high-specification floaters (ultradeepwater, deepwater, and harsh-environment semisubmersibles and drillships), 29 midwater floaters, 10 high-specification jack ups, 54 standard jackups, and other assets utilized in the support of offshore drilling activities worldwide.

MAN Turbo,

Oberhausen, Germany, has acquired through its US affiliate Louisiana-based Baton Rouge Machine Works Inc. and its sister company, Alabama-based Holley Machinery Inc., for $19 million. Baton Rouge Machine Works is an established service supplier for turbo machinery. Its portfolio includes the production and servicing of large and heavy components as well as field service. The company serves chemical and petrochemical plants, refineries, and the upstream oil and gas industry. The acquisition of Baton Rouge Machine Works serves to strengthen MAN Turbo's regional presence in the US after-sales service market. The company recently acquired the Texas service specialist HB Turbo and now has service shops strategically located throughout the Gulf Coast region.

Leitko

The MAN Turbo Group, a subsidiary of MAN AG, Munich, offers one of the most comprehensive product ranges of turbines and compressors in the world and occupies a leading position on the global market for turbomachinery.

Alliance Engineering,

Houston, has appointed Scott Leitko vice-president of corporate strategy. A veteran of 20 years in the oil and gas industry, he has been with Alliance since 2005, most recently as vice-president of engineering. He is a registered professional engineer in Texas. Alliance, part of John Wood Group PLC, is an independent services provider to the international oil and gas industry. Alliance specializes in engineering, design, procurement, project management, and construction management of onshore and offshore upstream oil and gas facilities and structures. Capabilities range from feasibility studies through complete turnkey installations.

Wood Group is an international energy services company with three businesses—engineering and production facilities, well support, and gas turbine services—providing a range of engineering, production support, maintenance management, and industrial gas turbine overhaul and repair services to the oil and gas and power generation industries worldwide.

Subsea 7 Inc.,

Westhill, UK, has been awarded a 1-year inspection, repair, and maintenance services agreement by TAQA Bratani Ltd., part of Abu Dhabi National Energy Co., for the provision of project management, engineering, dive support, and remote intervention services to assist with work on TAQA's newly acquired northern North Sea assets. TAQA became operator of its newly acquired assets Cormorant North, Cormorant South, Eider, Kestrel, Tern, and Pelican on Dec. 1, 2008. A Subsea 7 project team, based in the company's new Aberdeen office, will manage work scopes under the frame agreement, the first of which commenced in mid-December.

Subsea 7 is one of the world's leading subsea engineering and construction companies, offering all the expertise and assets that make subsea, umbilical, riser, and flowline field development possible.

The company's global offshore operations are supported out of the North Sea, Africa, Brazil, North America, and Asia-Pacific regions. Subsea 7 has a fleet of industry leading, dynamically positioned ships capable of reeled and flexible pipelay, subsea construction, and saturation diving and a portfolio of pipeline construction yards worldwide.

New service helps upstream operations track stock

StockNet, one of a new generation of web-based reporting services for the industry's upstream operations, is designed to transform the way stock is tracked.

Features include simplicity, ease, and speed of use. Training rarely takes more than 15 min, and it can enable users to raise a manifest in 2 or 3 min, the company points out.

StockNet is designed to incorporate all logistics information and make it easy to share and transfer. Its master equipment list can be shared, and all the information can be viewed offshore, in advance. The purchasing tool allows users to raise purchase orders, while a link to the firm's CostNet service allows invoice generation. The drag and drop facility to build manifests and load-out lists helps eliminate the time spent creating multiple spreadsheets and the errors associated with cutting and pasting.

The system incorporates a rental register and even flags up a reminder if items remain on hire for longer than intended. Being web-based, StockNet is easy to share with vendors and partners and can be used as a stand-alone system or as part of a wider package while background synchronization helps ensure that all nodes of the service are up to date, the company says.

It is also possible within StockNet to scan the certification documentation and attach it to the inventory list right at the line item level.

The service allow users to be given different rights of access through secure and personalized accounts. All data are stored and backed up on remote servers and are easily recoverable, the firm notes.

Source: **Independent Data Services,** Suite 08.03, 8th Floor, Menara Keck Seng, 203 Jalan Bukit Bintang, Kuala Lumpur 55100, Malaysia.

New process pump

This new process pump offers oil-free operation without risk of medium contamination and can be equipped with

a double diaphragm system for increased safety. Typical uses include air and gas sampling, vapor recovery, and analytical instrumentation for refining and chemical and petrochemical plants

All Type N0150 pumps can be customized to meet application requirements. Versions can be supplied with explosion-proof motors for compliance with ATEX and Class 1 Division 1 Groups C and D hazardous locations, corrosion-resistant models can be developed to withstand harsh environments, specialized leaktight capabilities can be enhanced, and a range of available pump materials can be specified to expand application potential.

Depending on model, these pumps can achieve flow rates up to 300 l./min, maximum vacuums as high as 29.3 in. Hg, and maximum pressure up to 30 psig.

Source: **KNF Neuberger Inc.,** 2 Black Forest Rd., Trenton, NJ 08691-1810.

Imports of crude and products

	Districts 1-4		District 5		Total US		
	12-12 2008	12-5 2008	12-12 2008	12-5 2008	12-12 2008	12-5 2008	*12-14 2007
	1,000 b/d						
Total motor gasoline	743	1,106	59	0	802	1,106	1,108
Mo. gas. blending comp.	607	940	59	0	666	940	704
Distillate	175	99	0	4	175	103	249
Residual	276	312	0	0	276	312	610
Jet fuel-kerosine	40	21	5	5	45	26	190
Propane-propylene	291	207	8	15	299	222	136
Other	574	103	101	2	675	105	510
Total products	**2,706**	**2,788**	**232**	**26**	**2,938**	**2,814**	**3,507**
Total crude	**8,839**	**8,787**	**834**	**1,172**	**9,673**	**9,959**	**9,111**
Total imports	**11,545**	**11,575**	**1,066**	**1,198**	**12,611**	**12,773**	**12,618**

*Revised.
Source: US Energy Information Administration
Data available in OGJ Online Research Center.

Purvin & Gertz LNG netbacks—Dec. 19, 2008

Receiving terminal	Liquefaction plant					
	Algeria	Malaysia	Nigeria	Austr. NW Shelf	Qatar	Trinidad
	$/MMbtu					
Barcelona	12.08	10.05	11.29	9.95	10.61	11.22
Everett	5.01	3.25	4.70	3.36	3.67	5.25
Isle of Grain	7.78	5.91	7.22	5.83	6.35	7.24
Lake Charles	3.19	1.67	3.01	1.81	1.94	3.69
Sodegaura	9.09	11.19	9.36	10.91	10.25	6.20
Zeebrugge	11.39	8.29	10.79	8.05	9.61	10.79

Definitions, see OGJ Apr. 9, 2007, p. 57.
Source: Purvin & Gertz Inc.
Data available in OGJ Online Research Center.

Crude and product stocks

District	Crude oil	Motor gasoline		Jet fuel, kerosine	Fuel oils		Propane-propylene
		Total	Blending comp.[1]		Distillate	Residual	
	1,000 bbl						
PADD 1	13,144	56,057	32,603	8,919	53,931	12,720	3,566
PADD 2	75,289	47,279	18,244	7,145	27,176	1,194	19,783
PADD 3	165,478	66,164	34,057	11,673	35,866	16,558	32,919
PADD 4	14,164	6,940	2,384	541	3,160	262	[1]2,626
PADD 5	53,214	27,519	23,032	9,638	13,390	5,196	—
Dec. 12, 2008	**321,289**	**203,959**	**110,320**	**37,916**	**133,523**	**35,930**	**58,894**
Dec. 5, 2008	**320,764**	**202,664**	**109,174**	**39,315**	**130,587**	**38,037**	**61,144**
Dec. 14, 2007[2]	**296,932**	**205,221**	**98,437**	**39,331**	**129,376**	**42,215**	**57,942**

[1]Includes PADD 5. [2]Revised.
Source: US Energy Information Administration
Data available in OGJ Online Research Center.

Refinery report—Dec. 12, 2008

District	Refinery operations		Refinery output				
	Gross inputs	Crude oil inputs	Total motor gasoline	Jet fuel, kerosine	Fuel oils: Distillate	Fuel oils: Residual	Propane-propylene
	1,000 b/d						
PADD 1	1,269	1,269	2,292	78	429	106	64
PADD 2	3,151	3,115	2,244	193	1,005	51	186
PADD 3	7,330	7,280	2,793	594	2,418	259	604
PADD 4	538	534	316	17	221	13	[1]139
PADD 5	2,526	2,354	1,554	433	544	105	—
Dec. 12, 2008	**14,814**	**14,552**	**9,199**	**1,315**	**4,617**	**534**	**993**
Dec. 5, 2008	**15,398**	**14,967**	**8,999**	**1,391**	**4,654**	**573**	**1,202**
Dec. 14, 2007[2]	**15,316**	**15,240**	**9,112**	**1,383**	**4,315**	**616**	**1,105**
	17,610 Operable capacity		**84.1% utilization rate**				

[1]Includes PADD 5. [2]Revised.
Source: US Energy Information Administration
Data available in OGJ Online Research Center.

Additional analysis of market trends is available through **OGJ Online**, *Oil & Gas Journal's* electronic information source, at http://www.ogjonline.com.

OIL&GAS JOURNAL online research center

OGJ crack spread

	*12-19-08	*12-21-07	Change	Change, %
	$/bbl			
SPOT PRICES				
Product value	48.43	101.55	–53.13	–52.3
Brent crude	42.81	92.42	–49.61	–53.7
Crack spread	5.61	9.13	–3.52	–38.5
FUTURES MARKET PRICES				
One month				
Product value	49.22	102.37	–53.15	–51.9
Light sweet crude	39.65	91.35	–51.70	–56.6
Crack spread	9.57	11.03	–1.46	–13.2
Six month				
Product value	57.94	104.89	–46.94	–44.8
Light sweet crude	51.67	90.21	–38.54	–42.7
Crack spread	6.27	14.67	–8.40	–57.3

*Average for week ending.
Source: Oil & Gas Journal
Data available in OGJ Online Research Center.

OGJ GASOLINE PRICES

	Price ex tax 12-17-08	Pump price* 12-17-08	Pump price 12-19-07
	¢/gal		
(Approx. prices for self-service unleaded gasoline)			
Atlanta	126.0	172.5	303.0
Baltimore	120.6	162.5	298.6
Boston	125.6	167.5	296.6
Buffalo	107.4	168.3	312.4
Miami	119.9	171.5	311.7
Newark	140.7	173.3	286.6
New York	117.5	178.4	299.6
Norfolk	129.9	168.3	291.6
Philadelphia	126.7	177.4	300.3
Pittsburgh	131.7	182.4	302.0
Wash., DC	149.0	187.4	300.8
PAD I avg	126.8	173.6	300.3
Chicago	111.2	175.6	319.1
Cleveland	108.7	155.1	296.2
Des Moines	120.1	160.5	288.6
Detroit	107.5	166.9	298.7
Indianapolis	106.2	165.6	295.9
Kansas City	119.2	155.2	281.9
Louisville	120.7	161.6	289.7
Memphis	115.1	154.9	290.5
Milwaukee	109.4	160.7	290.0
Minn.-St. Paul	115.6	159.6	289.7
Oklahoma City	115.5	150.9	279.3
Omaha	107.5	152.8	286.1
St. Louis	130.3	166.3	289.6
Tulsa	119.2	154.6	275.4
Wichita	111.6	155.0	282.1
PAD II avg	114.5	159.7	290.2
Albuquerque	133.5	169.9	291.8
Birmingham	126.2	165.5	287.9
Dallas-Fort Worth	123.7	162.1	282.2
Houston	113.5	151.9	282.1
Little Rock	120.3	160.5	290.6
New Orleans	128.9	167.3	291.7
San Antonio	132.5	170.9	277.7
PAD III avg	125.5	164.0	286.3
Cheyenne	124.5	156.9	287.5
Denver	125.6	166.0	298.9
Salt Lake City	118.0	160.9	300.2
PAD IV avg	122.7	161.2	295.5
Los Angeles	110.8	177.9	327.6
Phoenix	131.4	168.8	291.3
Portland	140.4	183.8	312.5
San Diego	121.7	188.8	335.7
San Francisco	117.6	184.7	350.9
Seattle	122.9	178.8	319.2
PAD V avg	124.1	180.4	322.9
Week's avg.	**121.5**	**167.1**	**297.2**
Nov. avg.	**169.9**	**215.5**	**307.6**
Oct. avg.	**272.3**	**317.6**	**280.9**
2008 to date	**285.0**	**329.3**	—
2007 to date	**234.7**	**278.2**	—

*Includes state and federal motor fuel taxes and state sales tax. Local governments may impose additional taxes.
Source: Oil & Gas Journal.
Data available in OGJ Online Research Center.

REFINED PRODUCT PRICES

	12-12-08 ¢/gal		12-12-08 ¢/gal
Spot market product prices			
Motor gasoline (Conventional-regular)		Heating oil No. 2	
New York Harbor	106.50	New York Harbor	146.85
Gulf Coast	105.00	Gulf Coast	131.80
Los Angeles	104.55	Gas oil	
Amsterdam-Rotterdam-Antwerp (ARA)	96.31	ARA	147.77
Singapore	103.14	Singapore	134.40
Motor gasoline (Reformulated-regular)		Residual fuel oil	
New York Harbor	103.75	New York Harbor	87.21
Gulf Coast	107.30	Gulf Coast	96.95
Los Angeles	110.55	Los Angeles	103.65
		ARA	92.43
		Singapore	89.85

Source: DOE Weekly Petroleum Status Report.
Data available in OGJ Online Research Center.

BAKER HUGHES RIG COUNT

	12-19-08	12-21-07
Alabama	4	5
Alaska	12	9
Arkansas	55	43
California	38	37
Land	38	35
Offshore	0	2
Colorado	101	104
Florida	1	0
Illinois	0	0
Indiana	2	2
Kansas	18	15
Kentucky	9	8
Louisiana	172	159
N. Land	87	57
S. Inland waters	9	27
S. Land	23	27
Offshore	53	48
Maryland	0	1
Michigan	0	1
Mississippi	21	11
Montana	11	10
Nebraska	0	0
New Mexico	63	72
New York	4	5
North Dakota	81	52
Ohio	12	13
Oklahoma	165	196
Pennsylvania	24	20
South Dakota	1	0
Texas	824	894
Offshore	8	12
Inland waters	0	2
Dist. 1	20	18
Dist. 2	35	35
Dist. 3	59	76
Dist. 4	80	86
Dist. 5	163	186
Dist. 6	132	123
Dist. 7B	27	40
Dist. 7C	57	58
Dist. 8	105	119
Dist. 8A	31	28
Dist. 9	43	48
Dist. 10	64	63
Utah	33	38
West Virginia	30	36
Wyoming	71	65
Others—NV-4; TN-4; VA-3; WA-1	12	13
Total US	**1,764**	**1,809**
Total Canada	**369**	**372**
Grand total	**2,133**	**2,181**
Oil rigs	387	343
Gas rigs	1,366	1,461
Total offshore	67	62
Total cum. avg. YTD	**1,882**	**1,768**

Rotary rigs from spudding in to total depth.
Definitions, see OGJ Sept. 18, 2006, p. 42.

Source: Baker Hughes Inc.
Data available in OGJ Online Research Center.

SMITH RIG COUNT

Proposed depth, ft	12-19-08 Rig count	12-19-08 Percent footage*	12-21-07 Rig count	12-21-07 Percent footage*
0-2,500	93	4.3	63	6.3
2,501-5,000	110	53.6	115	60.8
5,001-7,500	248	16.1	218	24.7
7,501-10,000	405	2.9	456	1.5
10,001-12,500	385	2.0	427	4.4
12,501-15,000	349	0.2	277	—
15,001-17,500	156	—	121	—
17,501-20,000	78	—	67	—
20,001-over	35	—	32	—
Total	**1,859**	**6.6**	**1,776**	**8.6**
INLAND	22		34	
LAND	1,785		1,689	
OFFSHORE	52		53	

*Rigs employed under footage contracts.
Definitions, see OGJ Sept. 18, 2006, p. 42.

Source: Smith International Inc.
Data available in OGJ Online Research Center.

OGJ PRODUCTION REPORT

	[1]12-19-08	[2]12-21-07
	1,000 b/d	
(Crude oil and lease condensate)		
Alabama	20	21
Alaska	689	739
California	654	657
Colorado	62	62
Florida	6	7
Illinois	28	25
Kansas	100	94
Louisiana	1,144	1,210
Michigan	15	14
Mississippi	61	60
Montana	97	92
New Mexico	165	161
North Dakota	178	134
Oklahoma	178	167
Texas	1,312	1,333
Utah	54	53
Wyoming	151	146
All others	64	71
Total	**4,978**	**5,046**

[1]OGJ estimate. [2]Revised.

Source: Oil & Gas Journal.
Data available in OGJ Online Research Center.

US CRUDE PRICES

	12-19-08 $/bbl*
Alaska-North Slope 27°	68.18
South Louisiana Sweet	32.25
California-Kern River 13°	19.65
Lost Hills 30°	28.10
Wyoming Sweet	18.87
East Texas Sweet	29.75
West Texas Sour 34°	22.50
West Texas Intermediate	30.25
Oklahoma Sweet	30.25
Texas Upper Gulf Coast	25.75
Michigan Sour	23.25
Kansas Common	29.50
North Dakota Sweet	14.25

*Current major refiner's posted prices except North Slope lags 2 months. 40° gravity crude unless differing gravity is shown.

Source: Oil & Gas Journal.
Data available in OGJ Online Research Center.

WORLD CRUDE PRICES

$/bbl[1]	12-12-08
United Kingdom-Brent 38°	41.17
Russia-Urals 32°	39.77
Saudi Light 34°	38.40
Dubai Fateh 32°	39.54
Algeria Saharan 44°	41.65
Nigeria-Bonny Light 37°	44.02
Indonesia-Minas 34°	42.01
Venezuela-Tia Juana Light 31°	38.52
Mexico-Isthmus 33°	38.41
OPEC basket	40.36
Total OPEC[2]	39.11
Total non-OPEC[2]	38.26
Total world[2]	38.73
US imports[3]	36.58

[1]Estimated contract prices. [2]Average price (FOB) weighted by estimated export volume. [3]Average price (FOB) weighted by estimated import volume.

Source: DOE Weekly Petroleum Status Report.
Data available in OGJ Online Research Center.

US NATURAL GAS STORAGE[1]

	12-12-08	12-5-08	12-12-07	Change, %
	bcf			
Producing region	933	955	985	–5.3
Consuming region east	1,780	1,871	1,757	1.3
Consuming region west	454	465	431	5.3
Total US	**3,167**	**3,291**	**3,173**	**–0.2**
	Sept. 08	**Sept. 07**		
Total US[2]	**3,163**	**3,316**		**–4.6**

[1]Working gas. [2]At end of period.
Source: Energy Information Administration
Data available in OGJ Online Research Center.

Imports of crude and products

	Districts 1–4		District 5		Total US		
	12-19 2008	12-12 2008	12-19 2008	12-12 2008	12-19 2008	12-12 2008	*12-21 2007
	1,000 b/d						
Total motor gasoline	1,254	743	0	59	1,254	802	1,015
Mo. gas. blending comp.	1,064	607	0	59	1,064	666	600
Distillate	240	175	0	0	240	175	145
Residual	386	276	236	0	622	276	269
Jet fuel–kerosine	111	40	0	5	111	45	153
Propane–propylene	229	291	11	8	240	299	122
Other	134	574	–3	101	131	675	798
Total products	**3,418**	**2,706**	**244**	**232**	**3,662**	**2,938**	**3,102**
Total crude	**8,046**	**8,839**	**1,072**	**834**	**9,118**	**9,673**	**9,805**
Total imports	**11,464**	**11,545**	**1,316**	**1,066**	**12,780**	**12,611**	**12,907**

*Revised.
Source: US Energy Information Administration
Data available in OGJ Online Research Center.

Purvin & Gertz LNG netbacks—Dec. 26, 2008

Receiving terminal	Liquefaction plant					
	Algeria	Malaysia	Nigeria	Austr. NW Shelf	Qatar	Trinidad
	$/MMbtu					
Barcelona	12.08	10.06	11.30	9.96	10.61	11.22
Everett	5.32	3.50	5.02	3.61	3.95	5.57
Isle of Grain	7.57	5.88	7.03	5.79	6.29	7.04
Lake Charles	3.50	1.91	3.31	2.05	2.19	4.01
Sodegaura	7.10	11.19	7.37	10.91	10.25	6.55
Zeebrugge	11.39	7.57	10.49	7.48	8.63	10.60

Definitions, see OGJ Apr. 9, 2007, p. 57.
Source: Purvin & Gertz Inc.
Data available in OGJ Online Research Center.

Crude and product stocks

District	Crude oil	Motor gasoline		Jet fuel, kerosine	Fuel oils		Propane-propylene
		Total	Blending comp.[1]		Distillate	Residual	
	1,000 bbl						
PADD 1	13,303	58,169	34,816	8,838	53,026	12,441	3,459
PADD 2	78,845	46,783	17,795	6,551	28,561	1,059	19,558
PADD 3	158,689	69,143	34,853	11,663	37,792	17,326	32,983
PADD 4	13,751	7,079	2,561	474	2,913	261	[1]2,518
PADD 5	53,600	26,121	21,713	9,821	13,045	4,906	—
Dec. 19, 2008	**318,188**	**207,295**	**111,738**	**37,347**	**135,337**	**35,993**	**58,518**
Dec. 12, 2008	**321,289**	**203,959**	**110,320**	**37,916**	**133,523**	**35,930**	**58,787**
Dec. 21, 2007[2]	**293,633**	**205,857**	**100,162**	**39,245**	**126,608**	**40,991**	**56,061**

[1]Includes PADD 5. [2]Revised.
Source: US Energy Information Administration
Data available in OGJ Online Research Center.

Refinery report—Dec. 19, 2008

District	Refinery operations		Refinery output				
	Gross inputs	Crude oil inputs	Total motor gasoline	Jet fuel, kerosine	Fuel oils: Distillate	Fuel oils: Residual	Propane-propylene
	1,000 b/d						
PADD 1	1,239	1,231	2,288	69	426	111	66
PADD 2	3,173	3,139	2,222	158	1,015	40	177
PADD 3	7,374	7,198	2,794	664	2,295	352	609
PADD 4	524	521	312	20	197	11	[1]141
PADD 5	2,602	2,422	1,474	479	471	114	—
Dec. 19, 2008	**14,912**	**14,511**	**9,090**	**1,390**	**4,404**	**628**	**993**
Dec. 12, 2008	**14,814**	**14,552**	**9,199**	**1,315**	**4,617**	**534**	**993**
Dec. 21, 2007[2]	**15,359**	**15,218**	**9,004**	**1,452**	**4,294**	**742**	**1,145**
	17,610 Operable capacity		**84.7% utilization rate**				

[1]Includes PADD 5. [2]Revised.
Source: US Energy Information Administration
Data available in OGJ Online Research Center.

Additional analysis of market trends is available through **OGJ Online**, *Oil & Gas Journal's* electronic information source, at http://www.ogjonline.com.

OIL&GAS JOURNAL online research center

OGJ crack spread

	*12-26-08	*12-28-07	Change $/bbl	Change, %
SPOT PRICES				
Product value	41.66	105.72	–64.06	–60.6
Brent crude	36.43	97.08	–60.65	–62.5
Crack spread	5.24	8.64	–3.40	–39.4
FUTURES MARKET PRICES				
One month				
Product value	42.76	106.02	–63.26	–59.7
Light sweet crude	37.99	95.68	–57.69	–60.3
Crack spread	4.77	10.34	–5.57	–53.9
Six month				
Product value	51.70	107.83	–56.13	–52.1
Light sweet crude	46.59	92.86	–46.27	–49.8
Crack spread	5.12	14.97	–9.85	–65.8

*Average for week ending.
Source: Oil & Gas Journal
Data available in OGJ Online Research Center.

OGJ GASOLINE PRICES

	Price ex tax 12-24-08	Pump price* 12-24-08	Pump price 12-26-07
	¢/gal		
(Approx. prices for self-service unleaded gasoline)			
Atlanta	124.3	170.8	302.3
Baltimore	118.9	160.8	298.1
Boston	123.9	165.8	296.1
Buffalo	105.8	166.7	311.4
Miami	118.2	169.8	310.5
Newark	139.1	171.7	286.1
New York	115.8	176.7	299.1
Norfolk	128.3	166.7	291.1
Philadelphia	125.0	175.7	299.4
Pittsburgh	130.0	180.7	301.3
Wash., DC	147.3	185.7	300.2
PAD I avg	125.1	171.9	299.6
Chicago	110.1	174.5	317.0
Cleveland	107.2	153.6	294.7
Des Moines	119.0	159.4	287.5
Detroit	106.2	165.6	296.8
Indianapolis	105.1	164.5	294.9
Kansas City	118.3	154.3	281.2
Louisville	119.6	160.5	288.5
Memphis	113.8	153.6	289.4
Milwaukee	108.2	159.5	287.9
Minn.-St. Paul	114.5	158.5	288.5
Oklahoma City	114.2	149.6	277.7
Omaha	106.2	151.5	286.0
St. Louis	129.4	165.4	288.5
Tulsa	118.1	153.5	273.7
Wichita	110.2	153.6	280.6
PAD II avg	113.3	158.5	288.9
Albuquerque	132.2	168.6	290.5
Birmingham	125.1	164.4	286.6
Dallas-Fort Worth	122.9	161.3	280.7
Houston	112.2	150.6	281.3
Little Rock	118.6	158.8	289.5
New Orleans	127.3	165.7	291.2
San Antonio	131.2	169.6	276.5
PAD III avg	124.2	162.7	285.2
Cheyenne	123.2	155.6	286.4
Denver	123.5	163.9	298.2
Salt Lake City	116.7	159.6	300.0
PAD IV avg	121.1	159.7	294.9
Los Angeles	108.1	175.2	327.1
Phoenix	128.8	166.2	291.0
Portland	137.8	181.2	312.1
San Diego	119.1	186.2	335.2
San Francisco	115.1	182.2	350.2
Seattle	120.3	176.2	318.3
PAD V avg	121.5	177.9	322.3
Week's avg.	**120.0**	**165.6**	**296.3**
Nov. avg.	**169.9**	**215.5**	**300.6**
Oct. avg.	**272.3**	**317.6**	**307.6**
2008 to date	**281.9**	**326.2**	—
2007 to date	**235.0**	**278.6**	—

*Includes state and federal motor fuel taxes and state sales tax. Local governments may impose additional taxes.
Source: Oil & Gas Journal.
Data available in OGJ Online Research Center.

REFINED PRODUCT PRICES

	12-19-08 ¢/gal		12-19-08 ¢/gal
Spot market product prices			
Motor gasoline (Conventional-regular)		Heating oil No. 2	
New York Harbor	96.75	New York Harbor	139.05
Gulf Coast	94.25	Gulf Coast	133.05
Los Angeles	121.75	Gas oil	
Amsterdam-Rotterdam-Antwerp (ARA)	98.30	ARA	145.85
Singapore	109.52	Singapore	141.55
Motor gasoline (Reformulated-regular)		Residual fuel oil	
New York Harbor	92.50	New York Harbor	81.26
Gulf Coast	96.00	Gulf Coast	89.60
Los Angeles	127.75	Los Angeles	103.65
		ARA	79.49
		Singapore	85.98

Source: DOE Weekly Petroleum Status Report.
Data available in OGJ Online Research Center.

BAKER HUGHES RIG COUNT

	12-26-08	12-28-07
Alabama	4	5
Alaska	12	7
Arkansas	53	42
California	37	35
Land	36	33
Offshore	1	2
Colorado	98	102
Florida	1	0
Illinois	0	0
Indiana	2	2
Kansas	20	15
Kentucky	8	8
Louisiana	173	158
N. Land	90	55
S. Inland waters	8	27
S. Land	22	27
Offshore	53	49
Maryland	0	1
Michigan	0	0
Mississippi	17	10
Montana	7	10
Nebraska	0	0
New Mexico	65	68
New York	4	5
North Dakota	80	47
Ohio	12	11
Oklahoma	159	198
Pennsylvania	24	20
South Dakota	1	0
Texas	801	885
Offshore	8	12
Inland waters	0	2
Dist. 1	16	17
Dist. 2	34	34
Dist. 3	56	74
Dist. 4	79	92
Dist. 5	152	183
Dist. 6	135	118
Dist. 7B	28	36
Dist. 7C	56	59
Dist. 8	101	116
Dist. 8A	29	27
Dist. 9	43	50
Dist. 10	64	65
Utah	29	35
West Virginia	30	36
Wyoming	72	69
Others—NV-4; TN-4; VA-3; WA-1	12	13
Total US	**1,721**	**1,782**
Total Canada	**279**	**260**
Grand total	**2,000**	**2,042**
Oil rigs	364	325
Gas rigs	1,347	1,452
Total offshore	68	63
Total cum. avg. YTD	**1,879**	**1,768**

Rotary rigs from spudding in to total depth.
Definitions, see OGJ Sept. 18, 2006, p. 42.

Source: Baker Hughes Inc.
Data available in OGJ Online Research Center.

SMITH RIG COUNT

Proposed depth, ft	Rig count	12-19-08 Percent footage*	Rig count	12-21-07 Percent footage*
0-2,500	93	4.3	63	6.3
2,501-5,000	110	53.6	115	60.8
5,001-7,500	248	16.1	218	24.7
7,501-10,000	405	2.9	456	1.5
10,001-12,500	385	2.0	427	4.4
12,501-15,000	349	0.2	277	—
15,001-17,500	156	—	121	—
17,501-20,000	78	—	67	—
20,001-over	35	—	32	—
Total	**1,859**	**6.6**	**1,776**	**8.6**
INLAND	22		34	
LAND	1,785		1,689	
OFFSHORE	52		53	

*Rigs employed under footage contracts.
Definitions, see OGJ Sept. 18, 2006, p. 42.

Source: Smith International Inc.
Data available in OGJ Online Research Center.

No new data as of press-time.

OGJ PRODUCTION REPORT

	[1]12-26-08	[2]12-28-07
	1,000 b/d	
(Crude oil and lease condensate)		
Alabama	20	21
Alaska	692	738
California	654	654
Colorado	62	60
Florida	7	7
Illinois	27	25
Kansas	101	90
Louisiana	1,149	1,230
Michigan	15	14
Mississippi	61	60
Montana	97	92
New Mexico	166	161
North Dakota	177	135
Oklahoma	176	164
Texas	1,309	1,336
Utah	54	53
Wyoming	151	145
All others	65	71
Total	**4,983**	**5,056**

[1]OGJ estimate. [2]Revised.

Source: Oil & Gas Journal.
Data available in OGJ Online Research Center.

US CRUDE PRICES

	12-26-08 $/bbl*
Alaska-North Slope 27°	68.18
South Louisiana Sweet	36.25
California-Kern River 13°	23.45
Lost Hills 30°	32.00
Wyoming Sweet	22.71
East Texas Sweet	33.75
West Texas Sour 34°	26.50
West Texas Intermediate	34.25
Oklahoma Sweet	34.25
Texas Upper Gulf Coast	29.75
Michigan Sour	27.25
Kansas Common	33.25
North Dakota Sweet	15.75

*Current major refiner's posted prices except North Slope lags 2 months. 40° gravity crude unless differing gravity is shown.

Source: Oil & Gas Journal.
Data available in OGJ Online Research Center.

WORLD CRUDE PRICES

$/bbl[1]	12-19-08
United Kingdom-Brent 38°	42.68
Russia-Urals 32°	40.72
Saudi Light 34°	41.90
Dubai Fateh 32°	42.95
Algeria Saharan 44°	44.42
Nigeria-Bonny Light 37°	47.03
Indonesia-Minas 34°	44.50
Venezuela-Tia Juana Light 31°	38.54
Mexico-Isthmus 33°	38.43
OPEC basket	42.54
Total OPEC[2]	41.91
Total non-OPEC[2]	39.85
Total world[2]	40.99
US imports[3]	37.80

[1]Estimated contract prices. [2]Average price (FOB) weighted by estimated export volume. [3]Average price (FOB) weighted by estimated import volume.

Source: DOE Weekly Petroleum Status Report.
Data available in OGJ Online Research Center.

US NATURAL GAS STORAGE[1]

	12-19-08	12-12-08	12-19-07	Change, %
	bcf			
Producing region	909	933	951	–4.4
Consuming region east	1,689	1,780	1,686	0.2
Consuming region west	422	454	418	1.0
Total US	**3,020**	**3,167**	**3,055**	**–1.1**
	Sept. 08	**Sept. 07**		
Total US[2]	**3,163**	**3,316**		**–4.6**

[1]Working gas. [2]At end of period.
Source: Energy Information Administration
Data available in OGJ Online Research Center.

PACE REFINING MARGINS

	Oct. 2008	Nov. 2008	Dec. 2008	Dec. 2007	2008 vs. 2007 Change	2008 vs. 2007 Change, %
			$/bbl			
US Gulf Coast						
West Texas Sour	7.68	9.81	6.75	9.53	–2.79	–29.2
Composite US Gulf Refinery	7.38	7.57	8.93	13.01	–4.08	–31.3
Arabian Light	6.10	5.41	6.58	15.39	–8.82	–57.3
Bonny Light	1.08	1.23	–0.55	3.39	–3.93	–116.1
US PADD II						
Chicago (WTI)	12.51	2.19	2.42	6.87	–4.45	–64.8
US East Coast						
NY Harbor (Arab Med)	9.00	6.43	9.94	14.29	–4.35	–30.5
East Coast Comp–RFG	10.04	6.73	7.89	12.35	–4.46	–36.1
US West Coast						
Los Angeles (ANS)	12.59	5.97	8.19	12.31	–4.12	–33.4
NW Europe						
Rotterdam (Brent)	5.12	2.56	3.14	4.02	–0.88	–21.8
Mediterranean						
Italy (Urals)	6.89	4.31	4.91	3.95	0.97	24.5
Far East						
Singapore (Dubai)	2.23	–2.50	4.13	4.65	–0.52	–11.2

Source: Jacobs Consultancy Inc.
Data available in OGJ Online Research Center.

US NATURAL GAS BALANCE DEMAND/SUPPLY SCOREBOARD

	Oct. 2008	Sept. 2008	Oct. 2007	Oct. 2008-2007 change	Total YTD 2008	Total YTD 2007	YTD 2008-2007 change
				bcf			
DEMAND							
Consumption	1,627	1,458	1,631	–4	18,954	18,833	121
Addition to storage	334	398	334	—	3,032	2,934	98
Exports	69	59	64	5	787	635	152
Canada	38	27	31	7	438	353	85
Mexico	27	27	29	–2	307	241	66
LNG	4	5	4	—	42	41	1
Total demand	**2,030**	**1,915**	**2,029**	**1**	**22,773**	**22,402**	**371**
SUPPLY							
Production (dry gas)	1,714	1,540	1,654	60	17,031	15,926	1,105
Supplemental gas	5	5	4	1	44	52	–8
Storage withdrawal	91	98	76	15	2,501	2,433	68
Imports	310	313	348	–38	3,263	3,870	–607
Canada	279	274	314	–35	2,937	3,100	–163
Mexico	4	7	2	2	28	47	–19
LNG	27	32	32	–5	298	723	–425
Total supply	**2,120**	**1,956**	**2,082**	**38**	**22,839**	**22,281**	**558**

NATURAL GAS IN UNDERGROUND STORAGE

	Oct. 2008	Sept. 2008	Aug. 2008	Oct. 2007	Change
			bcf		
Base gas	4,235	4,231	4,228	4,236	–1
Working gas	3,399	3,163	2,867	3,567	–168
Total gas	**7,634**	**7,394**	**7,095**	**7,803**	**–169**

Source: DOE Monthly Energy Review.
Data available in OGJ Online Research Center.

WORLDWIDE NGL PRODUCTION

	Sept. 2008	Aug. 2008	9 month average Production 2008	9 month average Production 2007	Change vs. previous year Volume	Change vs. previous year %
			1,000 b/d			
Brazil	89	88	87	84	3	3.8
Canada	572	553	636	690	–54	–7.9
Mexico	357	363	368	404	–36	–8.9
United States	1,537	1,839	1,810	1,754	56	3.2
Venezuela	200	200	200	200	—	—
Other Western Hemisphere	194	197	195	204	–10	–4.7
Western Hemisphere	**2,949**	**3,240**	**3,295**	**3,336**	**–40**	**–1.2**
Norway	165	249	274	278	–5	–1.6
United Kingdom	148	87	161	137	24	17.7
Other Western Europe	10	10	10	10	—	–4.8
Western Europe	**323**	**346**	**445**	**426**	**19**	**4.5**
Russia	426	426	422	426	–4	–1.0
Other FSU	150	150	150	160	–10	–6.3
Other Eastern Europe	13	15	15	15	1	3.9
Eastern Europe	**589**	**591**	**587**	**601**	**–14**	**–2.3**
Algeria	362	360	356	340	16	4.7
Egypt	70	70	70	70	—	—
Libya	80	80	80	80	—	—
Other Africa	127	126	129	126	3	2.2
Africa	**639**	**636**	**635**	**616**	**19**	**3.0**
Saudi Arabia	1,440	1,440	1,440	1,440	—	—
United Arab Emirates	250	250	250	250	—	—
Other Middle East	886	886	880	870	9	1.1
Middle East	**2,576**	**2,576**	**2,570**	**2,560**	**9**	**0.4**
Australia	67	72	66	75	–9	–12.0
China	650	650	630	613	17	2.8
India	—	—	—	4	–4	–100.0
Other Asia-Pacific	180	180	179	177	2	1.1
Asia-Pacific	**897**	**902**	**875**	**869**	**6**	**0.7**
TOTAL WORLD	**7,972**	**8,291**	**8,408**	**8,408**	**–1**	**—**

Totals may not add due to rounding.
Source: Oil & Gas Journal.
Data available in OGJ Online Research Center.

OXYGENATES

	Oct. 2008	Sept. 2008	Change	YTD 2008	YTD 2007	Change
			1,000 bbl			
Fuel ethanol						
Production	20,048	19,197	851	179,531	124,899	54,632
Stocks	15,192	15,994	–802	15,192	11,423	3,769
MTBE						
Production	1,539	563	976	14,820	19,290	–4,470
Stocks	762	1,058	–296	762	1,454	–692

Source: DOE Petroleum Supply Monthly.
Data available in OGJ Online Research Center.

US HEATING DEGREE-DAYS

	Nov. 2008	Nov. 2007	Normal	2008 % change from normal	Total degree-days July 1 through Nov. 30 2008	2007	Normal	% change from normal
New England	758	775	727	4.3	1,433	1,246	1,384	3.5
Middle Atlantic	698	694	667	4.6	1,198	965	1,193	0.4
East North Central	786	762	757	3.8	1,355	1,145	1,337	1.3
West North Central	806	788	840	–4.0	1,393	1,248	1,447	–3.7
South Atlantic	417	350	339	23.0	625	447	528	18.4
East South Central	535	450	449	19.2	778	597	695	11.9
West South Central	273	253	293	–6.8	390	336	385	1.3
Mountain	540	545	676	–20.1	982	951	1,219	–19.4
Pacific	274	326	396	–30.8	469	606	690	–32.0
US average*	**537**	**521**	**539**	**–0.4**	**899**	**782**	**922**	**–2.5**

*Excludes Alaska and Hawaii.
Source: DOE Monthly Energy Review.
Data available in OGJ Online Research Center.

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Forecasts for oil prices depend on economic outlook

Guess the question from the answer: It all depends on the global economy.

If you work in the oil and gas business, you haven't been paying attention to developments around you if you didn't respond with this: When will oil prices quit falling?

Marker crude prices dropped below $40/bbl this week after two developments that normally would strengthen oil values.

In the first of those developments, the Organization of Petroleum Exporting Countries announced its biggest production cut ever. If fully implemented, the action would remove enough oil from the market to avert a catastrophic inventory build.

But OPEC members seldom implement production cuts fully. That partly explains why crude prices fell after OPEC's announcement.

In the other development that normally might boost crude prices, the US Federal Reserve cut the interest rate on interbank loans to almost nothing. The dollar's value plunged. Buying a barrel of oil should require more dollars than before. But oil prices still fell.

The oil market, at the expense of everything else, seems focused on demand and its relationship to the global economy. Rightly so. The economy looks grim.

Indeed, assumptions about economic growth drive predictions for average oil demand in 2009.

Three important forecasting entities differ interestingly in predictions published in December. The International Energy Agency sees a slight gain in average 2009 demand for oil, to 86.3 million b/d.

The US Energy Information Administration and OPEC both see slight declines. The lower of those two forecasts is EIA's: 85.3 million b/d. That larger-than-usual 1 million b/d difference reflects the uncertainty now terrorizing traders.

It largely results from divergent assumptions for economic growth: 2.1% for IEA, which uses the International Monetary Fund's projection; 0.5% for EIA; and 1.5% for OPEC.

IEA points out, "Should the recession prove to be more prolonged than expected, this [demand] prognosis could be further revised down."

The obverse, though, is worth considering: With supply limits in place and the dollar down, early economic recovery—unexpected, yes, but not out of the question—would jerk oil prices back up quicker and by more than anyone now thinks possible.

(Online Dec. 19, 2008; author's e-mail: bobt@ogjonline.com)

The Editor's Perspective

by Bob Tippee, Editor

Market Journal

by Sam Fletcher, Senior Writer

Demand and prices fall

Even as a winter storm dumped snow and ice on the US Midwest and East Coast during Christmas week, markets remained unconvinced the Organization of Petroleum Exporting Countries can cut production fast enough to offset plummeting demand for oil.

"The colder weather continues to take a backseat to economic concerns, which are now weighing heavily on industrial and power generation demand," said analysts in the Houston office of Raymond James & Associates Inc. "Two of the world's biggest oil importers reported significant year-over-year declines in oil demand. Japan, the world's third biggest oil importer, reported its November crude imports were down 17% from the previous year, and South Korea, the world's fifth biggest importer, reported that its oil consumption was down 12% in November."

In New Orleans, Pritchard Capital Partners LLC analysts reported Abu Dhabi verbally informed India's Bharat Petroleum Corp. Ltd. to expect a cut in oil supplies in January, while Saudi Arabia and Kuwait had not yet issued similar notices. Meanwhile, crude production by Petroleos Mexicanos fell 6.5% from year-ago levels in November. Pemex reduced its 2008 production outlook for the third time, down 3.6% due to disruptions by hurricanes and the faster-than-expected decline of Cantarell field.

Demand outlook

On the natural gas front, Pritchard Capital analysts said, "The gas market seems poised to reset itself," in a process that includes shutting in some production and more than a 30% drop in the number of active land rigs in the US. They see "a 4-6 month lag time before recent well decline rates translate into production volume decreases. We may see gas prices around $5/Mcf before things get better."

Pritchard Capital also perceives a shift from a supply-constrained market to a demand-constrained market for LNG. "Global LNG prices on the spot market seem to be stabilizing [at] $8-9/MMbtu in the Atlantic Basin and in the $11-12 range in the Pacific Basin." With prices at the Henry Hub, La., spot market "well below the prices a year ago," LNG terminals at Lake Charles, La., and at Sabine Pass and Freeport in Texas remain inactive, analysts said.

Olivier Jakob at Petromatrix, Zug, Switzerland, observed, "With the low oil prices and the low refining margins, the process of supply destruction is already in the works, and this is further evidenced by the falling trend of rotary rig utilization. Most of Wall Street is now targeting $30/bbl for West Texas Intermediate, a level which will only accelerate the supply destruction process in North America, making the US more dependent on 'foreign oil.'" More important, low oil prices "will be destroying production capacity, which will then allow for a reversal trade," Jakob said.

He added, "The [futures market] price of corn or soybean is holding much better than gasoline or heating oil, the ethanol processing margins are in the red, and the current oil prices also question the sustainability of biofuels in the supply and demand equation. The retail price of gasoline in the US is at the lowest level since early 2004 and with the gasoline crack giving back some of its recent gains, there should be some more improvement in the pump price for the US customer."

Paul Horsnell, Barclays Capital Inc., London, said, "Although the pace of decline in commodity prices has slowed in December, we believe there is still downside risk to prices should financial markets remain unstable, the dollar continue to strengthen, and global growth projections continue to suffer cuts. Significant portions of existing output are unable to cover cash costs at current prices and output cuts are being rapidly enacted alongside the deferral of large numbers of new projects that have become very difficult to finance in the current environment. The damage being done to the supply side suggests prices could recover rapidly once the mood of pessimism surrounding global growth prospects starts to clear. We expect price volatility to stay elevated by historical standards as liquidity is thin, short positions in a number of markets are large and the potential for both demand and supply shocks is high."

Horsnell said, "We are in the midst of the most severe global recession since at least the early 1980s, if not the Great Depression. It is difficult to find an economy anywhere in the world that is not being hit hard, and the downward momentum underway virtually ensures that activity will continue to fall significantly through first quarter. The baseline Barclays Capital forecast expects the economic contraction to find a bottom around mid-year, but the recovery to be well below par."

(Online Dec. 29, 2008; author's e-mail: samf@ogjonline.com)

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