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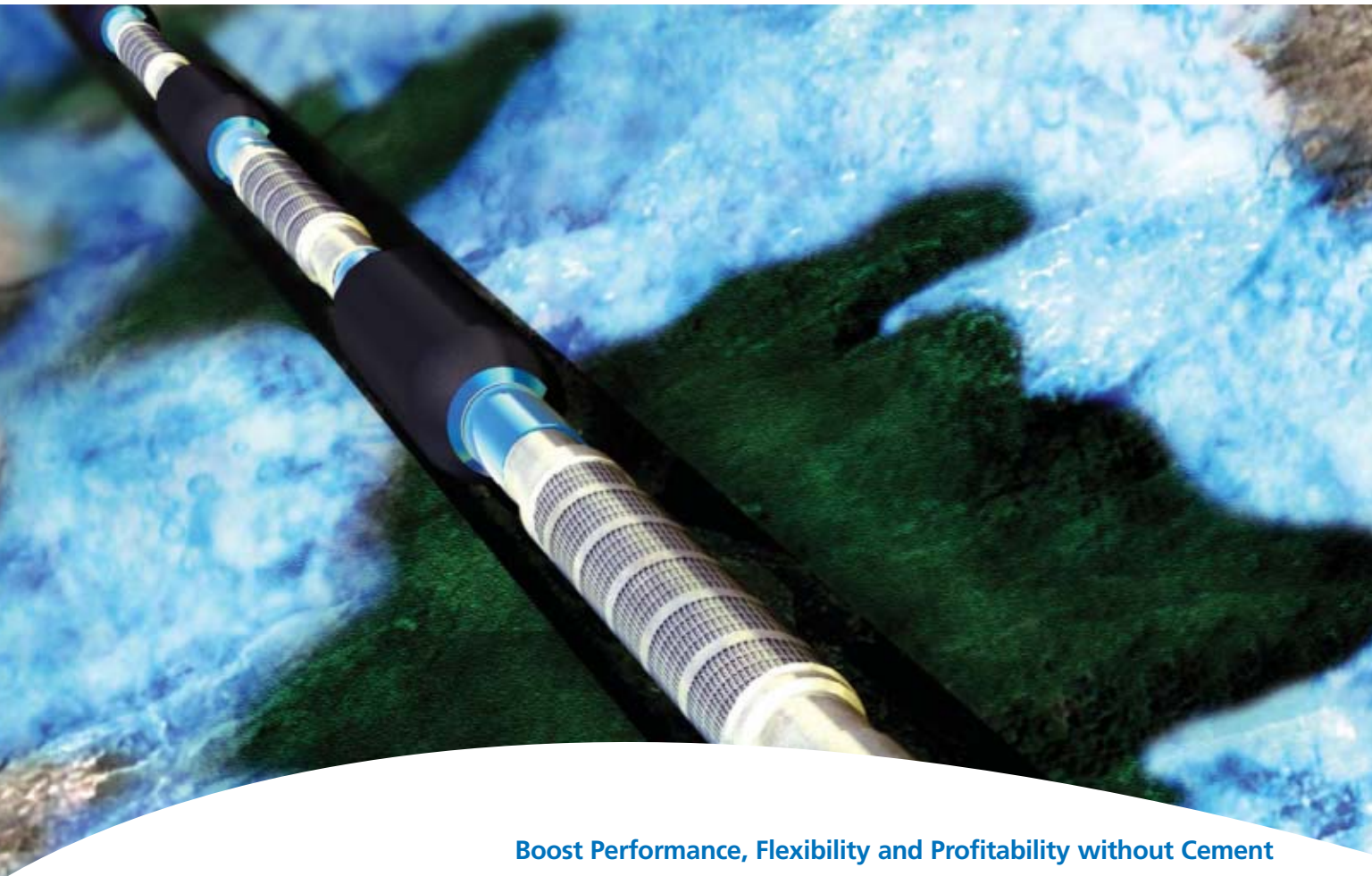

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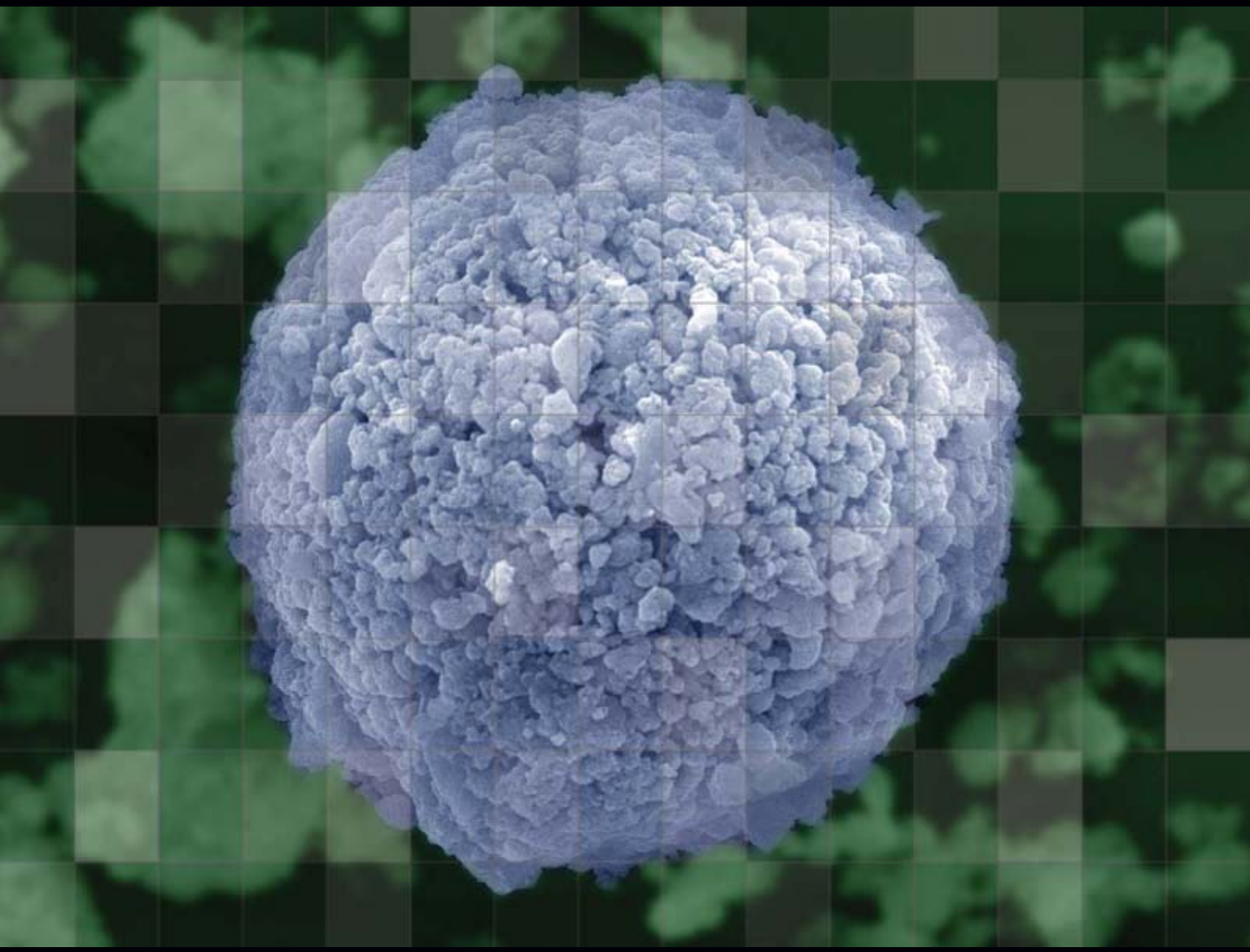

Catalyst Report

Have oil futures traders driven up the market?
Giant prospects lie in distal part of E. Mediterranean basin
Operators increase stakes in Marcellus shale
Modified equation aids integrity management

GE Oil & Gas

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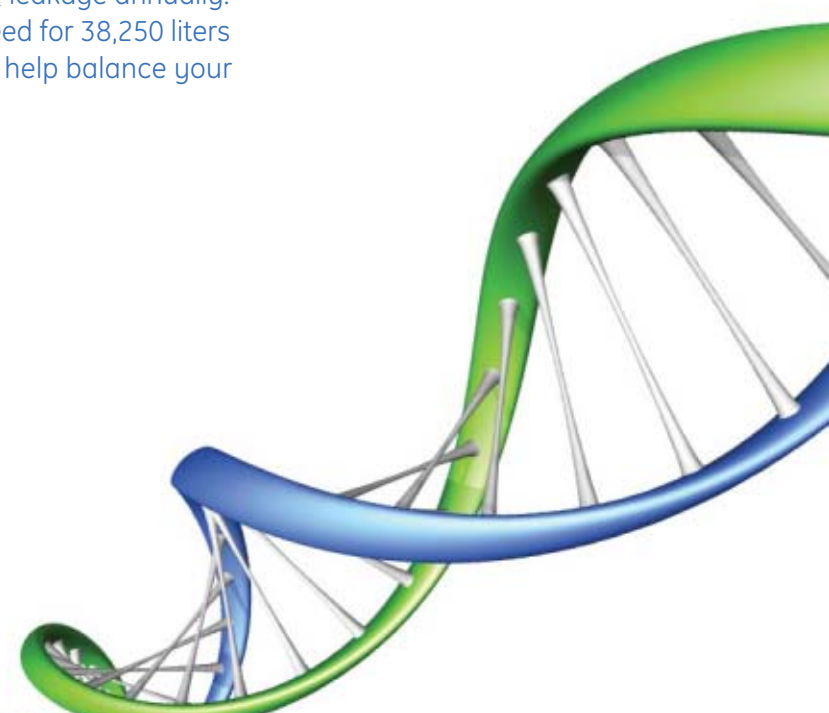

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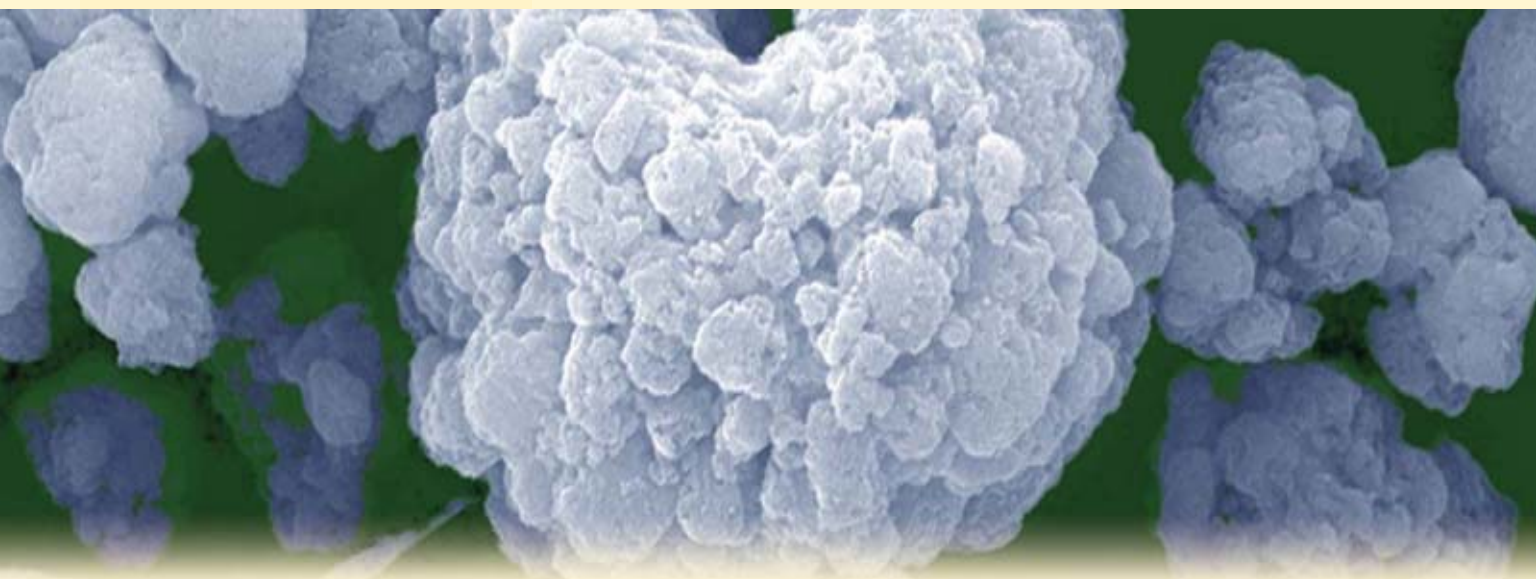
Oct. 6, 2008
Volume 106.37

CATALYST REPORT



REGULAR FEATURES

COVER

A scanning electron microscope image shows a particle of spray-dried alumina (Al_2O_3) used as a carrier in catalyst production. Refiners will increase their use of new and improved catalysts to reduce emissions and meet new fuel specifications. Refiners are also using catalysts to improve operations and lower costs. Oil & Gas Journal's Catalyst report, which begins on p. 66, discusses how one refiner evaluates different FCC catalysts to find the optimum choice. Images from Haldor Topsøe AS.

General Interest

Exploration & Development

Drilling & Production

Processing

Transportation

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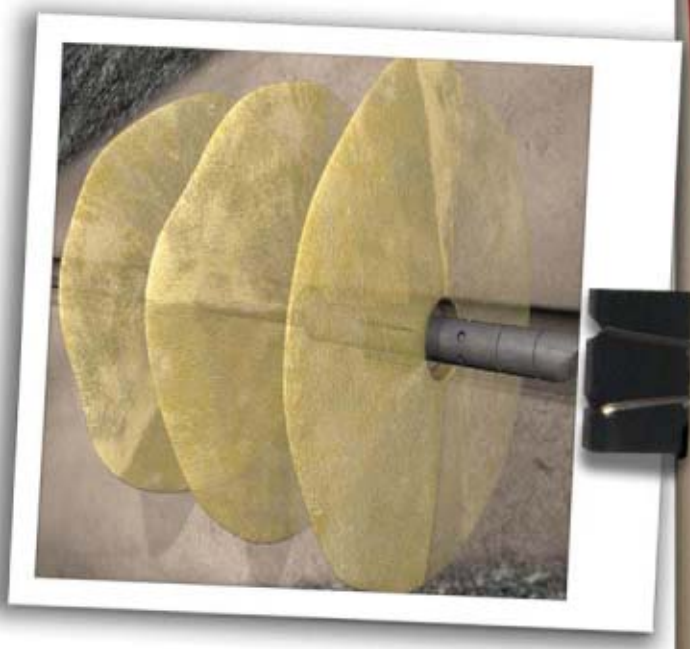
CobraMax® H service boosts gas production, cuts time and cost on horizontal wells by fracturing with coiled tubing

The Challenge:

British Columbia, Canada—A Canadian operator used Halliburton's **CobraMax® H** service to place multiple fractures in a horizontal well in the Montney shale formation. The treatment was successful and the well produced 160,000 m^3 gas/day (5.6 mmcf/d) which was more than the operator expected. Completing the five fractures took five days and the treatment required three bottomhole assemblies (BHAs). The operator liked the results and requested Halliburton work on speeding up the process because each BHA change required eight hours of coiled tubing operations.



The new CobraMax H system achieves maximum conductivity in the near-wellbore region to overcome flow convergence issues common in horizontal wells.

The Solution:

Halliburton made three improvements that dramatically increased the speed of CobraMax H treatments: an erosion-resistant BHA that could last for an entire operation on a well, an improved sand plug technique to isolate intervals and a new fluid design.

"I now have higher production with increased speed *and* lower cost from CobraMax H — quality, service and price without any tradeoffs."

The Results:

The new CobraMax H system has now been used on dozens of horizontal wells in the Montney play. Seven zones fractured in 40 hours is now routine performance. Completion costs have typically been slashed by more than 40 percent. Safety and reliability have improved. And wells fractured with CobraMax H service are the best performers in the field.

For more information about how CobraMax H service can help reduce the time for multizone frac treatments and make your field more profitable, visit www.halliburton.com/reliability or e-mail stimulation@halliburton.com.

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Performance Profile 100

OGJ Newsletter

Oct. 6, 2008

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General Interest — Quick Takes

Senate rejects oil shale moratorium

The US Senate on Sept. 26 defeated by 52 to 42 votes an economic stimulus bill containing a provision to extend a moratorium on federal oil shale leasing. The measure fell 8 votes short of the 60 votes necessary for passage.

Republicans were pleased with the outcome. "This Democrat-controlled 'do nothing and drill nothing' Congress is out of touch with the people that put them in office," said Sen. Wayne Allard (Colo.), who is retiring in January. "Earlier this week, we saw the largest single-day jump in oil prices in history. How do Democrats in Congress react? They attempt to extend the ill-conceived Udall moratorium on oil shale regulations. This places over 800 billion bbl of potentially recoverable oil out of reach; that's an energy source larger than the proven reserves of Saudi Arabia," Allard said.

Rep. Mark Udall (D-Colo.), who is running to succeed Allard, and two other Democrats on Colorado's congressional delegation, Sen. Ken Salazar and Rep. John Salazar, said on Sept. 24 that they would try to reinstate the moratorium when Congress comes back to work.

"The Democrat-controlled Congress is completely ignoring the needs of our nation," Allard maintained. "This is not only unfortunate but also insulting to the American people who are struggling to pay these high fuel prices. This attempt is a clear sign that they would rather help the economy of foreign oil producers. Had this misguided moratorium continued, it would have helped [Venezuelan President] Hugo Chavez stimulate his economy more than our own."

Statoil teams with schools in heavy oil research

StatoilHydro has partnered with universities in Canada and Norway to examine ways to improve recovery of heavy oil and oil sands in an environmentally friendly way.

The group will support PhD students at Canada's University of Calgary, University of Alberta, and Vancouver Island University, and at the Norwegian University of Science and Technology (NTNU) in Trondheim.

The Canadian universities have broad research experience with heavy oil, and their projects will complement StatoilHydro's research activities.

High oil prices have made development of heavy oil and oil sands projects economically feasible. NTNU rector Torbjorn Digernes said heavy oil would be important in future global energy scenarios, but these posed serious challenges. Cooperation with StatoilHydro would be important in identifying solutions.

The universities will collaborate with NTNU in their respective areas of the value chain for heavy oil production, with the University of Calgary specializing in recovery methods.

The University of Alberta focuses on emulsion stabilization mechanisms for such oils, while Vancouver Island University deals with environmental monitoring of their production. ✦

Exploration & Development — Quick Takes

Verenex finds more oil in Libya's Ghadames basin

Libya's state-owned National Oil Co. said Verenex Energy Inc. has made a seventh oil discovery on production-sharing contract Area 47 in Libya's Ghadames basin.

The discovery, in the Lower Acacus and Memouniat formations, is Verenex's second on Block 4 in the northern part of Area 47 and is the eighth consecutive oil and gas discovery since drilling began in September 2006.

Exploration well C1-47/04, about 150 km southwest of Tripoli, was drilled and cased to a depth of 10,155 ft in the Memouniat Formation. The operator carried out extended flow tests on the well from 48 ft of perforations in two sandstone intervals. They included a 28-ft interval in the Memouniat Formation, starting at 9,962 ft, which flowed 900 b/d of 56° gravity oil and 4.2 MMcfd of gas and a 20-ft interval in the Lower Acacus formation, starting at 7,819 ft, which flowed 150 b/d of 55° gravity oil and 4.5 MMcfd of gas, all through a $^{32}/_{64}$ in. choke.

The tests yielded a combined maximum measured flow rate—restricted by test equipment capability—of 1,350 b/d (gross) of oil and 10.3 MMcfd (gross) of gas through $^{32}/_{64}$-$^{56}/_{64}$ in. chokes, Verenex said.

C1-47/04 (well No. 13) lies 14 km northwest of Verenex's nearest oil and gas discovery at A1-47/04 on Block 4.

According to Verenex, eight new field wildcat exploration wells and two appraisal wells in the area have tested at a maximum aggregate rate of 93,800 b/d and have been suspended as potential future oil and gas production wells.

The latest find is the seventh in Area 47, in which Verenex and partner PT Medco Energi Internasional share a 13.7% interest. NOC holds the remaining 86.3%.

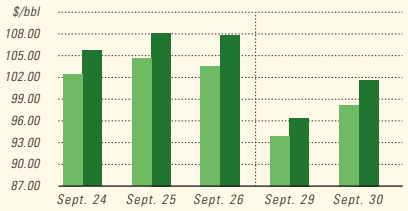
Inpex chooses Darwin, 850 km line for Ichthys

Japanese company Inpex Australia and joint venture partner Total of France have shunned Western Australia and selected Blaydin Point at Darwin's Middle Arm Peninsula in the Northern Territory as the landfall for development of their Ichthys gas-condensate field in the Browse basin off northwest Western Australia.

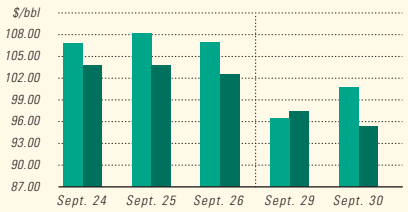
Inpex, as operator of the project proposal, believes Northern

Industry Scoreboard

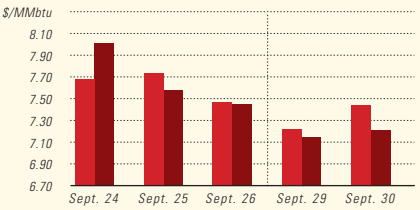
IPE BRENT / NYMEX LIGHT SWEET CRUDE



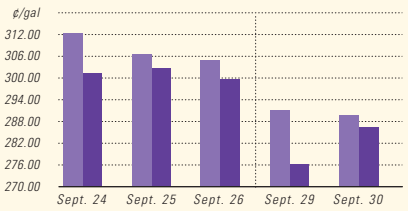
WTI CUSHING / BRENT SPOT



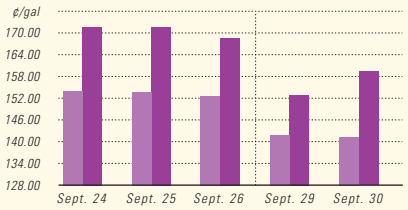
NYMEX NATURAL GAS / SPOT GAS - HENRY HUB



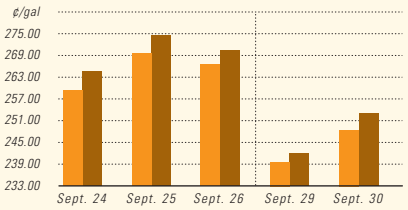
IPE GAS OIL / NYMEX HEATING OIL



PROPANE - MT. BELVIEU / BUTANE - MT. BELVIEU



NYMEX GASOLINE (RBOB)[1] / NY SPOT GASOLINE[2]



[1]Reformulated gasoline blendstock for oxygen blending.
[2]Non-oxygenated regular unleaded.

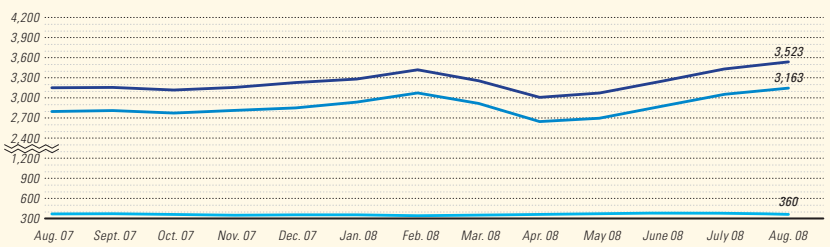
US INDUSTRY SCOREBOARD — 10/6

Latest week 9/19	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	9,041	9,371	–3.5	9,102	9,304	–2.2
Distillate	3,926	4,156	–5.5	4,071	4,210	–3.3
Jet fuel	1,523	1,594	–4.5	1,556	1,630	–4.5
Residual	526	705	–25.4	615	738	–16.7
Other products	4,527	4,807	–5.8	4,717	4,818	–2.1
TOTAL DEMAND	19,543	20,633	–5.3	19,846	20,729	–4.3
Supply, 1,000 b/d						
Crude production	4,275	4,895	–12.7	5,033	5,081	–0.9
NGL production[2]	2,186	2,407	–9.2	2,254	2,373	–5.0
Crude imports	8,516	10,310	–17.4	9,725	10,072	–3.4
Product imports	2,959	3,332	–11.2	3,157	3,547	–11.0
Other supply[3]	1,159	908	27.6	1,376	1,040	32.3
TOTAL SUPPLY	19,095	21,852	–12.6	21,545	22,113	–2.6
Refining, 1,000 b/d						
Crude runs to stills	14,747	15,366	–4.0	14,747	15,169	–2.8
Input to crude stills	14,980	15,616	–4.1	14,980	15,456	–3.1
% utilization	85.4	89.5	—	85.4	88.6	—

Latest week 9/19	Latest week	Previous week[1]	Change	Same week year ago[1]	Change	Change, %
Stocks, 1,000 bbl						
Crude oil	290,186	291,706	-1,520	320,617	-30,431	-9.5
Motor gasoline	178,739	184,634	-5,895	191,366	-12,627	-6.6
Distillate	125,449	129,625	-4,176	137,060	-11,611	-8.5
Jet fuel-kerosine	37,087	39,084	-1,997	41,751	-4,664	-11.2
Residual	35,613	35,980	-367	37,960	-2,347	-6.2
Stock cover (days)[4]			Change, %		Change, %	
Crude	21.7	20.4	6.4	20.7	4.8	
Motor gasoline	19.8	20.1	-1.5	20.4	-2.9	
Distillate	32.0	32.1	-0.3	33.5	-4.5	
Propane	60.4	56.8	6.3	55.8	8.2	
Futures prices[5] **9/26**			**Change**		**Change**	**%**
Light sweet crude ($/bbl)	107.32	97.29	10.03	82.10	25.22	30.7
Natural gas, $/MMbtu	7.69	7.54	0.15	6.30	1.40	22.1

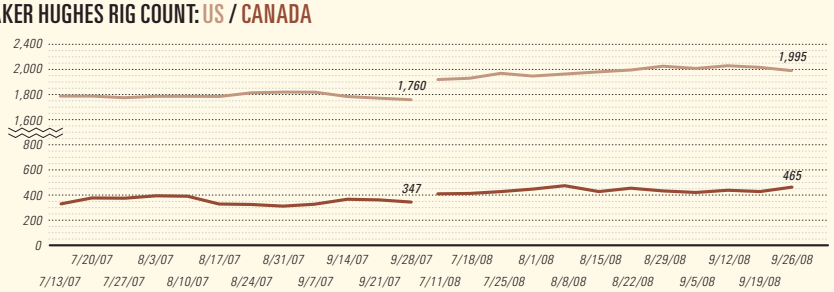
[1]Based on revised figures. [2]Includes adjustments for fuel ethanol and motor gasoline blending components. [3]Includes other hydrocarbons and alcohol, refinery processing gain, and unaccounted for crude oil. [4]Stocks divided by average daily product supplied for the prior 4 weeks. [5]Weekly average 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

Territory's friendlier business environment, gas-ready location, significant in-place infrastructure, lack of domestic gas reservation policy, and closer proximity to the Asian markets will offset the costs of the 850 km undersea pipeline that will be needed to deliver the gas from the field to Darwin.

Inpex Pres. Naoki Kuroda said Sept. 26 that Darwin provided the certainty required for the project's tight schedule to enable first LNG to come on stream in late 2014 or early 2015.

He added that environmental, economic, and engineering studies demonstrate the viability of Blaydin Point as the best location for the LNG plant. Front-end engineering and design is expected to follow shortly to enable a final investment decision by yearend 2009 or early 2010.

Ichthys field in permit WA-285-P holds an estimated 12.8 tcf of gas plus 527 million bbl of recoverable condensate.

Initial plans calls for a $20 billion (Aus.), two-train project producing more than 8 million tonnes/year of LNG, 1.6 million tonnes/year of LPG, and more than 100,000 b/d of condensate.

The project will inject about $50 billion into the Northern Territory economy over the next 20 years, beginning with site work in 2010. Inpex's original plan was to pipe gas a much shorter distance to the Maret Islands off Western Australia's Kimberley coast. Gas was scheduled to come on stream in 2012, but ongoing delays in Western Australian bureaucracy caused the date to slip into 2013-14.

Western Australia's approvals process, including restrictive environmental controls, has been blamed for the delays. In addition, the WA government-federal government-backed plan to select a single Kimberley hub for all Browse basin projects has added to the uncertainties.

In contrast, Northern Territory stepped in earlier this year, ensuring Inpex that it had port access and land on which to build, and that environmental and planning approvals would be streamlined.

Inpex and Total also found gas at the Mimia-1 wildcat in nearby Browse permit WA-344-P earlier this year and that production likely will be added to the Ichthys system.

Interest now will turn to the likely landfall of Woodside Petroleum group's Browse gas project, still in its planning stage. Inpex's withdrawal from contention throws the question of a Kimberley hub open to conjecture.

Woodside now may take the view that its best bet also will be a pipeline extending more than 800 km from its Torosa-Brecknock-Calliance fields in the Scott Reef area direct to the Burrup Peninsula in the Pilbara area, where it is building the Pluto LNG plant. It is in need of more gas supplies to enable construction of a second and perhaps third LNG train. This would make the Kimberley hub unnecessary and obviate the need for Woodside to go through the lengthy approvals process. ✦

Drilling & Production — *Quick Takes*

Mexican production continues downward spiral

Mexico's state-owned Petroleos Mexicanos said that during January-August 2008 its production of crude oil fell to 2.83 million b/d or 9.7% while exports dropped 16% compared with the same period in 2007.

Natural gas production, however, was 6.776 bcfd, up 14% over the first 8 months of 2007. In August alone, natural-gas production rose slightly to 6.968 bcfd, up from 6.902 bcfd in July and 5.942 bcfd in August 2007.

The decline in the country's production of crude oil was led by its largest field, Cantarell, which dropped 29.2% to 1.11 million b/d, while output at the second-largest field, Ku-Maloob-Zaap fell 39% to 688,800 b/d.

For August alone, Mexico's crude oil production slid to 2.76 million b/d due to the decline in overall production and to temporary production glitches.

August production was down from 2.78 million b/d in July and 2.84 million b/d in August 2007, Pemex said. Production figures for August were the lowest monthly numbers since November 1995.

Mexico exported some 1.44 million b/d of crude during the January-August 2008 period, down from 1.71 million b/d sold in the same period last year. However, due to soaring oil prices, Pemex earned $34.38 billion from exports, or about 51.4% more than in 2007.

August exports stood at 1.42 million b/d, up slightly from July, but down from 1.63 million b/d in August 2007.

Mexico President Felipe Calderon has proposed giving Pemex broad financial and managerial autonomy and exempting the state-owned firm from some government rules on procurement and outsourcing.

While Calderon insists he has no intention of privatizing Pemex, some contend the bonuses the company would be permitted to offer private contractors represented a disguised form of profit-sharing aimed at opening the door to privatization.

The administration is focusing on the search for deepwater oil in the Gulf of Mexico near areas where the US and Cuba are already exploring.

The government recently presented an analysis which concluded that the decline in production at Cantarell, Mexico's largest oil field and located in the Sound of Campeche, was costing Pemex $10 billion/year.

The study said production at Mexico's main oil fields would fall by 800,000 b/d by 2012, with the drop in output reaching 1.5 million b/d by 2018.

California OKs Occidental Long Beach drilling

California Governor Arnold Schwarzenegger has signed legislation enabling oil exploration and drilling in Wilmington oil field in Long Beach.

Under Bill 2165, California's State Lands Commission can negotiate a contract with the city and Occidental Petroleum Corp. to explore and develop the western end of Wilmington field, which includes tidelands mineral deposits.

In the past, California shouldered most costs for previous oil efforts in the tidelands deposits, but Occidental offered to take on

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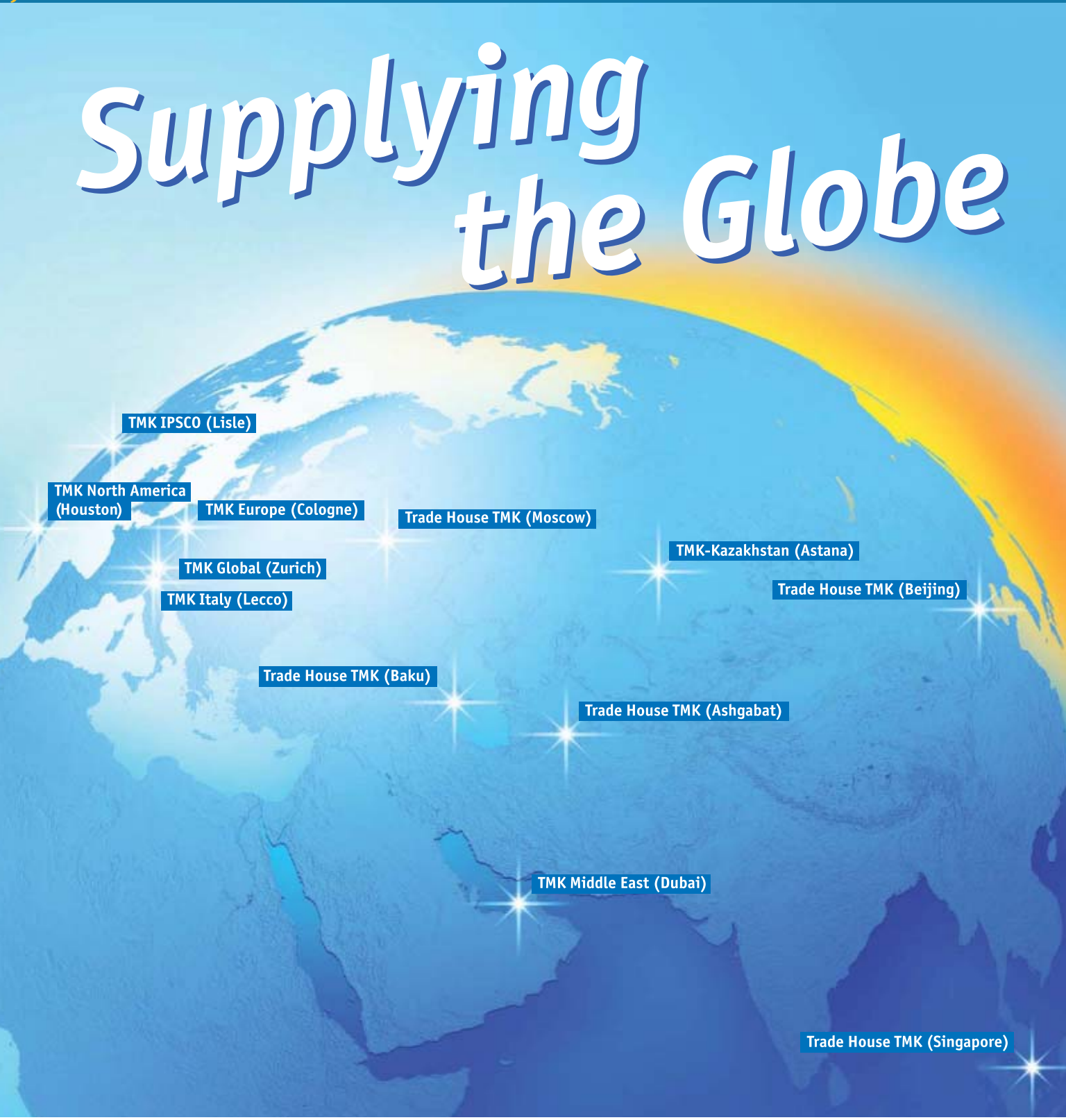

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that role in exchange for a larger share of the potential revenues—an offer that required the new legislation.

Occidental spokesman Richard Kline said the Los Angeles-based firm needs a new contract with more financial incentives to make the Wilmington deal worthwhile. The current agreement gives 95% of revenue to the state and 5% to Occidental—too little to allow the firm to recover its investment.

Altogether, Occidental is expected to invest more than $200 million to increase production by injecting water, carbon dioxide, or other material into some of the field's estimated 500-700 existing wells. Occidental would also drill as many as 200 new wells, Kline said.

Bill 2165 does not allow for offshore drilling or expansion of the existing drilling area. According to officials, Occidental would use directional drilling techniques to reach beneath the port's tidelands, increasing output by as much as 63%.

Long Beach city analysts say that under the agreement with Occidental, reserves could rise by 22 million bbl from the current 35 million bbl in the West Wilmington unit, where the new drilling is planned.

Any drilling also must comply with existing regulations of the South Coast Air Quality Management District, as well as the California Environmental Quality Act.

Wilmington, which produces about 8,500 b/d, is California's sixth largest oil field. It has produced more than 2.5 billion bbl since 1932, when General Petroleum, an antecedent of ExxonMobil Corp., drilled the first well.

Last year, it was reported that the central area of Wilmington field is in the midst of a redevelopment project over the next few years, with Los Angeles city authorities approving the drilling of as many as 540 directional oil and water injection wells from central facilities (OGJ Online, Feb. 19, 2007).

Indonesia approves storage facility for Cepu

Indonesia's upstream oil and gas regulator BPMigas, rejecting earlier criticism voiced in testimony before the country's parliament, has approved the construction of a floating oil storage facility for the Cepu oil and gas block.

"The study shows the floating storage facility is more feasible economically [than land storage]," said BPMIgas head R. Priyono, who added that the floating facility would be easier to implement as it did not require the sometimes costly and time-consuming process of acquiring land.

Earlier in September, the Indonesian parliament heard a report that a floating offshore storage project jointly planned by ExxonMobil Corp. and state-owned PT Pertamina EP might incur up to $1.2 billion in state losses (OGJ Online, Sept. 12, 2008).

The report attracted the attention of members of parliament—who currently are eyeing illegal expense claims—as it came from Hestu Subagyo, a former director of PT Pertamina EP.

Hestu claimed that the decision to build a floating storage facility was made solely by ExxonMobil, without any involvement on the part of Pertamina EP, which he said rejected the idea from the start.

According to Hestu, Pertamina had instead proposed renting land storage, which would be far cheaper than constructing the floating storage facility.

But Priyono rejected Hestu's testimony, noting that the project feasibility study was made jointly by ExxonMobil and Pertamina.

"It's impossible that BPMigas would approve the project without Pertamina's participation," said Priyono, who noted that, "Hestu also signed the report."

BPMigas approved the proposal for a floating storage facility with a capacity of 2 million bbl in May 2007. A tender currently is underway for procurement of the facility.

Earlier this week, Pertamina announced plans to invest some $500 million of company funds in the Cepu Block, which it shares 50:50 with ExxonMobil (OGJ Online Sept. 23, 2008). The Cepu Block is estimated to hold some 600 million bbl of oil along with 1.7 tcf of natural gas. ✦

Processing — *Quick Takes*

UOP to upgrade Abu Dhabi refinery

Abu Dhabi Oil Refining Co. (Takreer) selected UOP LLC, a Honeywell International company based in Des Plaines, Ill., to supply technology and engineering services for upgrading its 120,000 b/d Ruwais refinery 240 km west of Abu Dhabi City in the UAE.

The value of the project was not revealed.

The refinery will produce propylene, unleaded gasoline, naphtha, liquefied petroleum gas, aviation turbine fuel, kerosine, gas-oil, bunker fuel, and other hydrocarbon derivatives. Basic engineering design is under way and is expected to be completed in 2014.

The facility will utilize a wide range of UOP technologies for the production of low-sulfur distillate and gasoline, including its Unicracking and Unionfining processes to upgrade heavy feedstocks and produce ultralow-sulfur diesel and its Merox process to remove sulfur from saturated LPG streams. In addition, the company's BenSat process will manage the benzene content in the gasoline pool.

The refinery includes a hydrotreating unit that will use UOP's naphtha hydrotreating process and a distillate Unionfining unit to produce low-sulfur kerosine. The unit is the largest kerosine-fed hydrotreating unit licensed by UOP.

Synthesis licenses ExxonMobil's technology

Synthesis Energy Systems (SES), Houston, signed a technology licensing agreement with ExxonMobil Research & Engineering Co. (EMRE) that provides SES the option to execute up to 15 methanol-to-gasoline (MTG) licenses.

SES assigned the first license to a 7,000 b/cd unit at its U-Gas coal gasification project under development near Benwood, W. Va., where Consol Energy Inc. has a coal mine. SES and Consol are negotiating a joint venture agreement.

ExxonMobil's MTG technology converts crude methanol directly to low-sulfur, low-benezene gasoline that can be sold directly or blended with conventional gasoline.

Although MTG technology originally processed methanol from

natural gas, it can be used for methanol from coal, petcoke, or biomass.

The SES projects will gasify the coal, convert the synthetic gas to methanol, and convert the methanol to gasoline via the MTG process. Conversion of coal to gasoline through gasification and methanol conversion is one way to reduce potential pollutants from coal.

SES is investigating development of coal-based gasification facilities to replace domestic production of various industrial chemicals that has been shut down because of the high cost of natural gas.

Petrobras lets refinery contract to Skanska

Petroleo Brasileiro SA (Petrobras) awarded a $125 million contract to Skanska AB, Sweden, to build a sulfur recovery unit (SRU) and a tail gas treatment unit (TGTU) at its 47,000 b/d Capuava refinery in Sao Paulo, Brazil.

Under the project, which is part of a nationwide environmental program to reduce sulfur contaminants in petroleum byproducts, the SRU facility will have a capacity to recover 20 tonnes/day of sulfur, while the TGTU will clean 40 tonnes/day of tail gas.

The scope of the contract includes detailed engineering, purchasing, construction, electromechanical installations, and assistance with commissioning and start-up of the plant.

Work will begin in October, and is scheduled for completion within 24 months. The total contract value is $125 million, with Skanska's share 40% or $50 million. Skanska's partner in the consortium is Brazilian engineering firm Promon. ✦

Transportation — *Quick Takes*

Pemex lets subsea pipeline to Global Industries

Mexicanos (Pemex) awarded Global Industries Ltd., Carlyss, La., a $75 million project to lay 12 km of 24-in. OD pipe under 150 ft of water in Ixtal field in the Bay of Campeche.

Work is to begin in October and is scheduled to be completed in January. Global's Shawnee construction vessel will perform the bulk of the work, with additional support vessels assisting.

The project also includes several pipeline crossings, risers, and expansion curves.

Fayetteville pipeline JV formed

Kinder Morgan Energy Partners LP (KMP) and Energy Transfer Partners LP (ETP) announced a 50:50 joint venture, Fayetteville Express Pipeline LLC, to build a 187-mile, 2-bcfd pipeline intended to increase takeaway capacity from the Fayetteville shale.

The pipeline will start in Conway County, Ark., continue eastward through White County, Ark., and terminate at an interconnection with Trunkline Gas Co., in Quitman County, Miss. Kinder Morgan and ETP expect the $1.3 billion pipeline to be in service by late 2010 or early 2011.

Fayetteville Express has secured binding 10-year commitments totaling 1.575 bcfd, including 1.2 bcfd from Southwestern Energy Services and 375 MMcfd—with an option for an additional 125 MMcfd—from Chesapeake Energy Marketing Inc.

Chesapeake's parent, Chesapeake Energy Corp., reached agreement with BP America in September to establish a JV in the Fayetteville shale to produce 180 MMcfd (OGJ, Sept. 8, 2008, p. 29).

France to increase gas transportation tariffs

France's Energy Regulatory Commission (CRE) reported that it will enable increases in usage tariffs on France's gas transport network in order to provide "better visibility" to market players, encourage relevant investments, and induce natural gas transporters to improve service quality and better control their costs.

On Jan. 1, 2009, GRTgaz, the transport affiliate of GdF Suez will benefit from an average 6% tariff increase over a 4-year period, while Total's transport affiliate Total Infrastructure Gaz France (TIGF) will benefit from a 10% average tariff hike on the same date.

With the new tariffs, a large balancing zone will be created covering half of northern France through the merger of the North, East, and West zones. CRE indicated that this will provide greater competition among the various gas sources: Norwegian gas, North European sources, LNG, and Russian gas. The merger was made possible through reinforcement of the network developed by GRTgaz. (OGJ Online, July 3, 2008).

In the South of France, notes CRE, investments TIGF and GRTgaz make on Artere de Guyenne will eliminate congestion where their networks meet.

CRE warned that important investments will be needed in the next few years to reduce congestion between northern and southern France and to ease access for new market entrants.

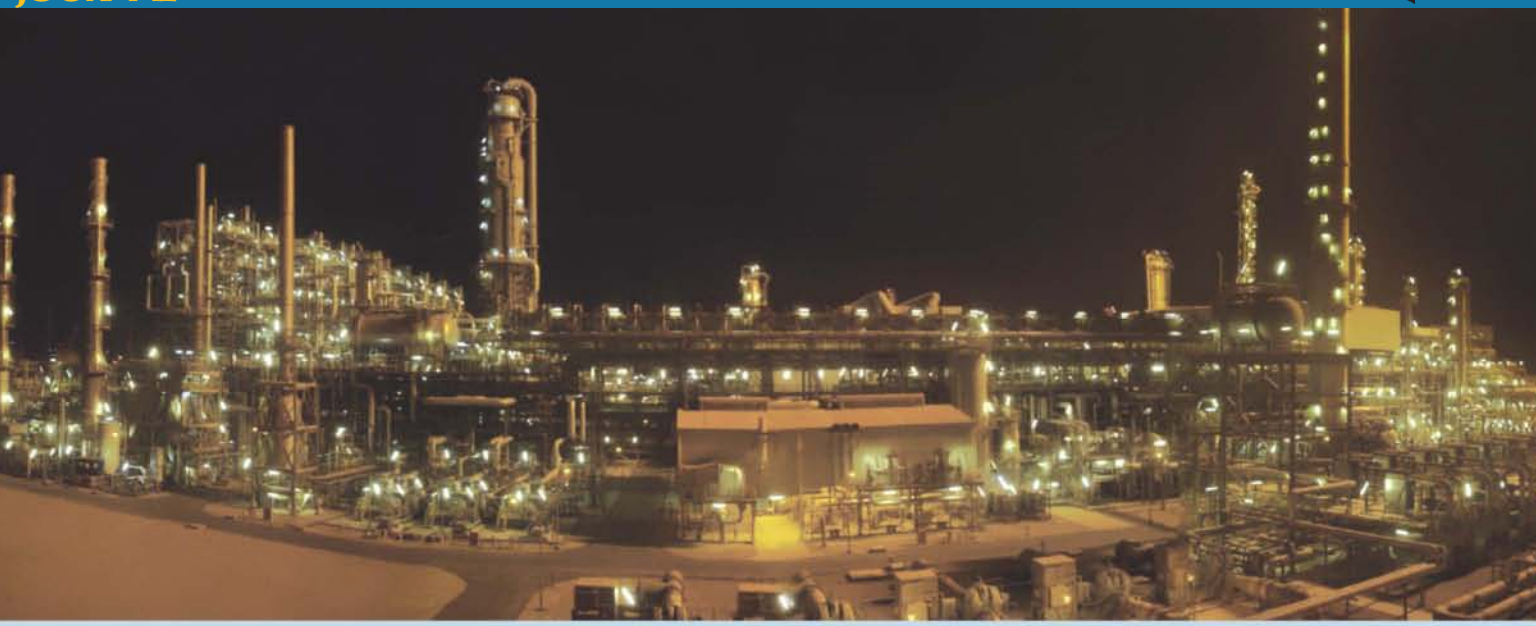
Interconnections between Belgium and Spain also are needed to satisfy markets and bolster supply security, while new methane terminal projects and gas-generated power units will require reinforcement of the transportation networks. ✦

CORRECTIONS

In the Sept. 15 special report, OGJ200, Cano Petroleum Inc. should have been ranked No. 36 in US liquid reserves, with 42.330 million bbl. Berry Petroleum Co. would have made the top 20 in US liquid reserves, coming in at No. 20 with 116.6 million bbl.

In the Sept. 22 article revealing PDVSA's criticism of Orimulsion, quotation marks were incorrectly placed, making it appear that an aside remark was the author's. It should have read:

1. *Making bitumen fluid would subject the Orinoco Belt to OPEC quotas.* Bernard Mommer...charged: "PDVSA looked for other ways to manipulate the definition of crude oil subject to OPEC quotas: Increasing production of the extra heavy (heavier than water) crude of the Orinoco Belt—the largest reserves of its kind in the world—the company argued that Orinoco deposits, which are processed into a product called 'Orimulsion,' did not fall under the definition of crude oil. (This assertion is technically correct, as the deposits do not constitute a liquid at normal temperatures.) Therefore, PDVSA argued, the Orinoco Belt should be classified as 'bitumen' and, hence, not be subjected to OPEC quotas," he wrote.[2]....
2. *Orimulsion would always be indexed to coal.*



Letters

Warming blame off base

I get so tired of reading such one-sided, biased letters as Jeff Temple's on the question of global warming and his conclusion that it is the oil industry that is primarily responsible (OGJ, July 7, 2008, p. 12).

Certainly, there is global warming occurring at this time as in the past, and it has melted most of the ice that covered much of North America during the past 20,000 years. But Mr. Temple's primary blaming of the oil industry is way off base.

An article by Arthur B. Robinson, Noah E. Robinson, and Willie Soon published in the December 2007 Journal of American Physicians and Surgeons reports research that strongly rejects the theory that hydrocarbons are primarily responsible for global warming. Their research is backed by the endorsement of 31,072 American scientists.

Donald E. Hibbard
Consulting petroleum geologist
Sherman Oaks, Calif.

Cooling or warming?

I read with interest David Archibald's letter on "Warming or cooling?" (OGJ, Aug. 11, 2008, p. 12).

There is lots of discussion about solar cycles and their apparent relation to warming (or cooling) of the earth.

It is safe to say Archibald's findings differ from the majority of climate scientists working in this field.

His conclusions suggest the earth is actually cooling, and man-made carbon-dioxide contributions are "minuscule" to the big picture.

Hasn't he been keeping up on current events? He surely must be aware of the retreat of almost every glacier on earth? Melting glaciers reflect long-term heating (or cooling) trends. If David's conclusions are correct, glaciers should not be retreating.

Is he aware the permafrost is melting? That, too, would suggest evidence of a long-term trend that is counter to the findings of this article.

Is he aware the ocean levels are rising around the earth? The Alaskan coastline is being battered with rising sea levels. Low-lying Pacific islands are loosing ground to rising oceans. Again: long-term evidence that counters this letter's conclusions.

This paper is not an objective discussion on the topic. The astute reader might conclude the Oil & Gas Journal does not want a balanced discussion. I would hope for a more objective coverage of a subject that will have profound effects on your readers and customers.

Mitch Findlay
First Energy Services
Los Angeles

Calendar

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

OIL&GAS JOURNAL online

Additional information on upcoming seminars and conferences is available through OGJ Online, Oil & Gas Journal's Internet-based electronic information source at http://www.ogjonline.com.

OCTOBER

NPRA Q&A Forum, Orlando, Fla., (202) 457-0480, (202) 457-0486 (fax), e-mail: info@npra.org, website: www.npra.org. 5-8.

GPA Houston Annual Meeting, Kingwood, Tex., (918) 493-3872, (918) 493-3875 (fax), e-mail: pmirkin@gasprocessors.com, website: www.gasprocessor.com. 7.

KIOGE Kazakhstan International Oil & Gas Exhibition & Conference, Almaty, + (44) 020 7596 5000, + (44) 020 7596 5111 (fax), e-mail: oilgas@ite-exhibitions.com, website: www.ite-exhibitions.com/og. 7-10.

IADC Drilling West Africa Conference & Exhibition, Lisbon, (713) 292-1945, (713) 292-1946 (fax); e-mail: conferences@iadc.org, website: www.iadc.org. 8-9.

International Gas Union Research Conference, Paris, +31 50 521 30 78, +31 50 521 19 46 (fax), e-mail: igrc2008@gasunie.nl, website: www.igrc2008.com. 8-10.

ERTC Lubes and Additives Conference, Berlin, +44 1737 365100, +44 1737 365101 (fax), e-mail: events@gtforum.com, website: www.gtforum.com. 13-15.

Middle East Plant Maintenance Conference, Abu Dhabi, +44 207 067 1800, +44 207 430 0552 (fax), e-mail: d.michalski@theenergyexchange.co.uk, website: www.theenergyexchange.co.uk. 13-15.

API Fall Petroleum Measurement Standards Meeting, Long Beach, (202) 682-8000, (202) 682-8222 (fax), website: www.api.org/events. 13-17.

Oil Shale Symposium, Golden, Colo., (303) 384-2235, e-mail: jboak@mines.edu, website: www.mines.edu/outreach/cont_ed/oilshale. 13-17.

Central and Eastern European Refining & Petrochemicals Roundtable, Warsaw, +44 207 067 1800, +44 207 430 0552 (fax), e-mail: c.taylor@theenergyexchange.co.uk, website: www.theenergyexchange.co.uk. 14-16.

ISA EXPO, Houston, (919) 549-8411, (919) 549-8288 (fax) website: www.isa.org. 14-16.

Oil & Gas Transportation in the CIS & Caspian Region Conference, Moscow, +44 (0) 207 067 1800, +44 207 430 0552 (fax), e-mail: j.golodnikova@theenergyexchange.co.uk, website: www.theenergyexchange.co.uk/cispipes10register.html. 14-16.

PIRA New York Annual Conference, New York, (212) 686-6808, (212) 686-6628 (fax), e-mail: sales@pira.com, website: www.pira.com. 16-17.

Petchem Arabia Conference, Abu Dhabi, +44 207 067 1800, +44 207 430 0552 (fax), e-mail: c.verma@theenergyexchange.co.uk, website: www.theenergyexchange.co.uk. 20-22.

SPE Asia Pacific Oil & Gas Conference & Exhibition, Perth, (972) 952-9393, (972) 952-9435 (fax), e-mail: spedal@spe.org, website: www.spe.org. 20-22.

SPE International Thermal Operations & Heavy Oil Symposium, Calgary, Alta., (972) 952-9393, (972) 952-9435 (fax), e-mail: spedal@spe.org, website: www.spe.org. 20-23.

Permian Basin International Oil Show, Odessa, Tex., (432) 367-1112, (432) 367-1113 (fax), e-mail: pbioilshow@pbioilshow.org, website: www.pbioilshow.org. 21-23.

AAPG International Conference & Exhibition, Cape Town, (918) 560-2679, (918) 560-2684 (fax), e-mail: convene@aapg.org, website: www.aapg.org. 26-29.

GPA Houston Midstream Conference, Houston (713) 222-0852, (713) 222-0858 (fax), e-mail: tom.rommel@accessed.com, website: www.gasprocessors.com. 28-29.

✦Gas to Liquids Conference, London, +44 (0) 20 7827 6000, +44 (0) 20 7827 6001 (fax), website: www.smi-online.co.uk/08gtl44.asp. 28-29.

Biofuels Conference, Berlin, +44 207 067 1800, +44 207 430 0552 (fax), e-mail: c.taylor@theenergyexchange.co.uk, website: www.theenergyexchange.co.uk. 28-30.

SPE Russian Oil & Gas Technical Conference & Exhibition, Moscow, (972) 952-9393, (972) 952-9435 (fax), e-mail: spedal@spe.org, website: www.spe.org. 28-30.

Arab Oil & Gas Show, Dubai, +971 4 3355001, +971 4 3355141 (fax), e-mail: info@icedxb.com, website: www.ogsonline.com. 28-30.

✦Offshore Middle East Conference, Doha., (918) 831-9160, (918) 831-9161 (fax), e-mail: registration@pennwell.com, website: http://ome08.events.pennnet.com/fl/index.cfm. 28-30.

IADC Contracts & Risk Management Conference, Houston, (713) 292-1945, (713) 292-1946 (fax); e-mail: conferences@iadc.org, website: www.iadc.org. 29-30.

NOVEMBER

Sulphur International Conference and Exhibition, Rome, +44 20 7903 2410, +44 20 7903 2432 (fax), e-mail: conferences@crugroup.com, website: www.sulphurconference.crugroup.com. 2-5.

ASME International Mechanical Congress & Exposition, Boston, (973) 882-1170,

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(973) 882-1717 (fax), e-mail: infocentral@asme.org, website: www.asme.org. 2-6.

Abu Dhabi International Petroleum Exhibition & Conference (ADIPEC), Abu Dhabi, +971 (0) 2 4444 909, +971 (0) 2 4444 383 (fax), e-mail: info@adipec.com, website: www.adipec.com. 3-6.

✦Purvin & Gertz Latin American LPG Seminar, Rio de Janeiro, (713) 331-4000, (832) 209-4451 (fax), e-mail: ts@prvingertz.com, website: www.purvingertz.com. 3-6.

Deepwater Operations Conference & Exhibition, Galveston, Tex., (918) 831-9160, (918) 831-9161 (fax), e-mail: registration@pennwell.com, website: www.deepwateroperations.com. 4-6.

North African Oil and Gas Summit, Vienna, +44 (0) 207 067 1800, +44 207 430 0552 (fax), e-mail: c.brown@theenergyexchange.co.uk, website: www.theenergyexchange.co.uk/nas3register.html. 4-6.

Mangystau International Oil & Gas Exhibition, Aktau, + (44) 020 7596 5000, + (44) 020 7596 5111 (fax), e-mail: oilgas@ite-exhibitions.com, website: www.ite-exhibitions.com/og. 5-7.

GPA North Texas Annual Meeting, Dallas, (918) 493-3872, (918) 493-3875 (fax), email: pmirkin@gasprocessors.com, website: www.gasprocessors.com. 6.

GITA's GIS Annual Oil & Gas Conference, Calgary, (303) 337-0513, (303) 337-1001 (fax), e-mail: info@gita.org, website: www.gita.org/ogca. 6-7.

IADC Annual Meeting, Paradise Valley, Ariz., (713) 292-1945, (713) 292-1946 (fax); e-mail: conferences@iadc.org, website: www.iadc.org. 6-7.

SEG International Exposition and Annual Meeting, Las Vegas, (918) 497-5542, (918) 497-5558 (fax), e-mail: register@seg.org, website: www.seg.org. 9-14.

IPAA Annual Meeting, Houston, (202) 857-4722, (202) 857-4799 (fax), website: www.ipaa.org. 10-12.

Houston Energy Financial Forum, Houston, (918) 831-9160, (918) 831-9161 (fax), e-mail: registration@pennwell.com, website: www.accessanalyst.net. 11-13.

✦Financial Modelling in the Oil and Gas Industry Conference, London, +44 (0) 20 7827 6000, +44 (0) 20 7827 6001 (fax), website: www.smi-online.co.uk/oilgas-modelling38.asp. 12-13.

American Institute of Chemical Engineers (AIChE) Annual Meeting, Philadelphia, (212) 591-8100, (212) 591-8888 (fax), website: www.aiche.org. 16-21.

ERTC Annual Meeting, Vienna, +44 1737 365100, +44 1737 365101 (fax), e-mail: events@gtforum.com, website: www.gtforum.com. 17-19.

Annual Houston Energy Financial Forum, Houston, (918) 831-9160, (918) 831-9161 (fax), e-mail: registration@pennwell.com, website: www.accessanalyst.net. 18-20.

Annual European Autumn Gas Conference (EAGC), Cernobbio, Italy, +44 (0) 1737 855281, +44 (0) 1737 855482 (fax), e-mail: vanessahurrell@dmgworldmedia.com, website: www.theeagc.com. 25-26.

DECEMBER

IADC Well Control Middle East Conference & Exhibition, Muscat, (713) 292-1945, (713) 292-1946 (fax), e-mail: conferences@iadc.org, website: www.iadc.org. 2-3.

Annual Refining & Petrochemicals in Russia and the CIS Countries Roundtable, Prague, +44 207 067 1800, +44 207 430 0552 (fax), e-mail: e.polovinkina@theenergyexchange.co.uk, website: www.theenergyexchange.co.uk. 2-4.

Downstream Asia Refining & Petrochemicals Conference, Singapore, +44 (0) 207 067 1800, +44 207 430 0552 (fax), e-mail: a.ward@theenergyexchange.co.uk, website: www.wraconferences.com/FS1/dalregister.html. 3-4.

IADC Drilling Gulf of Mexico Conference & Exhibition, Galveston, Tex., (713) 292-1945, (713) 292-1946 (fax); e-mail: conferences@iadc.org, website: www.iadc.org. 3-4.

Deep Offshore Technology International Asia/Pacific Conference & Exhibition, Perth, (918) 831-9160, (918) 831-9161 (fax), e-mail: registration@pennwell.com, website: www.deepoffshoretechnology.com. 3-5.

International Petroleum Technology Conference (IPTC), Kuala Lumpur, +971 (0)4 390 3540, +971 (0)4 366 4648 (fax), e-mail: iptc@iptcnet.org, website: www.iptcnet.org. 3-5.

USAEE/IAEE North American Conference, New Orleans, (216) 464-2785, (216) 464-2768 (fax), website: www.usaee.org. 3-5.

PIRA Natural Gas Markets Conference, New York, (212) 686-6808, (212) 686-6628 (fax), e-mail: sales@pira.com, website: www.pira.com. 8-9.

PIRA Understanding Global Oil Markets Conference, New York, (212) 686-6808, (212) 686-6628 (fax), e-mail: sales@pira.com, website: www.pira.com. 10-11.

Seatrade Middle East Maritime Conference & Exhibition, Dubai, +44 1206 545121, +44 1206 545190 (fax), e-mail: events@seatrade-global.com, website: www.seatrade-middleeast.com. 14-16.

AAPG Annual Convention & Exhibition, San Antonio, 1 (888) 945 2274, ext. 617, (918) 560-2684 (fax), e-mail: convene@aapg.org, website: www.aapg.org/sanantonio. 20-23.

SPE Improved Oil Recovery Symposium, Tulsa, (972) 952-9393, (972) 952-9435 (fax), e-mail: spedal@spe.org, website: www.spe.org. 20-23.

XSPE Progressing Cavity Pumps Conference, Houston, (972) 952-9393, (972) 952-9435 (fax), e-mail: spedal@spe.org, website: www.spe.org. 27-29.

2009

JANUARY

Petrotech International Oil & Gas Conference & Exhibition, New Delhi, +91 11 2436 4055, +91 11 2436 0872 (fax), e-mail: convenor_petrotech@iocl.co.in, website: www.petrotech2009.org/registration.aspx. 11-15.

Oil & Gas Maintenance Technology Conference & Exhibition, Manama, (918) 831-9160, (918) 831-9161 (fax), e-mail: attendingOGMT@pennwell.com, website: www.oilandgas-maintenance.com. 19-21.

Pipeline Rehabilitation & Maintenance Conference, Manama, (918) 831-9160, (918) 831-9161 (fax), e-mail: attendingOGMT@pennwell.com, website: www.pipeline-rehab.com. 19-21.

Pipeline Rehabilitation & Maintenance Conference & Exhibition, Manama, (918) 831-9160, (918) 831-9161 (fax), e-mail: registration@pennwell.com, website: www.piipeline-rehab.com. 19-21.

SPE Hydraulic Fracturing Technology Conference, The Woodlands, Tex., (972) 952-9393, (972) 952-9435 (fax), e-mail: spedal@spe.org, website: www.spe.org. 19-21.

World Future Energy Summit, Abu Dhabi, +971 2 444 6011, +971 2 444 3987 (fax), e-mail: sales@turretme.com, website: www.worldfutureenergysummit.com. 19-21.

API Exploration & Production Winter Standards Meeting, San Antonio, (202) 682-8000, (202) 682-8222 (fax), website: www.api.org. 19-23.

API/AGA Oil and Gas Pipeline Welding Practices Conference, San Antonio, (202) 682-8000, (202) 682-8222 (fax), website: www.api.org. 21-23.

International Process Analytical Technology Forum (IFPAC), Baltimore, (847) 543-6800, (847) 548-1811 (fax), e-mail: info@ifpacnet.org, website: www.ifpac.com. 25-28.

Global E&P Summit, Madrid, +44 (0)20 7202 7500, +44 (0)20 7202 7600 (fax), e-mail: info@wtgevents.com, website: www.epsummit.com. 26-28.

Offshore West Africa Conference, Abuja, (918) 831-9160, (918) 831-9161 (fax), e-mail: attendOWA@pennwell.com, website: www.offshorewestafrica.com. 27-29.

The European Gas Conference, Vienna, +44 (0) 1242 529 090, +44 (0) 1242 529 060 (fax), e-mail: wra@theenergyexchange.co.uk, website: www.theenergyexchange.co.uk. 27-29.

SIHGAZ International Hydrocarbon & Gas Fair, Hassi Messaoud, + 213 21 21 58 74, + 213 21 21 58 72/76 (fax), e-mail: contact@foirex.com, website: www.sihgaz2009.com. 28-31.

FEBRUARY

SPE Reservoir Simulation Symposium, The Woodlands, Tex., (972) 952-9393, (972) 952-9435 (fax), e-mail: spedal@spe.org, website; www.spe.org. 2-4.

IADC Health, Safety, Environment & Training Conference & Exhibition, Houston, (713) 292-1945, (713) 292-1946 (fax), e-mail: conferences@iadc.org, website: www.iadc.org. 3-4.

Deep Offshore Technology International Conference & Exhibition (DOT), New Orleans, (918) 831-9160, (918) 831-9161 (fax), e-mail:

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registration@pennwell.com, website: www.dotinternational.net. 3-5.

Global Petrochemicals Conference & Annual Meeting, Cologne, +44 (0) 1242 529 090. +44 (0) 1242 529 060 (fax), e-mail: wra@theenergyexchange.co.uk, website: www.wraconferences.com. 3-5.

Russia Offshore Annual Meeting, Moscow, +44 (0) 1242 529 090, +44 (0) 1242 529 060 (fax), e-mail: wra@theenergyexchange.co.uk, website: www.theenergyexchange.co.uk. 4-6.

NAPE Expo, Houston, (817) 847-7700, (817) 847-7704 (fax), e-mail: info@napeexpo.com, website: www.napeonline.com. 5-6.

Pipeline Pigging & Integrity Management Conference, Houston, (713) 521-5929, (713) 521-9255 (fax), e-mail: clarion@clarion.org, website: www.clarion.org. 9-12.

SPE Unconventional Fields Conference, Margarita Island, Venezuela, (972) 952-9393, (972) 952-9435 (fax), e-mail: spedal@spe.org, website: www.spe.org. 10-12.

Pipe Line Contractors Association Annual Conference (PLCA), Carlsbad, Calif., (214) 969-2700, e-mail: plca@plca.org, website: www.plca.org. 11-15.

IADC/SPE Managed Pressure Drilling & Underbalanced Operations Conference & Exhibition, San Antonio, (713) 292-1945, (713) 292-1946 (fax), e-mail: conferences@iadc.org, website: www.iadc.org. 12-13.

International Petrochemicals Technology Conference & Exhibition, London, +44 (0) 20 7357 8394, +44 (0) 20 7357 8395 (fax), e-mail: enquiries@europetro.com, website: www.europetro.com. 16-17.

IP Week, London, +44 (0)20 8561 6030, +44 (0)20 8561-0131 (fax), e-mail: events@energyinst.org.uk, website: www.energyinst.org.uk. 16-19.

International Downstream Technology & Catalyst Conference & Exhibition, London, +44 (0) 20 7357 8394, +44 (0) 20 7357 8395 (fax), e-mail: enquiries@europetro.com, website: www.europetro.com. 18-19.

✦ASEG/PESA International Geophysical Conference & Exhibition, Adelaide, +61 8 8352 7099, +61 8 8352 7088 (fax), e-mail: ASEG2009@sapro.com.au, website: www.sapro.com.au/aseg.htm. 22-25.

Laurance Reid Gas Conditioning Conference, Norman, Okla., (405) 325-2248, (405) 325-7164 (fax), e-mail: bettyk@ou.edu, website: www.engr.outreach.ou.edu. 22-25.

International Pump Users Symposium, Houston, (979) 845-7417, (979) 847-9500 (fax), e-mail: inquiry@turbo-lab.tamu.edu, website: http://turbolab.tamu.edu. 23-26.

MARCH

EAGE North African/Mediterranean Petroleum and Geosciences Conference & Exhibition, Tunis, +31 88 995 5055, +31 30 6343524 (fax), e-mail: eage@eage.org, website: www.eage.org. 2-4.

SPE Research & Development Conference, Lisbon, (972) 952-9393, (972) 952-9435 (fax), e-mail: spedal@spe.org, website: www.spe.org. 3-4.

APPEX Prospect and Property Expo, London, (918) 560-2616, (918) 560-2684 (fax), e-mail: convene@aapg.org, website: www.aapg.org. 3-5.

Subsea Tieback Forum & Exhibition, San Antonio, (918) 831-9160, (918) 831-9161 (fax), e-mail: registration@pennwell.com, website: www.subseatiebackforum.com. 3-5.

GPA Annual Convention, San Antonio, (918) 493-3872, (918) 493-3875 (fax), e-mail: pmirkin@gasprocessors.com, website: www.gasprocessors.com. 8-11.

Doha Natural Gas Conference & Exhibition, Doha, e-mail: gascon@qp.com.qa, website: www.dohagascon.com.qa. 9-12.

✦ARTC Annual Meeting, Kuala Lumpur, +44 1737 365100, +44 1737 365101 (fax), e-mail: events@gtforum.com, website: www.gtforum.com. 10-12.

European Fuels Conference, Paris, +44 (0) 1242 529 090. +44 (0) 1242 529 060 (fax), e-mail: wra@theenergyexchange.co.uk, website: www.wraconferences.com. 10-12.

Turkish International Oil & Gas Conference & Showcase (TUROGE), Ankara, +44 (0) 207 596 5233, +44 (0) 207 596 5106 (fax), e-mail: oilgas@ite-exhibitions.com, website: www.oilgas-events.com. 10-12.

Middle East Oil & Gas Show & Conference (MEOS), Manama, +973 17 550033, +973 17 553288 (fax), e-mail: aeminfo@batelco.com.bh, website: www.allworldexhibitions.com/oil. 15-18.

Annual International LPG Seminar, The Woodlands, Tex., (281) 367-9797, website: www.purvingertz.com. 16-19.

Gas Asia, Kuala Lumpur, +44 (0) 1242 529 090, +44 (0) 1242 529 060 (fax), e-mail: wra@theenergyexchange.co.uk, website: www.theenergyexchange.co.uk. 17-18.

SPE/IADC Drilling Conference & Exhibition, Amsterdam, (972) 952-9393, (972) 952-9435 (fax), e-mail: spedal@spe.org, website; www.spe.org. 17-19.

Latin American Meeting on Energy Economics, Santiago, 56 2 3541411, 56 2 5521608 (fax), e-mail: info@elaee.org, website: www.elaee.org. 22-24.

NPRA Annual Meeting, San Antonio, (202) 457-0480, (202) 457-0486 (fax), e-mail: info@npra.org, website: www.npra.org. 22-24.

ACS Spring National Meeting & Exposition, Salt Lake City, (202) 872-4600, e-mail: service@acs.org, website: www.acs.org. 22-26.

NACE Corrosion Conference & Expo, Atlanta, (281) 228-6200, (281) 228-6300 (fax), website: www.nace.org/c2009. 22-26.

✦PIRA Understanding Global Oil Markets Seminar, Dubai, 65 6581 4122, e-mail: jay@pira.com, website: www.pira.com. 23-24.

SPE Americas E&P Environmental and Safety Conference, San Antonio, (972) 952-9393, (972) 952-9435 (fax), e-mail: spedal@spe.org, website; www.spe.org. 23-25.

API Spring Petroleum Measurement Standards Meeting, Dallas, (202) 682-8000, (202) 682-8222 (fax), website: www.api.org. 23-26.

Asian Biofuels Roundtable, Kuala Lumpur, +44 (0) 207 067 1800, +44 207 430 0552 (fax), e-mail: a.ward@theenergyexchange.co.uk, website: www.wraconferences.com/FS1/AB1register.html. 24-25.

SPE Western Regional Meeting, San Jose, (972) 952-9393, (972) 952-9435 (fax), e-mail: spedal@spe.org, website; www.spe.org. 24-26.

Offshore Mediterranean Conference & Exhibition (OMC), Ravenna, +39 0544 219418, +39 0544 39347 (fax), e-mail: conference@omc.it, website: www.omc2009.it. 25-27

NPRA International Petrochemical Conference, San Antonio, (202) 457-0480, (202) 457-0486 (fax), e-mail: info@npra.org, website: www.npra.org. 29-31.

Petroleum Geology Conference, London, +44 (0)20 7434 9944, +44 (0)20 7494 0579 (fax), e-mail: georgina.worrall@geolsoc.org.uk, website: www.geolsoc.org.uk. Mar. 30-Apr. 2.

SPE/ICoTA Coiled Tubing & Well Intervention Conference & Exhibition, The Woodlands, Tex., (972) 952-9393, (972) 952-9435 (fax), e-mail: spedal@spe.org, website: www.spe.org. Mar. 31-Apr. 1.

Offshore Asia Conference, Bangkok, 918) 831-9160, (918) 831-9161 (fax), e-mail: attendingOA@pennwell.com, website: www.offshoreasiaevent.com. Mar. 31-Apr. 2.

APRIL

Georgian International Oil, Gas, Energy and Infrastructure Conference & Showcase (GIOGIE), Tbilisi, +44 (0) 207 596 5233, +44 (0) 207 596 5106 (fax), e-mail: oilgas@ite-exhibitions.com, website: www.oilgas-events.com. 2-3.

SPE Production and Operations Symposium, Oklahoma City, (972) 952-9393, (972) 952-9435 (fax), e-mail: spedal@spe.org, website: www.spe.org. 4-8.

ATYRAU Regional Oil & Gas Exhibition & OilTech Kazakhstan Petroleum Technology Conference, Atyrau, +44 (0) 207 596 5233, +44 (0) 207 596 5106 (fax), e-mail: oilgas@ite-exhibitions.com, website: www.oilgas-events.com. 7-9.

GPA Mid-continent Annual Meeting, Oklahoma City, (918) 493-3872, (918) 493-3875 (fax), website: www.gasprocessors.com. 16.

✦ERTC Coking & Gasification Conference, Budapest, 44 1737 365100, +44 1737 365101 (fax), e-mail: events@gtforum.com, website: www.gtforum.com. 20-22.

Pipeline Technology Tradeshow, Hannover, +49 511 89 31240, +49 511 89 32626 (fax), website: www.hannovermesse.de. 20-24.

IADC Drilling HSE Middle East Conference & Exhibition, Abu Dhabi, (713) 292-1945, (713) 292-1946 (fax), e-mail: conferences@iadc.org, website: www.iadc.org. 21-22.

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A hard kick in the face

Judy R. Clark
Senior Associate Editor

Hurricane Ike, 600 miles in diameter, devastated Haiti and Cuba then came roaring into the Texas Gulf Coast in the wee hours of Saturday, Sept. 13, and gave the Galveston-Houston areas a sodden hard kick in the face.

Normally bustling with more than 4 million people, Houston was eerily dark and quiet following the storm's 8-hr battering that littered manicured lawns with tons of debris and toppled majestic trees and power lines in a jarring tangle that would take weeks to clear. Few people were unaffected.

To the south, whole neighborhoods were chewed up and spit out by the enormous storm surge that left only colossal debris piles and a few isolated posts where beautiful beachfront communities had been. At least 64 persons in Texas died.

In the aftermath, a stunned populous found themselves in the dark with little available electricity, water, food, gasoline, or means of communication. Gas stations could not pump gasoline, tap water had to be boiled, grocery shelves were bare, cell phones didn't work, areas were flooded, mosquitoes swarmed, and a curfew was necessary to protect people and vacated homes. Laundry was a problem, businesses were closed, and there were long lines for food, water, and gasoline.

In the sultry air, it was difficult for the "most-air-conditioned city in the world" to be without cooling for 2-3 weeks. But Texans are resilient. The long, hard cleanup began immediately. The city will pay $25 million to haul away all of the debris.

People helped each other wherever, however they could.

OGJ staff scattered

Those in the path of the storm surge were required to leave before the landfall. OGJ's Chief Technology Editor Warren True and his wife were among those in the mandatory evacuation area. Editor Bob Tippee invited them to his northwest Houston home, which sustained roof damage but regained power after only 14 hr. Two days later Production Editor Guntis Moritis joined them, staying for 2 days before driving to Austin to work there.

OGJ's offices were still dark on Monday, so Senior News Editor Steven Poruban was sent on a 9-hr drive to Tulsa to oversee completion of the final (General Interest) section of the magazine. When office power was restored Monday afternoon, Poruban was recalled to Houston. He had driven halfway to Tulsa.

Chief Editor-Exploration Alan Petzet, whose home had no power for 13 days, did drive to Tulsa and worked there for the duration.

This editor, heeding pleas from my daughter in Austin, drove there with my dog on Friday as the storm was approaching, and I slept on her couch and used her laptop and internet connection to edit articles and e-mail them back to Houston for the web site, E-Newsletter, and magazine. Highway signs in Austin and Dallas all week flashed, "Do not travel to Houston."

OGJ Senior Staff Writer Paula Dittrick, who was without power for more than 2 weeks and had to contend with damage to her home as well, e-mailed that it was a major coup that she got some gasoline after waiting only 30 min during her lunch hour.

Getting the job done

Before, during, and after the storm, Tippee, who had power in his home, wrote updates on the production numbers and storm damage to oil and gas facilities, and he and the General Interest staff got the E-Newsletter out daily and populated the web site.

Until power was restored to the office, Senior Writer Sam Fletcher used a neighbor's internet connection to send in his daily Market Watch, which also carried hurricane data.

Drilling Editor Nina Rach flew to Brazil before the Houston airports were closed but couldn't work on files online because the Houston server was shut down for several days. "It's hard enough juggling regular deadlines when traveling as well as reporting on whatever event you're attending," she said. "But in those first few days after Ike hit, I finished a 7-page Drilling Market Focus on Australia, due for the Oct. 13 issue," and wrote the story from the Rio conference on presalt (see p. 30).

She then flew to Houston, took a cab home in the dark, changed, repacked, and flew to Denver where she went with her luggage straight into convention presentations.

'Cone of uncertainty'

Communications enabled more than a million people to leave before the hurricane struck. Many who remained had bought water, food, batteries, generators, and other supplies "just in case."

Potential storm paths lay in a wide "Cone of Uncertainty" with 7-9 landfall possibilities, so until Sept. 11, one was never sure it really was going to affect us. After all, hadn't Hurricane Rita in 2005 missed Houston after millions of people fled and were stranded in giant traffic snarls, running out of gas in the late September heat? ✦

Process Notes

Oil Sands Crude – Profits and Problems?

Canadian bitumen production currently runs about 1 MMbpd, with some being sold as Synbit and Dilbit. Over the next 10-12 years output is expected to increase to 3.5 MMbpd and more refiners will begin investing to process it and come to depend on the Synbit and Dilbit for a significant part of their supply. Few today, however, have ever processed these feeds at high blend ratios, and are unaware that conventional process and equipment designs are not up to the job. Canadian oil sands feedstocks are extremely hard to desalt, difficult to vaporize, thermally unstable, corrosive, and produce high di-olefin product from the coker. If you intend to lock into a long-term supply, therefore, it is imperative that you consider reliability and run length from a particular design.

Too low tube velocity in the vacuum heater tubes will lead to precipitation of asphaltenes. Too fast a flow rate will erode the tube bends. If coil layout, burner configuration and steam rate are not correct, run length will be measured in months, not years. Diluent recovery unit designs must take into account possible upsets from water slugs and other unpredictable situations that have damaged internals, resulting in diluent losses and high vacuum unit overhead condensable oil. Diluent is neither cheap nor plentiful, and high vacuum column operating pressure will reduce overall liquid volume yields. And if the design of the delayed coker fractionator is based on today's experience with conventional heavy feedstocks you will be lucky to run six months.

What all this means is that special process and equipment designs are needed to satisfy the special demands of processing oil sands crudes. Such processes are not generated by computer based designers who have little or no experience and never leave the office. They are developed only by engineers with know-how who have real experience wearing Nomex® suits and measuring true unit performance in Northern Alberta. Shouldn't this be kept in mind by those considering long term supply agreements?

For a discussion of factors involved in designing refinery units to process difficult oil sands feedstocks, ask for Technical Papers #234 and 238.

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Editorial

The energy factor

A credit implosion threatening US prosperity magnifies the costs of errors in energy policy, of which the federal government has committed far too many in recent years. While attention now properly focuses on keeping a liquidity crisis centered on bad mortgage debt from strangling the US economy and infecting the rest of the world, energy cannot for long stay in the shadows. It's too important to economic health. And politicians have mistreated it for too long.

Hopeful signs glint in the gloom. Congress this month dropped moratoriums in effect since the 1980s on leasing of undrilled acreage on the Outer Continental Shelf. And, in his first debate against Democratic presidential contender Barack Obama, Republican John McCain gave voice to his politically bold opposition to subsidies for fuel ethanol.

But those are isolated exceptions to a national orientation toward energy that remains fundamentally wrong. They should arise instead as part of an energy strategy fully integrated with responses to the immediate crisis. Aligning energy with economic imperatives, however, requires a political discussion more enlightened than anything heard lately from the American political machinery.

Urge to spend

Both presidential candidates and most lawmakers, for example, still wail against imported oil for reasons that are at best skewed and at worst xenophobic. Foreign oil surely is less desirable than domestically produced energy. At the point of consumption, though, it beats any energy, domestic or not, that costs more.

Such economic verity escapes notice in the US, which commits itself to ever-growing public spending on noncommercial energy forms that promise minor contributions to supply. This urge to spend money on energy whose only appeal is that it isn't foreign oil needs to be brought under control. It has opened up a budgetary drain when national fiscal health is in jeopardy.

The natural linkage of energy and fiscal policies doesn't end there. First word of a proposal to use public funds to buy $700 billion worth of bad mortgages seemed to ease equity markets but weakened the US dollar, which had been recovering from the abysmal levels it reached in the first half of this year. Apparently, currency markets worried about the bail-out's budgetary effects. When the dollar weakened, the price of crude oil rebounded in line with the inverse relationship evident earlier this year before falling anew when the deal collapsed and concern turned to economic health and demand for oil.

Obviously, the dollar's value isn't the only factor in oil-price movements. Some economists say the relationship is illusory. But the strong correlation that emerged at a time of exceptional dollar weakness shouldn't be ignored. A government rescue of the financial system, hardly a sure bet at this writing, would expand the federal budget deficit and weaken the dollar if unaccompanied by economic growth, which will be difficult to achieve under any circumstances. The weaker dollar, if the crude-dollar correlation outweighs demand questions in traders' minds, would raise the nominal price for crude and lower growth prospects.

These interconnections compel the government to reject anything that expands the deficit without sound economic reason, such as limitless expenditure on energy forms that do nothing but perpetuate fantasies about energy independence. They also compel the government to favor anything that promises to generate incomes and tax revenues, boost domestic energy supply on a meaningful scale, and—oh, yes—trim oil imports. Leasing of federal land, on the Arctic National Wildlife Refuge coastal plain as well as the OCS, serves those goals. The need is urgent.

Clarifying vision

The credit crisis thus erects a framework within which the US can address energy as a central element of economic strategy. The very real threat of economic collapse should clarify America's energy vision. Correction of past mistakes can shed costs from the economy and federal budget, neither of which should have to carry extra baggage through the perilous course ahead. And development of commercial supply from natural resources can help strengthen the economy and balance national accounts.

At this anxious moment in history, the US must, at last, get energy policy right. ✦

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Have oil futures traders driven up the market?

Ronald D. Ripple
Curtin University of Technology
Perth

The US Commodity Futures Trading Commission (CFTC) in mid-July reclassified a futures trader as "large noncommercial" (speculator-investor) from its former designation as "large commercial."

Much of the general media coverage that followed implied that the action provides evidence that speculators have been the driving force behind rising crude oil prices. A careful examination of the CFTC data rejects such a conclusion.

It is particularly troubling that such inaccurate coverage permeates the media at a time of serious congressional debate regarding the role of speculators in these markets, especially when the reclassified trader actually may have been providing risk mitigation and liquidity service to the market via relatively low risk strategies.

The effects of the reclassification can be seen in CFTC comparative data for the week of July 15, 2008. Detailed tables available from CFTC show that the reclassification entails shifting only one firm to large noncommercial status. Media reports identified the firm involved as Vitol, a Swiss oil trader.[1]

The fact that only one firm is involved in the reclassification may be discerned from the CFTC tables showing change in the number of traders by only one under the headings of commercial long, commercial short, noncommercial long, and noncommercial spreading. This pattern of restructuring of the trades, especially the spreading component, does not support the conclusion that the shift implied a role for noncommercial traders in general in the upward movement of crude oil prices.

The shift in open interest from commercials to noncommercials falls almost entirely into the category of noncommercial spread trading. The spread trading reported in the CFTC data are predominantly calendar spreading, where a trader simultaneously holds a long (short) in a near month contract and a short (long) in a more distant maturity contract. Consequently, this shift in large trader classification does not shift the weight of longs vs. shorts attributable to noncommercials vs. commercials. The commercials are generally still net short in this market, and the shortfall of hedging services for short commercial traders remains satisfied by the noncommercials.

The recent argument has been that speculators have been long—excessively so—resulting in the upward move in prices. Moreover, recent claims contend that CFTC incorrectly classified traders, masking the role of speculators. The reclassification seems to have been interpreted as a lifting of this mask. However, an examination of the data shows that the reclassified firm had long positions of 150,716 contracts and simultaneously held short positions of 146,856 contracts (see table). This means that there were 146,856 contracts involved in calendar spread positions and that the firm was net long position by just 3,860 contracts.[2] These values are for futures contracts only, and the net long positions of this one firm amounted to just 0.3% (roughly a third of 1%) of the total open interest for the reported week.

COMMENT

The story is even more interesting when examining the combined futures and options positions. When including the delta-adjusted options equivalents to the futures-only data, the reclassified firm had 326,648 long positions and 330,741 short positions. This means that the firm actually was net short in the market by 4,093 contracts.

The claim that speculators accounted for as much as 81% of the market is not supported by the CFTC data.[3] Before the reclassification, the long positions for commercial traders accounted for 61.1% of total open interest, and the short positions accounted for 62%. After the reclassification, long commercial positions accounted for 49.8% of open interest, and

commercial shorts were 51.1%.

These shares are for the futures-only data. Combined futures and options data show that before the reclassification, commercial long positions were 56.6%, and shorts were 59.6%. After the reclassification these shares fell to 45.6% and 48.4%, respectively. In no case, however, is there room for noncommercials-speculators to account for 81% of the market.

COMPARISON OF OPEN INTEREST POSITIONS BEFORE AND AFTER RECLASSIFICATION

	Total open interest	Reportable positions							Nonreportable positions	
		Noncommercial			Commercial		Total			
		Long	Short	Spreading	Long	Short	Long	Short	Long	Short
		Contracts of 1,000 bbl								
Futures only										
New	1,344,411	210,013	187,631	369,766	670,135	686,747	1,249,914	1,244,144	94,497	100,267
Old	1,344,411	206,153	187,631	222,910	820,851	833,603	1,249,914	1,244,144	94,497	100,267
Futures and options										
New	2,974,130	238,974	150,870	1,269,679	1,356,837	1,440,782	2,865,489	2,861,330	108,641	112,800
Old	2,974,130	238,974	146,777	943,030	1,683,485	1,771,523	2,865,489	2,861,330	108,641	112,800

Source: US Commodity Futures Trading Commission

The general media's reporting of these issues implies that speculators are, in effect, uniquely long in these markets, thus driving price in only one direction, upward. This is a misrepresentation, or misunderstanding, of the nature of the trading positions in this market. Both commercials and noncommercials maintain considerable long and short positions. The commercials, usually seen as using the futures markets to hedge market price risk, tend to be net short; that is, tending to sell more futures contracts than they buy. For the market to balance, and to balance at the lowest risk mitigation cost, the net short positions of the commercials must be offset by net long positions by the noncommercials.

Nevertheless, it is not quite as simple as it sounds. The spreading positions by noncommercials also must be analyzed. This is because they represent quite different risk characteristics and because this type of trading dominates the activity of the noncommercials in this market. Spreading also enhances market liquidity simply by providing more opportunities for hedgers to enter and exit the market freely.

As noted, calendar spread positions represent a given trader simultaneously holding long and short positions in the same commodity but with different maturities. The returns on these spread positions are determined by changes in the slope of the forward curve in these futures prices.[4] As such, the volatility of the spreads returns is expected to be much less than if the trader took a straight long or straight short position. One interpretation of noncommercial use of spreads trading is that they accept exposure to this asset class in their diversified portfolios, thus providing risk mitigation and market liquidity service—but with minimized risk. Such action is not indicative of the risk seeking preferences often attributed to this class of trader.

Spread trading by noncommercials dominates straight trading by this class of trader; therefore, constraining their activity could significantly reduce the availability of risk mitigation and market liquidity services for commercials-hedgers. Because of reduced competition, this likely will increase the cost of the services that do survive.

The dominance of spread trading reported for futures only may be observed in the table, where the 369,766 spread positions clearly exceed the noncommercial's (after the reclassification) 210,013 long positions and 187,631 short positions. For the futures and options combined, the 1,269,679 spread positions dwarf the 238,130 long positions and 150,870 short positions.

Note, too, that although dominating noncommercial activity, there are fewer of these noncommercial spread positions than there are of the long and short positions held by commercial traders in either data set. Commercial traders, under the futures-only grouping, held 670,135 long and 686,747 short positions, and for the futures and options combined they held 1,356,837 long and 1,440,782 short positions.[5]

The spreading activity offers potentially more risk mitigation service for hedgers-commercials than would be the case if the same number of noncommercials invested in straight longs or shorts. This follows from the nature of futures contracts and spreads. As with any transaction, a sale must be offset with a purchase. For futures, this translates as every long in a maturity must be offset by a short in the same maturity. Since spreads involve longs and shorts in different maturities for a given trader, each side (maturity) of a spread transaction opens the opportu-

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nity for a hedger (exposed at one of the maturities and in a particular direction) to be in the opposite position. Thus, in the extreme, noncommercial spread positions may provide twice the hedging opportunities as straight long and straight short futures positions.

The trading activity of the reclassified trader was substantial; it constituted 11% of the market. However, this trader's net position, including options, was short, not long, and represented just 0.1% of the market.

A careful evaluation of the available data coupled with an understanding of how the futures contracts and markets operate does not support the mainstream media representations that the trader reclassification is evidence of massive market manipulation by noncommercial traders-speculators that was masked by incorrect classifications by CFTC. The reclassification does not provide support for proposed tightening of controls on noncommercial market participants. ✦

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3. Cho, op. cit.

4. If the price of both maturities moves in the same direction and by the same amount (a parallel shift of the forward curve), there is no gain.

5. Commercial traders also make extensive use of options on futures contracts in this market to meet their hedging requirements.

US House passes bill to stop oil commodities speculation

Nick Snow
Washington Editor

By a vote of 273 to 124, the US House of Representatives approved a bill Sept. 18 designed to stop excessive oil commodities speculation. The measure, which now moves to the Senate, also could bring reforms to natural gas markets, two business groups said.

"This bill is just one part of a comprehensive Democratic energy plan, which includes steps to lower [gasoline] prices immediately, increased drilling for oil and natural gas, more fuel-efficient cars, and serious investment in the energy technologies of the future," said House Majority Leader Steny H. Hoyer (D-Md.), following HR 6604's passage. "I urge the Senate to take action so that we can get vital energy legislation to the president's desk as soon as possible," he said.

The House's action came a week after its Agriculture Committee held a hearing on the subject hours after the Commodity Futures Trading Commission released a report on swap dealers and commodity index traders. Recommendations included removing swap dealers from the commercial trading category and creating a new classification for them.

"Our economists, as well as the interim task force report in July, did not find evidence that speculators were having an impact on crude oil prices. We're continuing to look at it, but our position hasn't changed," acting CFTC Chairman Walter L. Lukken told the committee, adding, "Admittedly, it was for a limited period, but we're still watching this."

But critics in the Senate as well as the House argued that CFTC's examination was too narrow and covered only a period from Dec. 31, 2007, to June 30, 2008, when oil prices soared, and not the time since mid-July when prices declined.

'Doesn't tell whole story'

Agriculture Committee Chairman Collin C. Peterson (D-Minn.) also criticized CFTC for not giving committee members time to examine the report before the hearing. "It provides us with the most accurate picture of index trading and swap dealer participation in the over-the-counter market to date. However, it still doesn't tell us the whole story," Peterson said.

"We need to examine the rise in commodity prices prior to 2008 and the fall in prices in July and August. I have asked the commission to look at these time periods so that we can see the complete narrative of the rise and fall of commodity prices," Peterson said following the Sept. 11 hearing.

The bill, which passed the House on Sept. 18, was essentially the same measure Peterson introduced on July 24 and the House narrowly defeated on July 30 after 20 Republicans changed their votes at their leadership's request.

It would require international exchanges trading US commodities to follow the same rules as US exchanges, direct CFTC to set position limits for commodities on designated contract markets, give CFTC new authority to impose position limits on currently unregulated over-the-counter markets, and limit hedge exemption eligibility to commercial traders.

HR 6604 also would require CFTC to define and classify index traders and swaps dealers and subject them to record-keeping and reporting requirements. It also would require CFTC to break out and publicly disclose data on the extent index funds and other

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WATCHING GOVERNMENT

Nick Snow, Washington Editor

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OCS lease bans lapse

Perhaps it was because of the proposed multibillion-dollar Wall Street bailout that the expiration of US Outer Continental Shelf leasing moratoriums on Sept. 30 went largely unnoticed (see p. 39). But it's likelier that nearly everyone involved recognizes the fight isn't over.

"Lifting the decades-old ban...is good news for the millions of American consumers...calling for the ban to be lifted, but it is only the first step. Congress should avoid reimposing this ban or any other obstacles to US oil and natural gas resources," said the American Petroleum Institute.

That same day, Natural Resources Defense Council official Rob Perks said, "Sadly, many elected officials who get that drilling won't lower prices at the pump or put a dent in our country's oil dependence nevertheless were unable to stop Big Oil and its friends in Congress."

"And in this election year, President Bush's threatened veto of a federal spending bill authorizing renewal of the drilling ban made the risk of a government shutdown too great for the Democrats to ignore," he continued on API's web site.

Opposition remains

Oil and gas association leaders agreed that congressional OCS leasing opponents, while toning down their rhetoric, are still firmly against opening new US offshore areas.

They pointed to the House bill passed Sept. 16 banning leases up to 50 miles offshore. From 50-100 miles, a state could have authorized federal leasing (if neighboring states didn't object), but it would be ineligible for a share of federal revenues.

Association executives said such provisions made the bill questionable; House Republicans called it a sham.

Still, some considered the OCS moratoriums' expiration a milestone. "Not only is Congress tackling the problem of rising energy prices head on by encouraging domestic energy development, we are doing so by working together across party lines," Senate Majority Leader Mitch McConnell (R-Ky.) said after the continuing resolution passed by 78 to 12 votes.

Refused to discuss it

Others were less upbeat. Sen. Thad Cochran (R-Miss.) said a continuing resolution became necessary when Democrats refused to allow OCS leasing amendments.

The result? "Before us, we now have an appropriations bill that does exactly what the majority hoped to avoid.... In the process of getting to that result, however, members of the House and Senate Appropriations Committees have been denied the opportunity to debate and offer amendments to the other appropriations bills," he continued.

Sen. Robert Menendez (D-NJ) contended: "Expanded OCS drilling is bad energy policy, bad environmental policy, and it will do nothing to lower the prices at the pump, now or ever. This country deserves a serious debate about energy and not just election year posturing."

Senate Energy and Natural Resources Committee Chairman Jeff Bingaman (D-NM) sent a clear signal on Sept. 25 when he told reporters: "We'll revisit this issue next spring." ✦

investment participants use commodity markets. The bill also authorizes the addition of 100 fulltime employees to CFTC, where staffing currently is at its lowest level since the agency was created in 1974, sponsors said.

'Vast amounts of capital'

In a floor statement, Peterson noted that commodity trading volumes have climbed dramatically in recent years. "This increase includes vast amounts of capital from parties that are not traditional futures market participants such as index funds, pension funds, and some hedge funds," he said.

"The presence of this additional capital has raised concerns that the resulting futures market prices may not accurately represent the forces of supply and demand, nor may they be fundamentally supported at the local selling points where those in the producing and selling of commodities are doing business," Peterson said.

The bill would go farther than the recommendations in CFTC's swap dealers and index traders report. In addition to removing these market participants from the commercial trading category, the study recommended development and publication of a new periodic supplemental report on OTC swap dealer activity, creation of a new CFTC data collection office with enhanced procedures and staffing, and development of "long form" reporting for some larger traders to more accurately assess their type of trading activity.

Other recommendations included adding staff and resources, encouraging more clearing of OTC transactions, and reviewing swap dealer commodity research independence.

"Transparency is healthy to regulators, participants, and the market," Lukken said at the Sept. 11 hearing. "Certainly, opening the drapes and shedding more light would be welcome. We were concerned that swap dealers had a loophole and were using it to get around reporting requirements. Having said this, we didn't find a significant number doing this. However, 18 is 18, and they

shouldn't be allowed to do it," he said.

Lukken said CFTC had not fully examined an independent report released on Sept. 10 which concluded that speculators were a likelier cause of oil price volatility in 2008 than underlying supply and demand. "My first impression is that there's a lot of margin of error and reverse engineering in their numbers. Our staff is still studying it," he said.

'100% fiction'

Energy economist Philip K. Verleger Jr., president of PK Verleger LLC, issued a statement that day calling Michael W. Masters' and Adam K. White's report, The Accidental Hunt Brothers, Part 2, a "piece that is 100% fiction" and "the worst example of junk economic analysis published in a very long time."

Verleger said oil prices rose during the first part of 2008 because light, sweet grades were in short supply because of continued US purchases and political problems in Nigeria. Prices came down after mid-July because new light, sweet crude production from Thunder Horse field in the Gulf of Mexico began, production in Nigeria stabilized, and the US finally stopped taking light, sweet crude off the market, he said.

But two business groups separately said on Sept. 18 that stronger commodity market regulation is needed to halt excessive speculation affecting natural gas as well as crude oil prices. "It has cost natural gas consumers over $40.4 billion from January to August 2008 when compared to the same time period last year," said Paul N. Cicio, president of the Industrial Energy Consumers of America.

Cicio said the US Energy Information Administration reports that domestic gas production rose by 8.6% from January to August, demand was essentially unchanged from the previous year, and national inventories were within their normal range. "These facts prove that the price spike was not driven by supply vs. demand fundamentals," Cicio said. He said HR 6604 was a good beginning but fell short of needed mandatory position limits in the OTC market.

American Public Gas Association Pres. Bert Kalisch said consumer confidence in the gas market has been shaken, and additional transparency measures are needed to restore trust. He also indicated that speculative investment played a role in pushing gas prices higher recently and stated that "consumers should not be forced to pay a 'speculative premium.'" ✦

Petrobras, IOCs share subsalt, presalt exploration views

Nina M. Rach
Drilling Editor

All eyes were on Brazil's "presalt" play at the Rio Oil & Gas Expo and Conference Sept. 15-19 in Barra de Tijuca, an eastern suburb of Rio de Janeiro.

State-owned Petroleo Brasileiro SA (Petrobras) and international oil company (IOC) executives spoke on subsalt exploration activities during the first 2 days of the conference. Several senior executives of Houston-based operators did not appear for scheduled presentations, because of problems caused by Hurricane Ike. They were represented by in-country staff.

In a plenary session on Sept. 15, Petrobras, Chevron, and Shell shared "Subsalt Experiences." Moderator Murio Marroquin, president of Devon Energy do Brazil, stressed the distinction between "presalt" plays off Brazil and "subsalt" plays in the Gulf of Mexico.

Petrobras

Francisco Nepomuceno Filho, E&P corporate executive manager for Petrobras, reviewed the company's recent offshore development strategy and results.

In 2000-01, Petrobras concentrated on monetizing its deepwater assets in the Campos basin, increasing oil production to 1.5 million b/d from 500,000 b/d. Likewise, it increased Tertiary sandstone reserves to 10 billion bbl from 3 billion bbl.

In 2003-06, Petrobras went outside the Campos basin, drilling in water 1,000-2,000 m deep in Espiritu Santo basin to the north, and Santos basin to the south. Filho said the company found "five new giant fields" outside Campos and explored deeper, Cretaceous sandstones. During this time, Petrobras began using centrifugal pumps, boosting oil production to 1.8 million b/d, up from 1.5 million b/d, and increasing reserves to 14 million bbl, up from 10 million bbl.

By 2007, Petrobras had accrued production of 11.5 billion bbl and logged reserves of 14 billion bbl, with most of the reserves in deep water.

Filho noted that Petrobras's previous strategic plan, including forecasts to 2012, was made before the presalt discoveries. He said a new strategic plan would be released before yearend.

During 2006-08, Petrobras explored and discovered light oil in presalt reservoirs, including eight discoveries in the deepwater Campos basin with 28-30° oil. Filho said cluster drilling in the Santos basin's Litoral Norte led to discoveries of light oil in complex carbonate reservoirs, typified by Tupi and Iaga. The salt is 2,000-m thick, and the hydrocarbons have associated CO_2. The high-pressure, acid environment requires special production equipment.

Filho believes Brazil's presalt prospectivity is greater than that of the Gulf of Mexico, noting that all nine of Brazil's presalt wells produced oil. Although wells in the Gulf of Mexico are deeper, they are not as productive, he said.

About 20% of Petrobras' presalt reserves are natural gas, leading to revi-

sions in the company's Plangas project. Petrobras planned to increase gas production in south and southeastern Brazil nearly 350% by 2010. Two new pipelines were designed to carry 55 million cu m/day (1.94 bcfd) up from 15.8 million cu m/day. Filho said the capacity has already increased to 25 million cu m/day.

The Tupi production pilot in the Santos basin should begin producing in 2010, and Petrobras approved two additional presalt pilotsfor 2013-14.

Chevron

Chevron Vice-Pres. Steven P. Thurston said the company has made 25 discoveries in deep water and is running 18 deepwater projects, with 8 of those already producing. Thurston participated in the subsalt experiences plenary on behalf of Melody Meyer, president of Chevron Energy Technology Co.

Chevron is investing billions in Brazil as a partner with Petrobras on Campos basin Block BC-20, which includes the Frade discovery, and in other areas.

Deepwater developments require integrated surface and subsurface technologies, he said. Chevron is working in deep water because it "offers a significant reward," and the company can leverage its people, portfolio, and deepwater capability. He described wide-azimuth 3D seismic as a "breakthrough" technology because of its use in subsalt imaging.

Thurston noted the success of the extended production test in 2006 at the subsalt Jack discovery in the Gulf of Mexico's Lower Tertiary trend. The water at Jack is deeper than 2,000 m and the well's TD was more than 8,000 m. Chevron will next run a well test at nearby St. Malo, also on Walker Ridge. The company uses titanium tubulars to mitigate high temperatures and pressures, and plans for subsea artificial lift and pumping systems.

"We believe we will find a commercial solution," Thurston said.

Thurston mentioned the installation of the topsides on the Tahiti truss spar in Green Canyon Block 640, which Hurricane Ike passed over with no problems. Tahiti is still expected to come online in third-quarter 2009, producing from Miocene reservoirs that are 25,000-28,000 ft subsea.

Chevron is working on ultradeepwater developments with long-distance tiebacks of more than 50 miles for oil and more than 200 miles for gas. Thurston said the company plans to drill through as much as 3,300 m of salt, and anticipates host facilities "with small field tie-ins."

Shell

Peter Voser, chief financial officer at Shell, described the company as a deepwater pioneer, citing the Perdido development in the Gulf of Mexico and the BC-10 development in Brazil.

Voser said Shell has discovered 8 billion bbl of oil globally in the last 7 years and increased its research and development spending to $1.2 billion/year, up from $500,000/year. He mentioned the success of ocean bottom sensor technology in seismic imaging.

Shell is building a new class of rigs called "bully rigs" and will take delivery of the first in 2010. It expects to improve fuel and safety performance and plans to use them in the Arctic and in deep water.

Voser said Shell has the largest LNG capacity of any IOC, and the company is investigating the use of floating LNG systems to tap and monetize hard-to-reach gas.

Shell's subsalt experience began with Groningen gas field, discovered in 1959, that has been producing since 1965. The company is adding compression at Groningen and using it as a swing producer.

About 10% of Shell's annual production comes from subsalt wells in Gabon, Oman, Kashagan, and the Gulf of Mexico.

In Oman, Shell is involved in a JV with Petroleum Development Oman LLC to develop intrasalt and presalt carbonate fields requiring advanced well techniques. PDO is a joint venture of the government of Oman 60%, Royal Dutch/Shell Group 34%, Total SA 4%, and Partex Oman Corp. 2%.

In the Gulf of Mexico, the Princess subsalt well was discovered in 2000, in water 1,083 m deep on Mississippi Canyon Block 765. Production began in 2002.

Shell has had downstream interests in Brazil since 1913. It now has interest in 10 offshore blocks, including 5 in the Santos basin. The company currently produces about 26,000 boed from Bijupira-Salema. Voser said Shell will drill more than 10 new subsalt wells in the coming years, in water deeper than 1,500 m. The company is fabricating subsea hardware in Brazil, and plans to incorporate subsea separation and pumping. The FPSO for BC-10 should arrive soon.

Panel

In a panel discussion on Sept. 16, Chevron, Schlumberger, and Petrobras discussed technological and economic challenges of exploring and exploiting subsalt reservoirs.

Mark Riding, deepwater theme director at Schlumberger, described a new seismic acquisition method developed by Schlumberger. "Coil shooting" is a full-azimuth (FAZ) technique with a circular geometry, in which a single vessel sails in overlapping circles, acquiring data constantly. Riding said FAZ data images subsalt more accurately than wide-azimuth data.

Riding also mentioned magnetotellurics, optimized drilling and well placement, geosteering, and fluid sampling and analysis (fluid profiling) as important technologies that will enable cost-efficient development of subsalt reservoirs.

"Deepwater E&P is on a technology fast track," he said.

Petrobras and partners began drilling presalt prospects in the Santos basin in 2005.

Brazil's national petroleum agency (ANP) approved five new deepwater fields in the Santos basin: Parati (BM-S-10), Tupi (BM-S-11), Caramba

(BM-S-21), and Carioca and Guará (both BM-S-9). Three more fields are under negotiation, according to Jose Formigli, executive manager of subsalt E&P at Petrobras.

The presalt reservoirs are complex carbonates, chiefly extensional basin sag ("sag") and synrift ("rift") formations.

Petrobras produced 1.79 million b/d in 2007 and expects production to increase at least 7%/year through 2012. In addition, the company anticipates that its new presalt fields in the Santos basin will begin commercial production in 2010, with a "steep ramp-up" to follow. By 2017, the presalt cluster in Santos will produce 1.126 million boed, Formigli said.

Petrobras said it will release its business plan for 2009-20 next month. ✦

NPC: 2007 'Hard Truths' findings, advisements still apply

Nick Snow
Washington Editor

Recommendations and findings in a groundbreaking 2007 report still apply more than a year after they were issued, members of the National Petroleum Council said at their 2008 annual meeting on Sept. 17.

But there also have been some surprises since the council submitted the report, "Facing the Hard Truths About Energy," to US Energy Sec. Samuel W. Bodman in July 2007, they added. Significant domestic onshore natural gas discoveries with production from unconventional formations have reduced the need to proceed with several LNG import projects, for instance.

And while much of the US energy workforce is headed toward retirements, enrollments in universities' petroleum engineering departments have doubled in the past 2 years, noted Rodney F. Nelson, who led the technology task force that helped prepare the original report.

This has created a new problem, a possible shortage of professors and instructors, which could be solved by asking recent retirees to step in on an interim basis, he said.

"We also need to reach out more aggressively to high school students before they make decisions about college. They need to become more aware that energy offers productive and rewarding careers," said Andrew Gould, chairman and chief executive of Schlumberger Ltd. and the study team's vice-chairman for technology.

A new energy reality

Bodman, who requested the report, said it highlighted the need for the US to develop a national energy strategy consensus. "We have reached a point where the old paradigm is being replaced by a new energy reality," he said.

Since the NPC issued the Hard Truths report, it has been downloaded more than 1.5 million times from its website, more than 8,200 hard copies have been distributed, more than 10,000 compact discs containing the report and its supporting materials have been distributed, and more than 180 summary presentations have been provided to opinion leaders worldwide, according to Alan Paul, the study team's chairman.

He said that when Bodman asked for an update, the council reconvened key participants to examine reactions to the report and the implications of recent energy outlooks and events on its findings and recommendations.

"Much has happened since the report was issued. Global crude oil and US natural gas prices rose to historic highs and remain volatile. Higher energy costs are beginning to slow demand growth. Aboveground risks such as conflicts, sabotage, and resource nationalism are widespread. The focus on carbon management has increased. Several of the Hard Truths demand modifications were addressed in the 2007 Energy Independence and Security Act. And energy has become a high profile topic in the political debate," Paul said.

But the report's key conclusions also have been validated, he continued. Global demand continues to grow appreciably, risks to expansion of conventional liquids supplies are increasing, and major additions to unconventional liquids supplies will be needed, exploration and production expenditures have increased dramatically, and growing pressure on cost and availability of project resources is hindering the ability to expand energy production capability, he said.

Fossil fuels' role

The first hard truth is that coal, oil, and natural gas will remain indispensable to meeting total projected energy demand growth, said James Burkhard, who was part of the Hard Truths team studying demand. "Updated projections show that fossil fuels will need to provide most of the world's energy supply through 2030," he said.

Donald L. Paul, a former chief technology officer at Chevron Corp. who was part of the Hard Truths study team examining supplies, said that the world is not necessarily running out of energy resources but their discovery and production risks are increasing. "Resource estimates are growing but turning those resources into supplies is a challenge," he said.

Expansion of all energy sources, including unconventional oil and gas, will be required, he continued. Required new capacity will have to come from outside as well as inside the Organization of Petroleum Exporting Countries and from biofuels. "Years are often required to increase production. For the US in particular, access to all resources will be critical," Paul said.

In the area of geopolitics, issues

created by revenue transfers, sovereign wealth funds in some producing countries, price subsidies in some consuming nations, and a growing understanding of the relationship between food and fuel need to be addressed, said Frank A. Verrastro, director and senior fellow at the Center for Strategic and International Studies' energy and national security program.

"Growing revenues are bringing new players into the picture who don't necessarily follow the traditional rules," he observed. ✦

Senators plan bill with MMS employee ethics reforms

Nick Snow
Washington Editor

Two US Senate Democrats plan to introduce legislation detailing appropriate conduct for government employees dealing with oil and gas producers in response to misconduct in the US Minerals Management Service's royalty-in-kind operation (OGJ Online, Sept. 12, 2008).

"If we need to put on the books 'Don't take money and drugs from the oil and gas industry,' that's what we'll do to stop the influence peddling. The whole sordid affair shows how much sway Big Oil holds over the government," said Bill Nelson (Fla.).

"With two oilmen in the White House for the past 8 years, parts of the federal government have become wholly owned subsidiaries of Big Oil," added Robert Menendez (NJ). "With these reforms, we intend to break up the cozy bond that has been allowed to develop for far too long, costing American taxpayers untold amounts of revenue."

They said their bill would ban the acceptance of all gifts from the oil and gas industry, increase the number of MMS employees required to file financial disclosure and past employment forms, require MMS employees to divest oil and gas investments before starting work at the US Department of the Interior agency, and hold MMS employees to the same standards as federal procurement officials. Those standards include a 1-year "revolving door" ban on accepting jobs at companies with which the federal employee worked while on the federal payroll, Nelson and Menendez explained.

The senators said their bill also would suspend the MMS royalty-in-kind program until the agency conducts full reviews and reports to Congress its findings determining if MMS has been collecting royalties accurately and ensuring that metering equipment is properly measuring royalties that are owed.

Training required

It also would require MMS to conduct "a robust training program," with employees certifying in writing that they understand the ethics laws and regulations, and to create an ombudsman position to monitor MMS's progress in carrying out reforms. The DOI's inspector general would hire the ombudsman and oversee his or her reports, Nelson and Menendez said.

Their announcement came 8 days after DOI Inspector General Earl E. Devaney submitted a report to Interior Sec. Dirk A. Kempthorne outlining ethics violations ranging from unauthorized outside employment to drug abuse and sexual solicitation by some employees in the MMS royalty-in-kind office.

The US House Natural Resources Committee, which is chaired by Nick J. Rahall (D-W. Va.), has scheduled a Sept. 18 hearing on Devaney's findings. Edward J. Markey (D-Mass.), who chairs the House Select Committee on Energy Independence and Global Warming, on Sept. 12 sent letters to the chief executives of three companies Devaney named in his report, requesting information about the firms' possible roles. ✦

SPE: Industry cites unconventional resources potential

Guntis Moritis
Production Editor

The estimated vast unconventional resources hold much promise for substantially adding to the world's energy needs, but developing these resources entails overcoming many restraints, attendees were told Sept. 22 during the opening session of the Society of Petroleum Engineers Annual Conference & Exhibition in Denver.

The speakers expected production from these resources to grow but each listed some practical barriers and limitations that may hinder development such as rising infrastructure costs and limited human capabilities.

Demand forecasts are that the world will need 50% more energy in the next 25 years, creating a need to continue developing unconventional resources from tight gas, shale gas, coalbed methane, Canadian oil sands, and oil shale, as discussed in the session.

Oil price

Marshall Adkins, director of energy research and managing director, equity research, Raymond James & Associates,

emphasized the need to have sufficiently high oil prices to develop unconventional resources economically.

"At today's prices development of these resources makes sense," he said.

Recent high oil prices have squeezed oil demand out of system but in the future, demand will continue increasing because of energy needs in such countries as China and India, Adkins said. He does see oil demand continuing to fall in the economically developed countries. In the US, he expects a continued minus 2% year-on-year demand drop.

Adkins noted that the world does not have an oil bubble because of the limited potential to increase production rates, especially in non-Organization of Petroleum Exporting Countries countries. He added that more rigs are drilling but production growth is not taking place. He expects an average $130/bbl oil price on the New York Mercantile Exchange in 2009.

Tight gas

Charles B. Stanley, executive vice-president and chief operating officer, Questar Corp., noted that tight gas development entails much more intense investment and activity than conventional gas.

Stanley said conventional gas reservoirs had a 70-80% recovery factor, with a few wells and limited infrastructure. In contrast, unconventional gas development requires many wells, he said. The wells decline by 60-70% during the first year and recover about one half of their recoverable gas in 5-6 years, with the remaining gas produced in the next 6-40 years, he added.

In the US, about one half of its produced gas is from tight gas, shales, and coal beds, and by 2020 this will increase to 60-70%, according to Stanley.

He noted that the US currently has an 8% year-to-year ramp-up in unconventional gas production.

Innovations in drilling, completions, and reservoir characterization have allowed development of these resources, Stanley said. Some innovations, he noted, were in rig design, bit design, new drilling fluids, directional drilling, fracing, coring, and microseismic.

Stanley said US permitting problems persist because local and state agencies are not staffed to handle the large number of wells needed to recover gas from unconventional resources.

Oil shale

Glen Vawter, executive director, National Oil Shale Association, said current oil shale research and development concerns in situ retorting. In the 1980s, before the US oil shale industry went bust, projects primarily involved mining and surface retorting. He noted that four of the main companies doing work in Colorado oil shales are Royal Dutch Shell PLC, ExxonMobil Corp., Chevron Corp., and American Shale Oil Co. in Colorado.

Vawter noted that this work is still in the research, development, and demonstration phase but he also expects gradual US oil shale development with possible production rates of 100,000-200,000 b/d in the next 25 years. He also noted that oil shales have much potential in many parts of the world. ✦

Bodman: Russia using energy as foreign policy 'tool'

Eric Watkins
Oil Diplomacy Editor

US Sec. of Energy Samuel Bodman, concerned about Russia's use of energy as a tool of foreign policy, said he would take up the issue with officials at a meeting next week in Vienna.

"I am concerned when...there seems to be a pattern of using energy and their God-given resources to affect foreign policy," Bodman said at an energy conference in Washington, DC. "That's a situation that bears looking into," he said.

Bodman's remarks coincided with reports that Abdalla Salem El-Badri, the secretary-general of the Organization of Petroleum Exporting Countries, would visit Moscow on Oct. 21-24.

The aim of El-Bari's visit is to hold talks following the attendance of a high-level Russian delegation, led by Vice-Premier Igor Sechin, at recent OPEC meetings.

At the meetings, Sechin proposed "extensive cooperation" with OPEC to meet global energy needs and said a draft memorandum of understanding would be drawn up to strengthen ties with the group.

While OPEC officials have downplayed the idea that Russia would join the organization, there are concerns in the US and elsewhere that Moscow will attempt to influence the group in connection with world markets—a point emphasized by Russian energy minister Sergei Shmatko on Sept. 26.

A more active position

"A Russian delegation attended the recent OPEC meeting, and I want to tell you what many of those in our delegation were saying: Russia needs to take a more active position concerning the current market price for oil," Shmatko said, adding, "There needs to be a Russian factor."

"We have always told OPEC, which tries to regulate it, that there are other factors: financial speculation, US inventories, etc. From our standpoint, we occupy such an important place in oil 'high society' we should be our own, Russian factor, perhaps not just one," Shmatko said.

"In any case, the [Russian] energy ministry has set that goal for itself. We will be preparing if not proposals then at least approaches. We haven't done this before. We want to formulate these approaches. And in that sense the deci-

sions might be most unexpected. Why not, for example, revise oil production forecasts?" he said.

"We believe we should more actively engage with the markets. Technological considerations prevent us from simply turning off the tap. We can't simply shut down a field and then open it up again at any time. We have different climatic conditions. In my view we can give our opinion from the point of view of forecasts, perhaps even engage in that in actuality," Shmatko said.

"The idea of reserving potential fields is very interesting in my view. Instead of discovering a field tomorrow and then proceeding [with development], we prepare a field from the point of view that it won't be touched for the time being, but there will be the ability to start it up in a fairly clearly defined term," he said.

"We are absolutely convinced, given those 'American bumps' oil prices have experienced in recent times, that we, a big, important oil power, need to formulate our relation to that—the Russian factor," Shmatko said.

As for when the new approaches would be ready, Shmatko said: "We are going to the next OPEC meeting in December, and I think we will have something before then.

"This is not a joint effort with OPEC," he added.

A new oil consortium?

Bodman's comments coincided with reports that Prime Minister Vladimir Putin of Russia and President Hugo Chavez of OPEC member Venezuela have established plans to create an oil consortium aimed at investing in joint oil ventures.

"[The Russians have] offered us the chance to create an oil consortium... the largest in the world," said Chavez in televised remarks from Moscow, adding that the consortium would be comprised of state-owned Petroleos de Venezuela SA, Russia's Lukoil Holdings, TNK, OAO Rosneft, and OAO Gazprom.

The venture initially would develop oil and gas projects in Venezuela then in other Latin American countries at a later time, Venezuela's communications ministry said in a statement.

While Russia may be using diplomatic efforts to affect market prices, it also has been criticized for using military tactics to control the flow of oil and gas.

In August, Russia attacked neighboring Georgia and was accused of efforts to undermine the transport of hydrocarbons from the Caspian-Central Asia region to world markets.

During the hostilities, Georgia accused Russia of attempting to bomb all three of the main pipelines through the country: the Baku-Tbilisi-Ceyhan and Baku-Supsa oil pipelines and the South Caucasus Pipeline, which carries gas to Turkey.

Anatoly Nogovitsyn, deputy head of Russia's general staff during the incursion denied early reports of attacks on the BTC line by his country, saying: "The oil pipeline was never a target that needed to be bombed" (OGJ Online, Aug. 12, 2008).

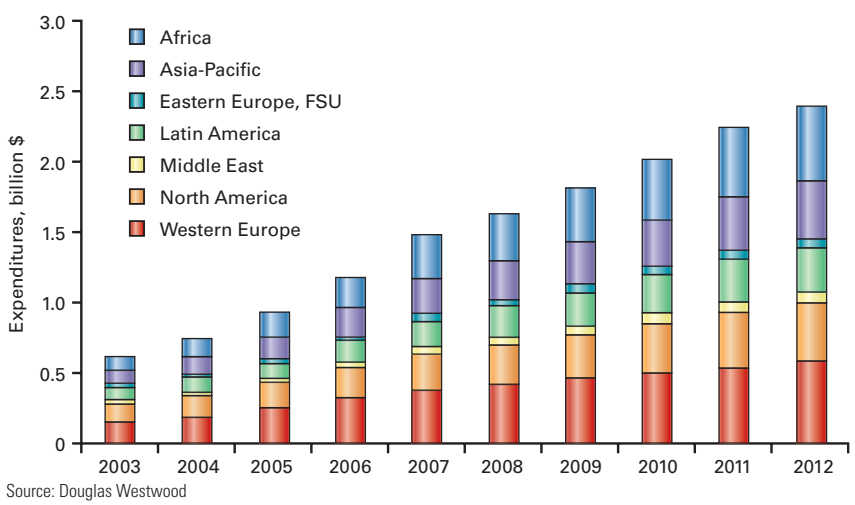
The Russian military incursion nonetheless caused the closure of oil and gas pipelines, as well as railway lines and ports, across the region (OGJ Online, Aug. 25, 2008). ✦

ROV operators to earn $9 billion over next 5 years

Oil and gas industry expenditure on work-class remotely operated underwater vehicle (ROV) operations is likely to total $1.6 billion in 2008, and the market is set to reach $2.4 billion by 2012, reports energy analysts Douglas-Westwood in a new market study, The World ROV Report 2008-12.

"Both offshore utilization and ROV day rates have increased dramatically over the past 5 years and stand at an all-time high," said lead analyst Lucy Miller. "In the past year, ROV day rates for Africa, Middle East, and the Caspian have increased by 42%, overtaking Norway, which was, until recently, the most expensive region. Also shortages of skilled operators have caused personnel day rates to grow by 47-50% in those regions."

WORK-CLASS ROV OPERATIONS MARKET



Source: Douglas Westwood

The report is based on analyzing underlying demand drivers and ROV operators' day rates, said Miller. "Although oil prices have fallen of late, this

is likely to be a short-lived phenomena as oil companies take a much longer-term view.

"High levels of drilling activity and increased installations of subsea wells, pipelines, control cables, and other hardware are to continue apace as shallow water oil reserves deplete worldwide and deep water increasingly becomes one of the few remaining places where major oil finds can be made," Miller said. Petrobras's recent deepwater discoveries off Brazil are evidence of this, she added.

In deep water, ROVs are a key enabling technology for drilling and field development, and increasingly service thousands of existing underwater installations worldwide, she said.

The analysts conclude that over the next 5 years a total of 655 new work-class ROVs must be built to satisfy the dual demands of market growth and attrition within the existing fleet. This compares with 411 over the past 5 years. ✦

FERC approves Oregon Columbia River LNG project

Nick Snow
Washington Editor

The US Federal Energy Regulatory Commission on Sept. 18 approved the first new LNG terminal and related send-out pipeline in the Pacific Northwest after a 3½-year review. Developers of the Bradwood Landing project on the Columbia River in Oregon will be required to fully implement 109 mitigation measures as a condition of the approval, FERC said.

The federal agency said the project, which would deliver as much as 1.3 bcfd of gas, consists of an LNG terminal consisting of a single marine berth, two insulated storage tanks, and other related facilities 20 miles east of Astoria, Ore. A 36.3-mile pipeline would connect with the Williams Northwest pipeline north of Kelso, Wash.

Gas from the project would be delivered to two contracted customers, Georgia Pacific Corp.'s mill in Wauna, Ore., and Portland General Electric Co.'s Beaver power plant, as well as into intrastate and interstate natural gas pipelines through interconnections with Northwest Natural Gas Co. and Williams Northwest Pipeline, FERC said.

Final approval came after the project's sponsor, NorthernStar Natural Gas Inc. of Houston, was granted prefiling status on Mar. 7, 2005. NorthernStar said that FERC's consideration of the proposed project ran more than a year longer than for any previous LNG project and reflects the agency's detailed and in-depth review.

NorthernStar said it expects to obtain the remaining required permits in the next several months. Construction is scheduled to begin in 2009, and the project is expected to become fully operational in 2012, according to NorthernStar, which is developing two other West Coast LNG projects.

A substantial record

FERC Chairman Joseph T. Kelliher said the required mitigation measures primarily reflect safety and environmental considerations. "Our order is also based on a substantial record that encompasses more than 50,000 pages of material. We carefully considered more than 1,827 public comments, many of which came from six scoping meetings held in Oregon, and numerous studies and analyses from federal, state, and local agencies," he indicated.

"Bradwood Landing can help meet the project energy needs of the Pacific Northwest in a safe, secure manner with limited adverse environmental impacts. It also provides [the US] with direct access to the LNG markets in the Pacific region," Kelliher said.

FERC said its review of the proposed project also included consideration of a report by Oregon's Department of Energy to the state's governor and an examination of alternatives, including different projects and sites, alternative energy sources, and the potential for energy conservation and renewable sources to replace the need for the Bradwood Landing project.

It said that denying approval would deprive the region of a new natural gas source. "Energy conservation cannot replace the natural gas needed in the future but can be a complementary component in the overall energy supply and demand mix. Renewable energy resources would not be able to provide the amount of energy equivalent to the Bradwood Landing project," FERC said in its approval order.

Filtered water system

The 109 mitigation measures that FERC's staff recommended and the commission adopted include a requirement for NorthernStar to install a system capable of delivering filtered water from the Columbia River to the LNG tankers for ballast and engine cooling during off-loading while the vessels are at berth.

FERC said the system's water intakes would require screens to prevent the potential entrapment or entrainment of juvenile fish. It also will require NorthernStar to conduct postinstallation water flow assessments of the screens for review and approval by the director of the federal agency's Office of Energy Projects prior to operation.

It denied requests from Oregon's governor and others, in response to the project's final environmental impact statement, to issue a supplemental EIS. FERC also rejected requests from Columbia Riverkeeper, a water quality advocacy organization based in Hood River, Ore., and others for a formal evidentiary hearing to develop a record on the project's need and potential impacts.

WATCHING THE WORLD

Eric Watkins, Oil Diplomacy Editor

Blog at www.ogjonline.com

Now Russians enter Somalia

The oil industry may think it can breathe a sigh of relief now that authorities in Somalia have called for help in getting rid of pirates infesting its waters. But think before you breathe.

"I call on the Somali people to fight against the pirates," said Somali President Abdullahi Yusuf Ahmed. "I also call on the international community to act quickly on what is happening in Somali waters as well as on shore."

Yusuf was speaking just a week after the seizure of a Ukrainian cargo ship—the MV Faina—carrying tanks and other weaponry. The seizure attracted further international attention on piracy off Somalia, whose waters command access to a route through which about 30% of the world's oil transits.

"I condemn the pirates, who are undermining trade and international maritime traffic off the Somali coast," said Yusuf. "They are imposing an embargo on the Somali people and the international community because they are blocking movement between the Mediterranean and the Indian Ocean, which affects not only Somalia but the whole world," Yusuf said.

Common sense approach

So far, so good. It seems like common sense. And the international community did appear to be doing just what Yusuf asked for as several US warships blockaded the MV Faina to prevent the offloading of its military cargo.

But Yusuf apparently was not happy enough with that sort of action by US and allied forces in the region. He wants stronger remedies and has asked the Russians to provide them—at least according to the Somali ambassador in Moscow.

Somalia welcomes Russian help in fighting piracy off its coast and is "not satisfied" with warships from other countries, said Ambassador Mohammed Mahmud Handule.

President Yusuf "gave permission for Russian ships to enter the sea (off Somalia) and fight the pirates in the sea and on the coast," he said.

Russia complies

"Many warships can be found near our shores, but we are not satisfied with the results of their activities," the ambassador added. "More than 10 countries are patrolling (Somalia waters) but we have asked Russia and she agreed to our request."

Even as he spoke, the Russian Navy confirmed that the frigate Neustrashimy was heading for Somali waters.

The Neutrashimy is said to be a multifunctional vessel capable of anti-sub, antiship and antiaircraft support. It carries the Vodopad-NK missile and torpedo system and displaces more than 4,000 tonnes. Its navigation range is about 3,000 miles.

"Russia will continue to send its ships to risky areas in order to protect Russian citizens and to ensure safe navigation," said one Russian official.

That sounds like the justification Russia used back in August when it decided to invade Georgia. With that in mind, don't breathe any sighs of relief just yet. Do we really want the Russians in control of a shipping lane that sees so much of the world's oil? ✦

FERC extended the comment period on the draft EIS to 120 days from 45, collected additional comments at six public meetings in Oregon and Washington, and reviewed studies and analyses from government agencies, third-party contractors, and others involving safety, security, and environmental issues.

Parties will have 30 days after the order is issued to appeal the decision, FERC said. ✦

UGI: Unconventional gas wealth seen in world's basins

G. Alan Petzet
Chief Editor-Exploration

Sedimentary basins in the US appear to contain a volume of technically recoverable unconventional gas that is 10 times the ultimately recoverable volume of conventional gas.

All resources are logarithmically distributed in nature, and the lower quality deposits need more expenditures and better technology to develop economically, Stephen A. Holditch of Texas A&M University told the opening session of Oil & Gas Journal's Unconventional Gas International Conference & Exhibition in Fort Worth Sept. 30.

Results of the studies of eight US basins are being configured into software that can be used as advisory points as operators begin to drill, complete, stimulate, and produce shale, tight sands, and coalbed gas reservoirs outside North America, where almost all of this type of drilling has occurred so far, Holditch said.

Based on the findings, which imply that vast quantities of gas can be produced in the world's basins, even Saudi Arabia's state oil company Saudi Aramco has started a tight gas sands research group, Holditch said. Holditch and a large group of his students plan to

release more details of the still incomplete findings at a Society of Petroleum Engineers conference in Pittsburgh in mid-October.

C. Michael Ming, president, Research Partnership to Secure Energy for America (RPSEA), noted the importance of basic research into unconventional gas recovery technology. Partly due to such research, which is under constant threat of reduced federal and other funding, the US has more gas reserves today than when former US President Jimmy Carter made his "moral equivalent of war" (meow) speech in the midst of the late 1970s energy crisis, Ming told the conference.

World gas study

Holditch's students, who compared conventional and unconventional gas statistics from eight US basins, plan to expand the study to 25 basins.

The information covered petroleum systems descriptions and other public data on the San Juan, Green River, Powder River, Uinta-Piceance, Black Warrior, Wind River, and Illinois basins. Data came from the National Petroleum Council, US Geological Survey, Energy Information Administration, Gas Research-Gas Technology Institute, Potential Gas Committee, and other sources.

When looking at a given target basin or formation anywhere in the world, we can find the analogous basin or formation in the US and glean from published case histories that abound in the literature what amount to the best practices for recovery of unconventional gas, Holditch said.

The system, still a work in progress, is advisory in nature and not an expert system, he cautioned. Unconventional oil reservoirs have not yet been considered.

Part of the current study, for example, lists US basins and ranks world basins by most analogous, second most analogous, and so on. The software would eventually help operating companies, service companies, and others to select a tight gas sand fracturing fluid, for instance, using defaults and best practices from similar US reservoirs as a starting point, Holditch said.

Need for research

Carter delivered the "meow" speech about the same time that Houston wildcatter George Mitchell "decided to take a stab" at producing gas from the Barnett shale, Ming recalled.

Noting that the drilling, completion, and stimulation procedures for each shale must be uniquely decoded, Ming said that operators are still improving Barnett shale gas recovery factors. Some of the improvement can be laid to iterative actions, but with concentrated research, the process might become more predictive, he postulated.

The positive contributions from projects such as DeepStar, Norway's DEMO2000, and Brazil's deepwater program demonstrate that what begins as pure research can be driven toward field demonstrations and commercialization, Ming said.

RPSEA, he noted, is shepherding projects on emerging shales in Alabama, the Barnett shale, treatment and management of produced and all other waters, advanced hydraulic fracturing technology, how gas migrates to fill unconventional reservoirs, and how to increase the area of reservoir contact in horizontal wells, among other projects. ✦

Democrats remove OCS leasing bans from continuing resolution

Nick Snow
Washington Editor

Faced with the prospect of a presidential veto of a continuing resolution, congressional Democrats deleted language dealing with US Outer Continental Shelf oil and gas leasing restrictions on Sept. 23.

House Budget Committee Chairman David R. Obey (D-Wis.) "negotiated the best package he could get with the White House to take a budget standoff off the table so we can address the larger Bush financial crisis," said a spokesman for House Speaker Nancy Pelosi (D-Calif.).

"The White House made it clear any new drilling provision was a nonstarter. The future resolution of offshore drilling will have to be addressed with a new president," the spokesman said.

The decision meant that existing moratoriums expired Sept. 30, but leasing will not begin immediately in those areas. The US Minerals Management Service, which has jurisdiction over federal offshore acreage, continues to operate under a 5-year plan that began in mid-2007, a spokesman said on Sept. 24.

The only acreage in that plan that was covered by a moratorium was off Virginia, where a sale is tentatively scheduled for 2011, he told OGJ.

He noted that MMS has received more than 160,000 comments after US Interior Sec. Dirk A. Kempthorne launched preparation of a new OCS plan that would cover the 2010-15 period. "We're currently evaluating and reviewing those comments. It's too early to say which areas will be considered, but we are looking at areas that were under moratorium. We're not scheduled to finish planning for the program until mid-2010," the MMS spokesman said.

There also were indications that a 1-year moratorium on developing leasing regulations for federal oil shale resources in three western states would not continue. The US Bureau of Land Management hopes to finalize such regulations by yearend, a spokesman for that agency said on Sept. 24.

Unified insistence

Congressional Republicans immediately claimed a victory. "The news that Democrats have finally recognized the significance of this energy crisis and will allow the moratorium on deep sea and oil shale production to expire is welcomed by the millions of American families, farmers, and small businesses struggling to make ends meet because of their soaring energy bills. But more importantly, it is a victory born directly from their unified insistence that Congress put America on a path of energy independence," House Minority Whip Roy Blunt (R-Mo.) said.

"While details remain unclear, I hope the Democrats do not use this as an opportunity for another ruse that would put vast energy reserves under lock and key. While the expiration of this ban is critically important, we must do more to invest in alternative and renewable energy sources that will fuel our economy in the future," he continued.

"The Democrats' capitulation is a victory for middle-class Americans who have suffered under the crushing burden of high [gasoline] prices. After a long summer of $4[/gal] gas, with winter home heating bills on the way, this good news could not have come too soon," added House Republican Conference Chairman Adam Putnam (Fla.).

Sen. Pete V. Domenici (R-NM), ranking minority member of the Energy and Natural Resources Committee, said on Sept. 24 that few gave his May 1 bill to lift offshore and oil shale leasing bans much chance of passing. "Now, not even 5 months later, Democrats have done a 180° turn on this issue. As the price of gasoline rose, the American people became outraged that Democrats have blocked us from producing offshore and from developing oil shale for many years. The American people spoke, and joined Republicans in Congress with a unified message: find more oil, use less," he said.

It will be up to the next president and Congress to determine whether these resources should be taken off the table again, he continued. "With these bans no longer in place, work can begin to allow us to tap into our abundant oil and gas resources—if our leaders don't lock them back up next year. Americans will be watching closely," Domenici said. ✦

Japanese firms boost Vietnamese oil industry

Eric Watkins
Oil Diplomacy Editor

Japanese firms are stepping up their involvement in Vietnam's oil industry, entering both upstream exploration and production and downstream refining and marketing.

State-owned Petrovietnam and Nippon Oil Corp. subsidiary Japan Vietnam Petroleum Co. have begun producing crude oil at offshore Phuong Dong oil field. JVPC holds a 64.5% stake in the venture, while Petrovietnam E&P holds the remaining 35.5%.

Production at the field, on Block 15.2, about 120 km off Ba Ria-Vung Tau province in southern Vietnam, is expected to increase to 15,000 b/d in 2009 from the current 10,000 b/d.

The field has reserves estimated at 36.3 million bbl of crude, 5.3 million bbl of condensate, and 3.16 billion cu m of natural gas.

Meanwhile, VRJ Petroleum, a joint venture of Idemitsu Kosan subsidiary Idemitsu Cuu Long Petroleum Co. 15%, Petrovietnam 35%, and Zarubezneft 50%, plans to develop Block 09-3, which lies in water 50 m deep some 135 km off southern Vietnam.

In January, after drilling three exploration wells, VJR Petroleum announced a find at Block 09-3, saying one well had an oil flow of 4,150 b/d. In 2006, the company estimated that Block 09-3 holds 50-70 million tonnes of oil.

The VJR Petroleum JV plans to invest ¥70 billion to build production facilities, with production of 20,000 b/d slated to start in the latter half of fiscal 2009.

Downstream activities

In connection with downstream activities, Idemitsu Kosan and Mitsui Chemicals announced in April that they would take part in a 200,000-b/d, $5.8 billion oil refinery and petrochemical complex project in Vietnam. Idemitsu intends to cater to sharply rising demand in Vietnam for oil products and ensure a steady supply of crude oil, while Mitsui is looking to expand the profits of its purified terephthalic acid and related operations through stable procurement of aromatics feedstock.

To implement the project in the Nghi Son economic zone in Thanh Hoa Province, 180 km south of Hanoi, a joint-venture company tentatively called Nghi Son Refinery & Petrochemical was established, with Idemitsu holding a 35.1% stake, Kuwait Petroleum International 35.1%, Petrovietnam 25.1%, and Mitsui 4.7%.

On Sept. 19, Petrovietnam deputy director Truong Van Tuyen and Masayasu Kawasaki, a representative from Marubeni Corp, signed a contract at Vietnam's Dung Quat oil refinery.

Under the contract, Marubeni will buy 75,000-150,000 tonnes/year of propylene products from the refinery.

Petrovietnam recently announced plans to import 52,500 tonnes of diesel to test-run the 140,000 b/d Dung Quat refinery, which is scheduled to start operations in 2009 (OGJ Online, Sept. 23, 2008).

In 2002, the Vietnamese government awarded the contract to build the Dung Quat refinery to a consortium comprised of Technip-Coflexip of France and JGC Corp.of Japan. ✦

James M. Peck
Deep Seek Exploration Experts LLC
Houston

The onshore and offshore portions of the Eastern Mediterranean basin (Fig. 1) have proven to be a prolific hydrocarbon producing area. As of December 2006, oil reserves are 15 billion bbl and gas reserves are 100 tcf.

The tectonic evolution of the basin is interpreted to have proceeded through the following five stages:

- A Late Triassic to Early Jurassic transtensional rift period.
- A Middle Jurassic to Early Cretaceous sag period.
- A Late Cretaceous to Early Paleogene alpine inversion period.
- A Late Paleogene to Miocene internal plate adjustment period.

—Oligo-Miocene Gulf of Suez rifting.

—Miocene Red Sea rifting.

—Messinian salinity crisis.

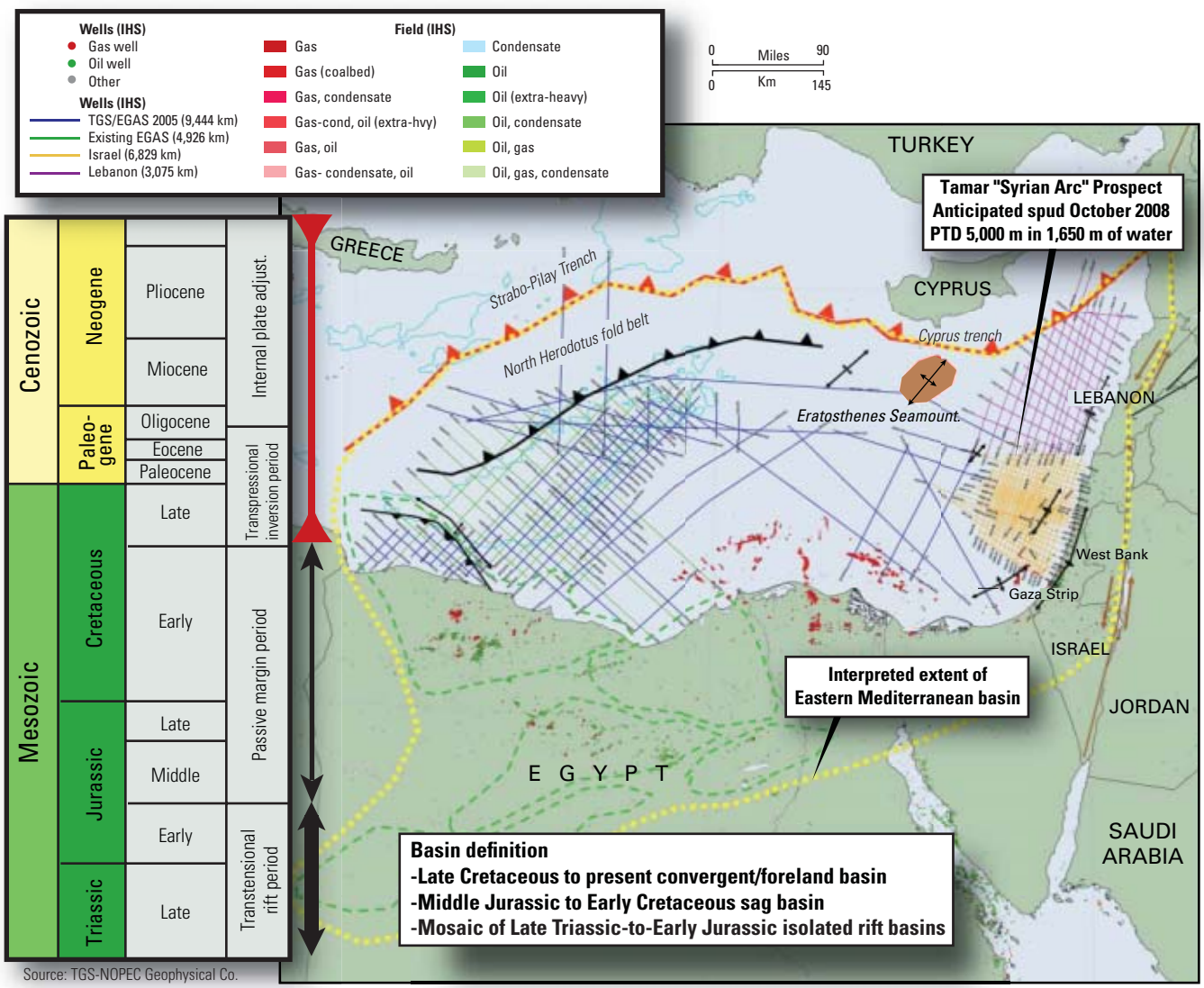
- A Pliocene flood period.

The basin's hydrocarbon reserves are

Giant oil prospects lie in distal portion of offshore East Mediterranean basin

TGS-NOPEC OFFSHORE EAST MEDITERRANEAN 2D SEISMIC PROGRAM

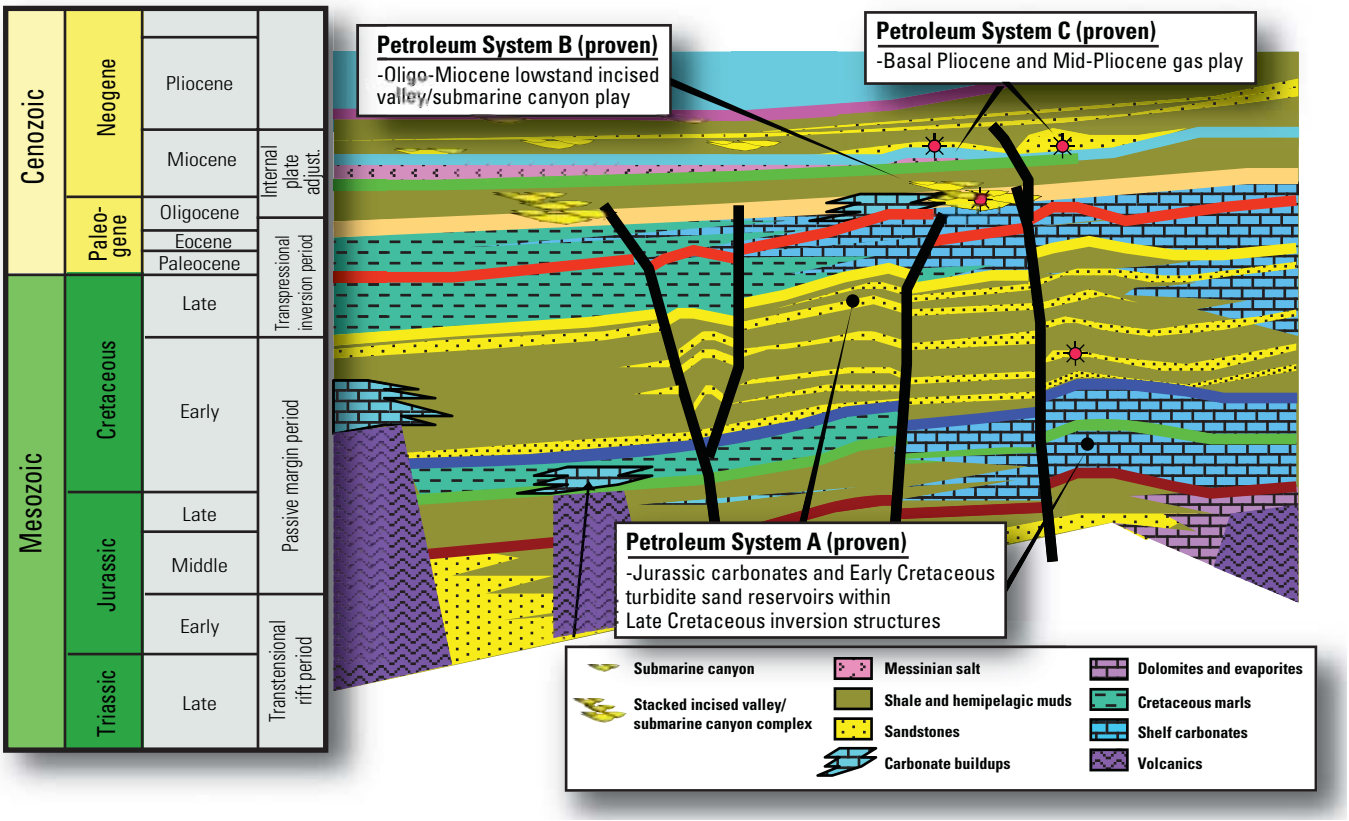
Fig. 1



Source: TGS-NOPEC Geophysical Co.

EAST MEDITERRANEAN BASIN PLAY CONCEPTS

Fig. 2



broadly distributed within three proven petroleum systems (Fig. 2) recognized within the EMB:

- Petroleum System A.

—Late Cretaceous-Eocene inversion structural play (referred to regionally as "Syrian Arc" folds).

—Middle Jurassic limestone and Early Cretaceous sandstone reservoirs.

- Petroleum System B.

—Oligo-Miocene incised valley/submarine canyon structural/stratigraphic play.

—Oligo-Miocene sands deposited within the incised valley/submarine canyons.

- Petroleum System C.

—Basal Pliocene-Pleistocene stratigraphic/structural play.

—Basal Pliocene turbidite sandstone reservoirs offshore Gaza Strip and offshore Israel.

—Mid-Pliocene to Pleistocene turbidite sandstone reservoirs offshore Egypt.

Important general phenomena observed associated with the distribution of hydrocarbons through the stratigraphic column include the following;

- There exists a distinct lightening-upward of the hydrocarbon phase from oil and gas in Petroleum System A to gas, oil, and condensate in Petroleum System B to mainly very light gas (mainly methane) occasionally associated with condensate (Fig. 3).
- With the historical shift in drilling from initial onshore and near offshore focus on Petroleum System A and Petroleum System B, the EMB was perceived as an oil and oil/gas prone basin. With the large success of offshore Petroleum System C, the more distal portion of the EMB is generally regarded as gas-prone.
- All Plio-Pleistocene gas and gas/condensate discoveries are proximal to deep-seated, near vertical paleofaults that extend through the entire stratigraphic column.
- Importantly to the petroleum systems in the distal portion of the EMB, operators and service companies have reported water-bottom oil seeps associated with these deep-seated, near vertical paleofaults that cut upward to the water bottom interface from the Mesozoic section through the entire Cenozoic section (inclusive of the Messinian Salt and overlying Plio-Pleistocene section (Fig. 3).

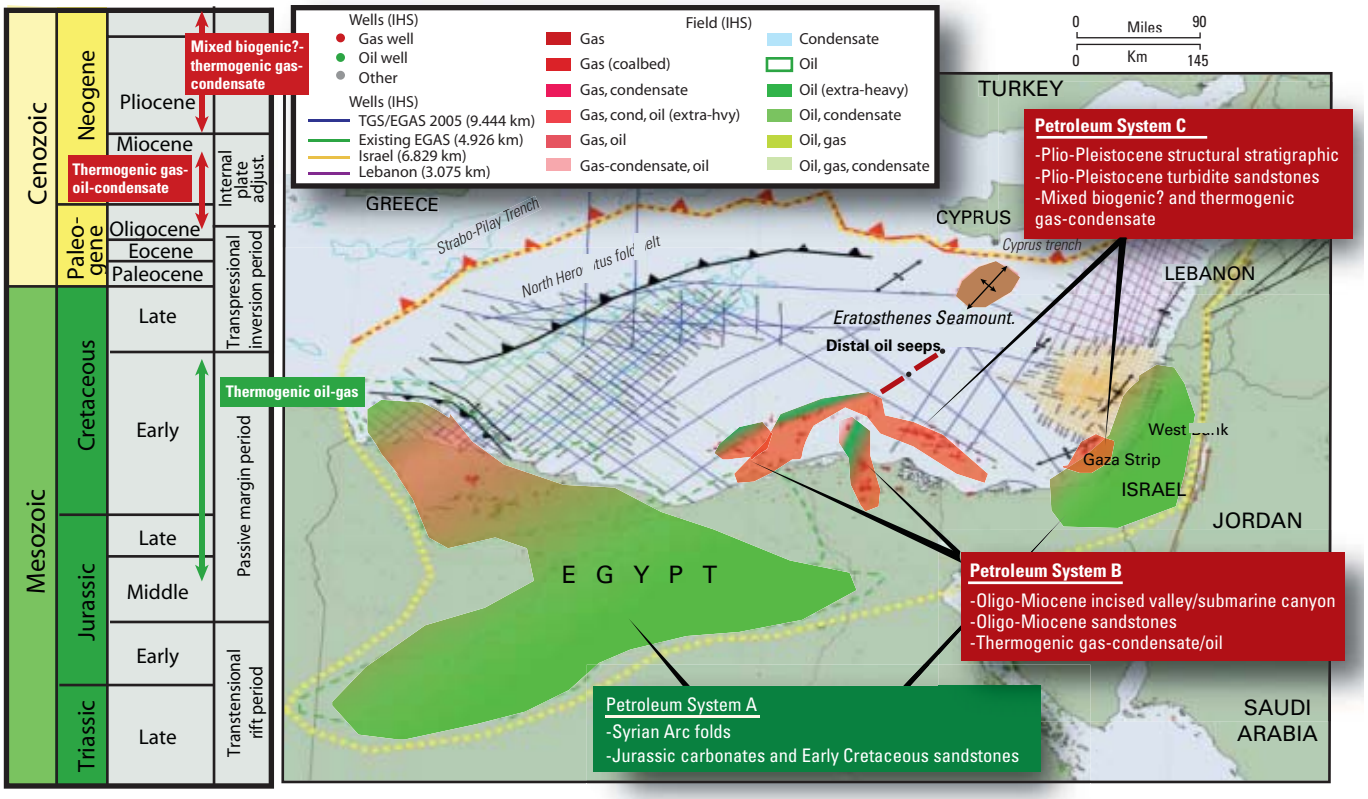
In spite of the impressive scale of the hydrocarbon reserves within the EMB, the distal portion of the basin remains underexplored.

Between 2001 and 2005, TGS-NOPEC Geophysical Co. acquired the nonexclusive Eastern Mediterranean basin 2D seismic database that consists of 19,256 km of new shoot 2D seismic data off Lebanon, Israel, and Egypt (Fig. 1). The company also reprocessed to merge with the new acquisition 4,526 km of existing EGAS offshore Egypt vintage seismic data (Fig. 1).

Importantly, the TGS-NOPEC Eastern Mediterranean basin 2D seismic database tied all preacquisition deep offshore wells (penetrated into the Mesozoic section). Those preacquisition

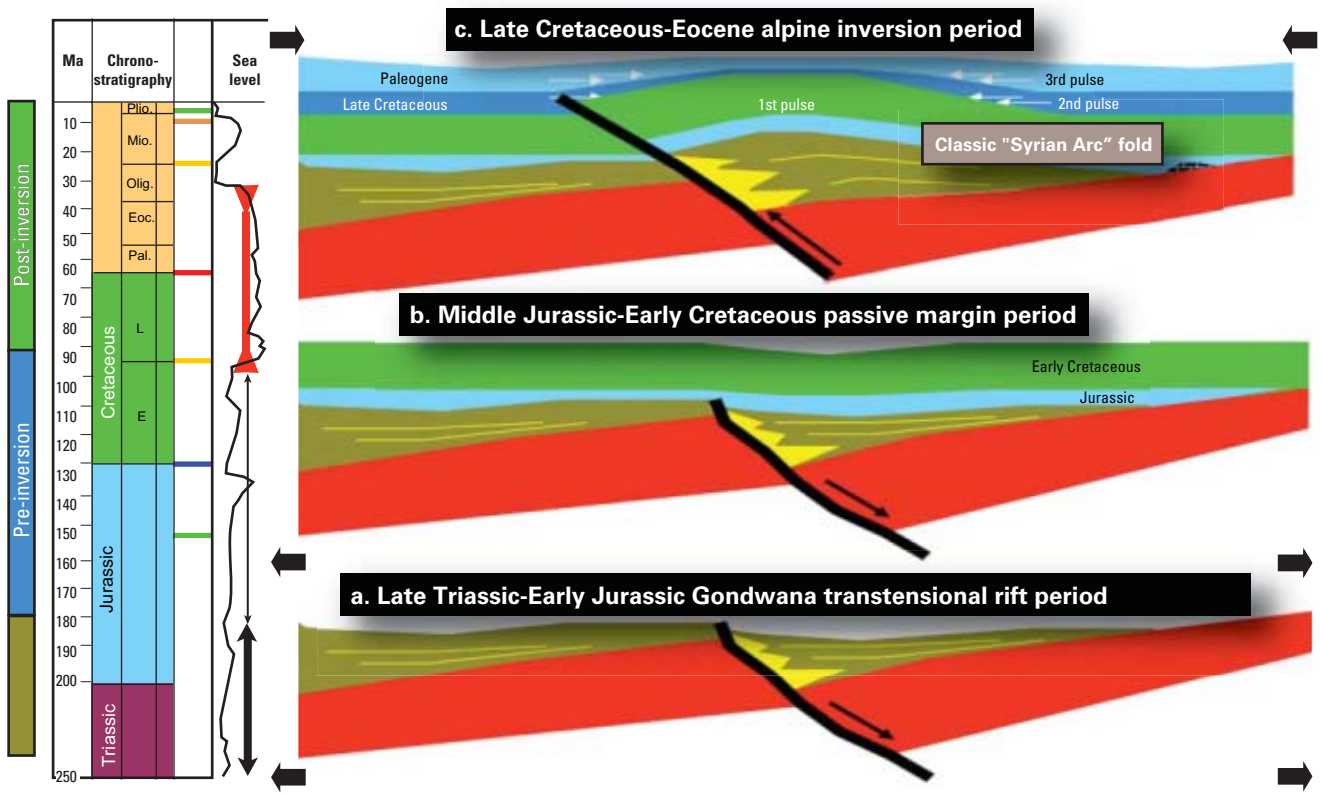
How petroleum system phase lightens upward

Fig. 3



Abrupt transpressional episodic pulses in late cretaceous-eocene

Fig. 4



offshore deep wells are all relatively near the shoreline of Egypt and Israel.

As onshore in the Egyptian Western Desert and northern Sinai Peninsula and the Israeli coastal plain, these preacquisition offshore deep wells commonly targeted large inversion structures (Petroleum System A: "Syrian Arc" folds) that were "squeezed up" from paleolows during strong, abrupt transpressional episodic pulses during the Late Cretaceous-Eocene period (Fig. 4). The stratigraphic section penetrated in these offshore "Syrian Arc" wells consists of a thick Mesozoic section under a thin Pre-Messinian Tertiary section. Middle Jurassic limestone or Early Cretaceous sandstones reservoirs in these offshore "Syrian Arc" wells frequently exhibit oil and gas shows or tested oil generated from mature Middle Jurassic and Early Cretaceous source rocks.

With the exception of one well (the Total Mango-1 well drilled in 1985 off the Sinai Peninsula), all other preseismic acquisition, deep offshore wells are separated from the distal portion of the EMB by extreme structural (prominent structural ridge offshore Israel) or stratigraphic (deep incised valley/submarine canyon complexes offshore western Egypt) obstructions and, thus, these deep wells do not provide reliable extrapolation with confidence of well ties along seismic lines to the distal portion of the EMB.

Previous attempts to extrapolate horizons along seismic lines tied to formation tops encountered in these proximal deep offshore wells to the distal portion of the EMB have been greatly influenced by these structural or stratigraphic obstructions. The prevailing interpretational paradigm has been to "drop down" along normal faults on the distal side of these obstructions. This "drop-down" interpretation has resulted in prevailing perspective that the distal portion of the EMB is widely interpreted to be dominated by a very thick Oligo-Miocene section (2-3 sec (TWT) thick) overlying a thin, deeply buried Mesozoic section (Fig. 5a).

Burial histories constructed on pseudowells utilizing the thick Oligo-Miocene section over a thin, deeply buried Mesozoic section predict:

- Known onshore/proximally offshore Early Cretaceous/Middle Jurassic source rocks are too thin, too deeply buried, and overmature to provide hydrocarbons to the overlying sections.
- The Paleogene/Neogene section is thermally immature and only capable (if source rock potential exists) of generating biogenic gas into the available Tertiary reservoirs.

Due to the above interpretational paradigm combined with the predominance of light gas in the Plio-Pleistocene traps, the distal portion of the EMB is therefore regarded near universally as a gas (methane-dominated) province.

However, several unusual aspects of

How the interpretations vary

Fig. 5

Fig. 5a

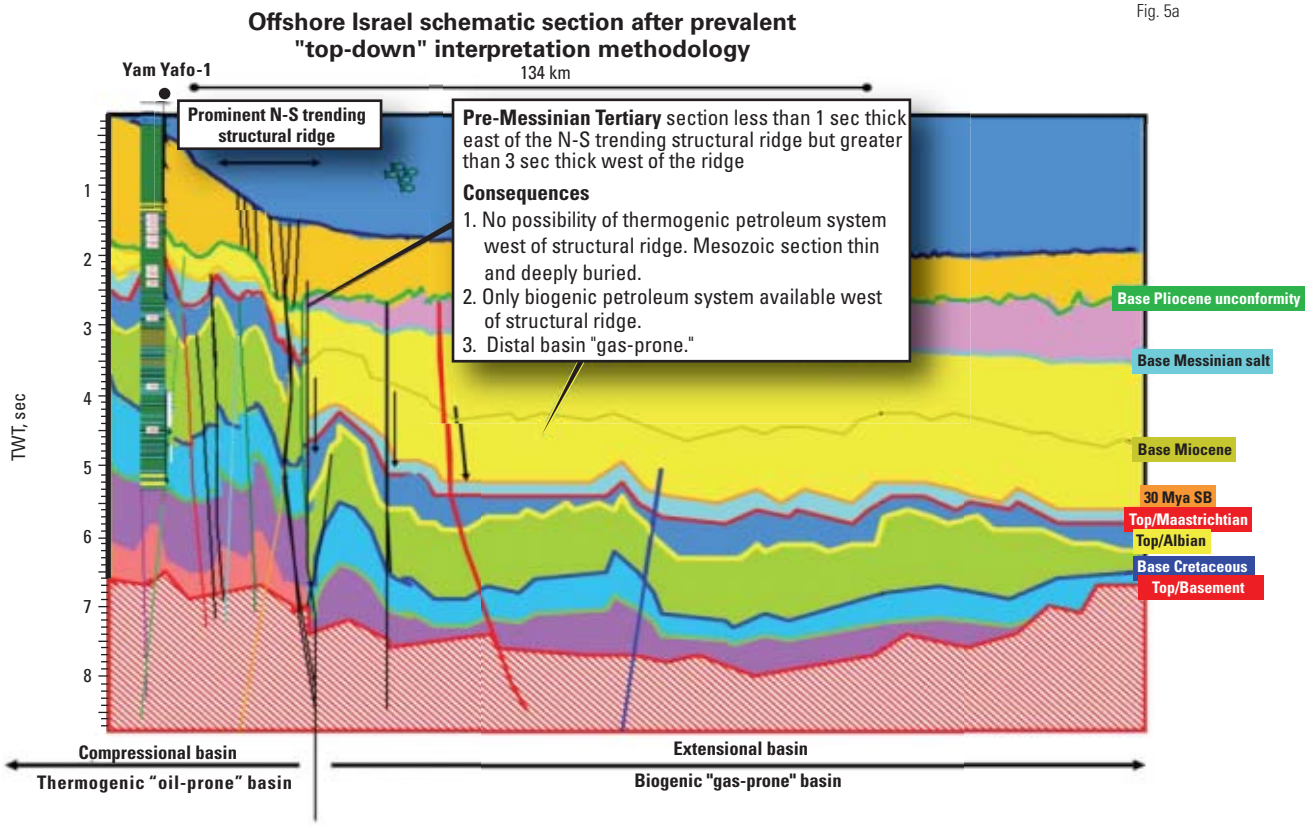
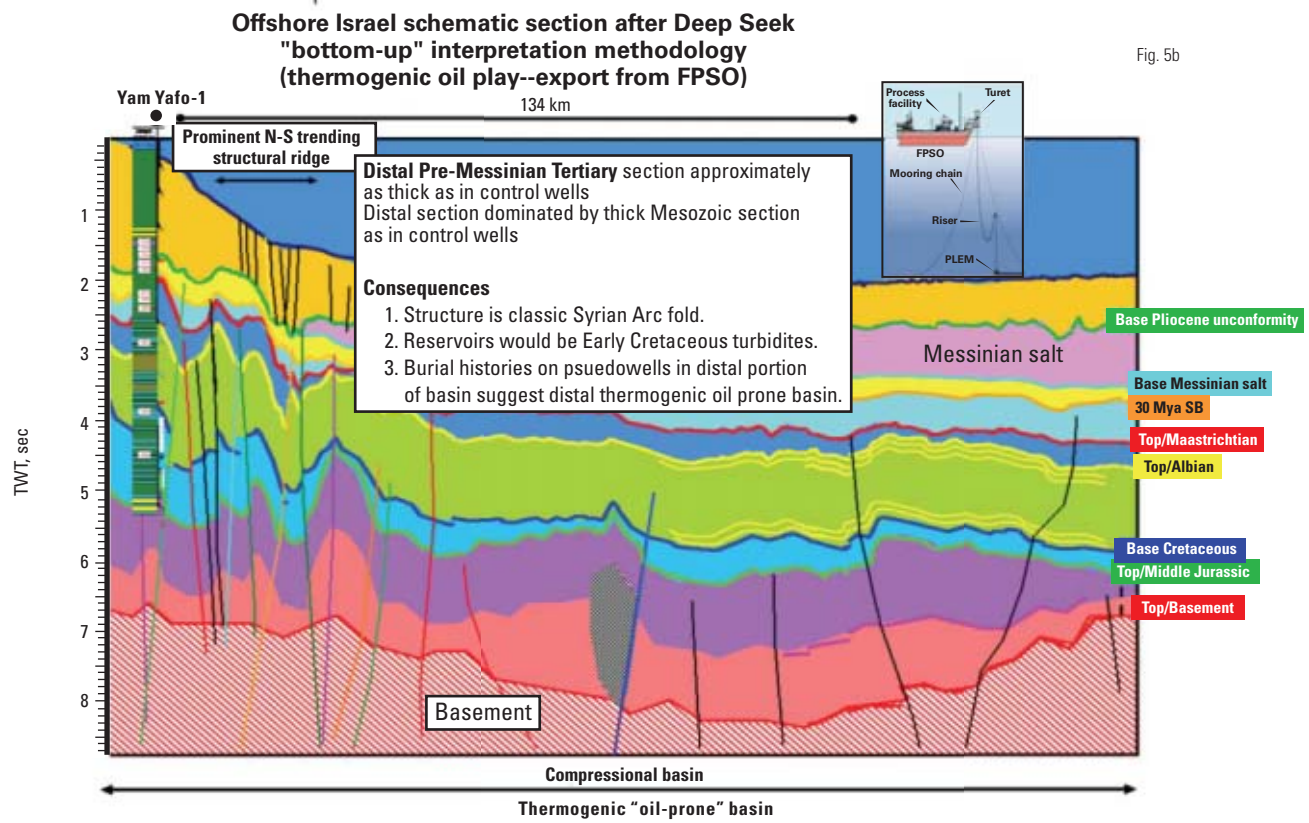


Fig. 5b

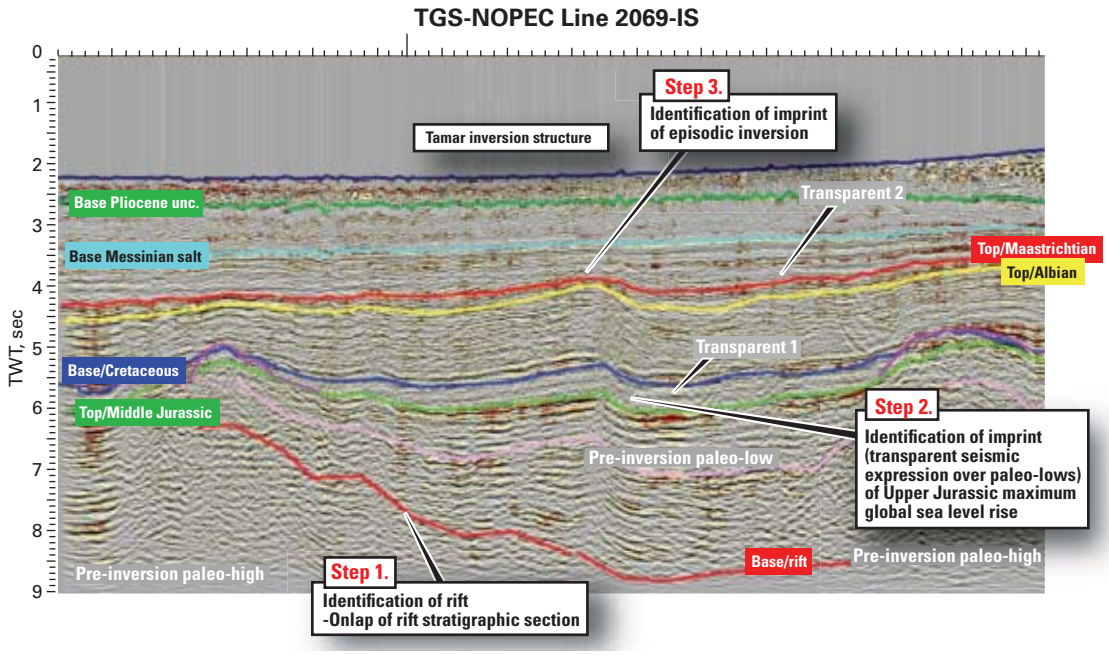


this prevailing interpretational distal EMB paradigm of a distal, thick Oligo-Miocene section over a thin, deeply buried Mesozoic section are as follows:

- The interpretational paradigm contrasts starkly with the known stratigraphic section in all the deep offshore wells of an overlying thin Oligo-Miocene section dominated by a thick Mesozoic section.
- The interpretational paradigm strongly implies a sudden, extreme Oligo-Miocene extensional tectonic phase as considerable accommodation space is required for the sudden 2-3 sec (TWT) expansion of the Oligo-Miocene section. This need for sudden expansion (and implied extension) again is in stark contrast with the known tectonic evolution that shows that the EMB was under continued compression from Late Cretaceous (initial collision of the northern Eurasian plate with the southern African/Arabian plates) to the present.
- Where a biogenic-gas generating petroleum system is predicted, water bottom oil seeps are reported in the distal portion of the EMB associated with deep-seated, near vertical paleofaults.

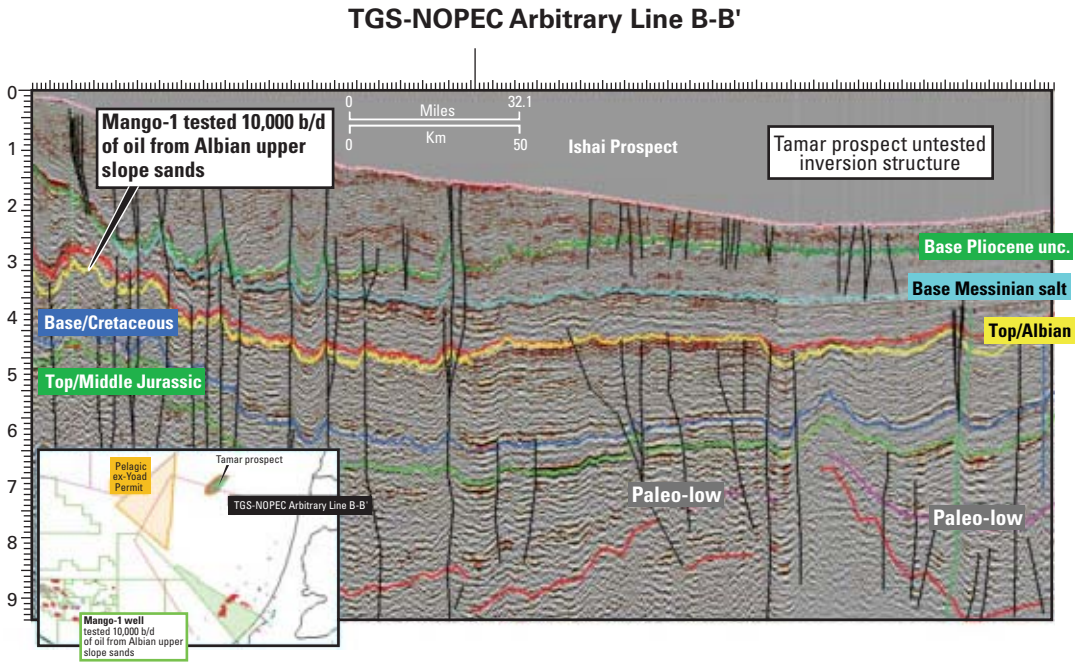
Bottom-up methodology

Fig. 6



Bottom-up interpretation

Fig. 7



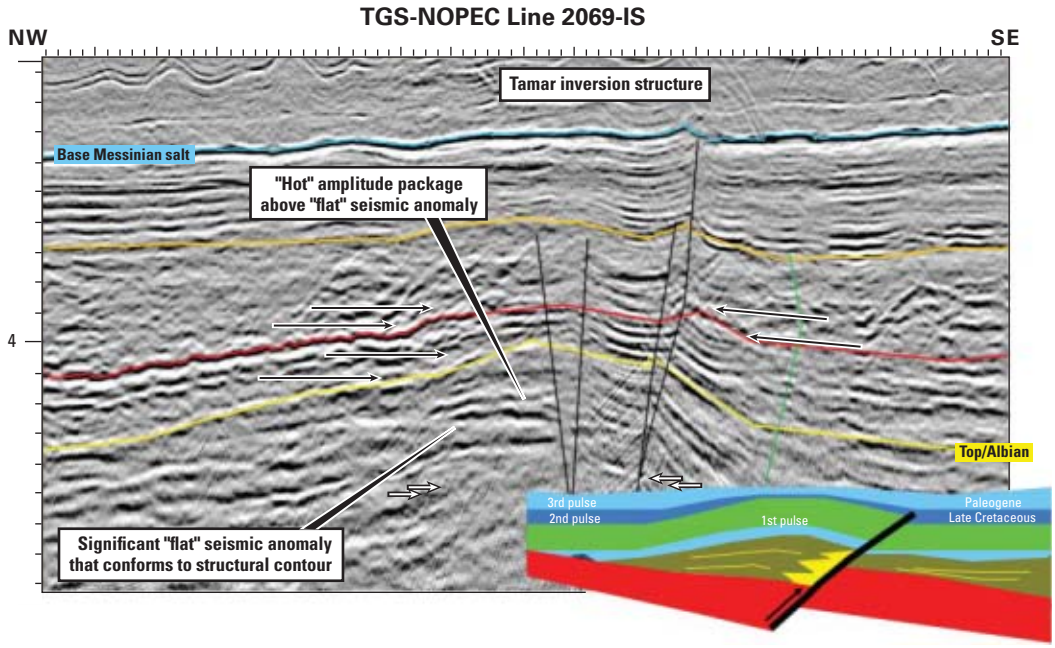
Deep Seek Exploration Experts LLC interpreted all the TGS-NOPEC Eastern Mediterranean 2D seismic database off Lebanon, Israel, and Egypt.

From the proximal deep well control to the distal portion of the EMB, this Deep Seek Exploration interpretation was uniquely accomplished by the following methodology:

1. Unlike previous "drop-down" interpretational attempts to extrapolate horizons distally, Deep Seek interpreted the TGS-NOPEC Eastern Mediterranean

TAMAR PROSPECT IN DISTAL PORTION OF EAST MEDITERRANEAN BASIN

Fig. 8



2D seismic database from "bottom up."

2. Deep Seek Exploration constrained the interpretation firmly within the basin's known tectonic evolution framework.

3. The EMB Triassic-to-present stratigraphic section is punctuated by two major megatransgressive periods including the Middle-to-Late Jurassic period and the Senonian-to-Eocene period. On seismic lines through deep offshore control wells, the end of each of these megatransgressive periods are marked by two thick seismically transparent (implying homogeneous lithology) units dated in the control wells as 1) Late Jurassic and 2) Latest Cretaceous to Eocene. Therefore in the distal portion of the EMB, the deepest seismically transparent unit is dated Late Jurassic while the shallowest seismically transparent unit is dated the Latest Cretaceous to Eocene.

Fig. 6 is the Deep Seek Exploration Experts' "bottom-up" interpretation of the TGS-NOPEC line 2069-IS. The pre-Messinian salt interpretation was accomplished through the following "bottom-up" steps:

• *Step 1*: Identification of the Triassic-Early Jurassic rift ztage base/rift horizon (red).

—This horizon is identified by onlap of seismic events (synrift) onto subparallel obliquely inclined prerift seismic events. Over the distal portion of the EMB, confident identification of this horizon ranges from poor-good.

• *Step 2*: Identification of the base/Cretaceous horizon (blue).

—This horizon is identified by being directly above the deepest seismically transparent unit interpreted as a Late Jurassic section of homogeneous hemipelagic mudstone deposited within paleolows during the maximum extend of the Jurassic megatransgression.

• *Step 3*: Identification of Top/Albian horizon (yellow).

—This horizon is identified by the first (from bottom-up) episodic "punch-up" or inversion of paleolows. Syn-inversion seismic events directly over this "punch-up" would onlap the Top/Albian horizon. The overlying syn-inversion section would thin over the structure and thicken off-flank of the structure.

The Deep Seek Exploration Experts' "bottom-up" constrained interpretation of the distal portion of the EMB utilizing the TGS-NOPEC Eastern Mediterranean basin 2D seismic database has the following consequences:

• The distal portion of the Eastern Mediterranean basin is interpreted to be dominated by a thick Mesozoic section under a thin Pre-Messinian Tertiary section (Fig. 4b).

• The interpretation of burial histories performed on pseudowells with thick Mesozoic section under a thin Pre-Messinian Tertiary stratigraphic sections (show that the distal portion of the EMB, like the known onshore and proximally offshore, is not a biogenic gas province but an oil province.

The significant exception to the previously mentioned extrapolation dilemma (horizons tied to well formation tops extended into the distal portion of the basin) is the Mango-1 well that was drilled offshore Sinai Peninsula by Total in 1985. The Mango-1 well targeted the crest of a large offshore Syrian Arc fold (inversion structure, Petroleum System A) and tested 10,000 bo/d from a number of thin Albian/Aptian sands. Total drilled the Mango-2 well along approximate structural strike but failed to penetrate correlative, productive sands to those that tested oil in the Mango-1 well. With the failure of the Mango-2 well, Total subsequently abandoned the project. Importantly, the Mango structure is located on the basinal side of a large structural ridge. TGS-NOPEC programmed the acquisition of the NW-SE trending line 5130-EG to tie the Mango-1 well. Along this line, horizons tied to the Mango-1 well formation tops can be extrapolated with a good confidence into extreme distal

portion of the Basin (Fig. 7) and tie to the "bottom-up" line 2069-IS (Fig. 6). This Mango-1 extrapolation into the distal portion of the EMB not only was utilized as a constrain on the "bottom-up" interpretation but helped support the interpretation that the distal portion of the EMB is oil-prone.

Exceptionally large four-way dip structural traps (100 sq km to over 1,500 sq km) have been mapped within drillable depths (generally less than 1 sec TWT below the base/Messinian salt) throughout the distal portion of the basin (offshore Lebanon, Cyprus, Israel, and Egypt). The "bottom-up" interpretation utilizing the TGS-NOPEC Eastern Mediterranean basin 2D seismic dataset predicts that these large structures are Petroleum System A inversion structure. If as suggested by burial histories executed on distal pseudowell location on the "bottom-up" interpretation and supported by the presence of distal water bottom oil seeps along deep-seated paleofaults, giant-to-supergiant accumulations of oil may be trapped within Early Cretaceous sandstone reservoirs contained by these distal "Syrian Arc" inversion structures.

The concept will soon be tested.

Noble Energy Inc. will spud the Tamar-1 well as early as October 2008 in the distal portion of the EMB (Fig. 8). The well will target a large (250 sq km), asymmetrical, NE-SW trending pre-Messinian salt four-way dip structure. Seismic amplitude anomalies including a "flat" amplitude anomaly at approximate structural spill-point with a high-amplitude seismic package above the "flat" event further enhancing the prospectivity of the large Tamar structure (Fig. 6 (close-up of Fig. 5)).

The "bottom-up" interpretation utilizing the TGS-NOPEC Eastern Mediterranean basin 2D seismic dataset would conclude the following concerning the Tamar structure:

- The NE-SW trending asymmetrical four-way dip structure is a very large Syrian Arc fold (inversion structure (Petroleum System A).
- The "flat" seismic anomaly with overlying "hot" seismic package is directly below the Top/Albian horizon and is interpreted as associated with an Albian turbidite sand unit.
- The "flat" seismic anomaly with overlying "hot" seismic package is directly below the Top/Albian horizon and is interpreted as an oil-filled Albian sand reservoir unit with good porosity and permeability above an oil/water contact.✦

The author

James M. Peck (jpeck@dpseek.com) is president of Deep Seek Exploration Experts LLC in Houston. He has been involved since 1975 in exploration in the Gulf of Mexico, West and North Africa, the Middle East, and Southeast Asia. For the last 10 years, he has focused on the Eastern Mediterranean basin and has interpreted more than 28,000 line-km of 2D seismic data over the offshore portion of the basin. He has a BS in geology from the University of Houston.

Operators increase stakes in Marcellus

Nina M. Rach
Drilling Editor

Operators have rushed to add acreage, expand leaseholds, and submit applications to drill the Marcellus shale. This middle-Devonian-age black organic shale underlies New York, Pennsylvania, Ohio, Virginia, and Maryland (Fig. 1).

Devonian shales in the Appalachians are the oldest gas play in the US.

In 2007, 18% of all US wells were spud in Appalachia—3,134 gas wells. Much of the drilling activity in Appalachia crosses multiple pay zones and types, including coalbed methane.

Shales are one-stop hydrocarbon shops, consisting of source, seal, trap, and reservoir. Shales have low permeability but shale gas wells generally have low decline rates, 2-3%/year, and long producing lives.

The Marcellus shale has been a known gas reservoir for 75 years but has only recently become newsworthy because the industry has new technology and new price incentives that make this regional gas play economic.[1]

According to the US Department of Energy, land drilling produces 72% of natural gas produced in the US, with only 13% coming from offshore US wells and about 15% from net imports.

Gas prices have been on a sustained high, averaging more than $7/Mcf for the past 3 years. In the last few months, prices have peaked at $13-14/Mcf. Despite recent softening, analysts believe gas prices will remain strong. NYMEX pricing suggests $8.40-9/Mcf for fourth-quarter 2008 and all 2009, which will spur drilling.

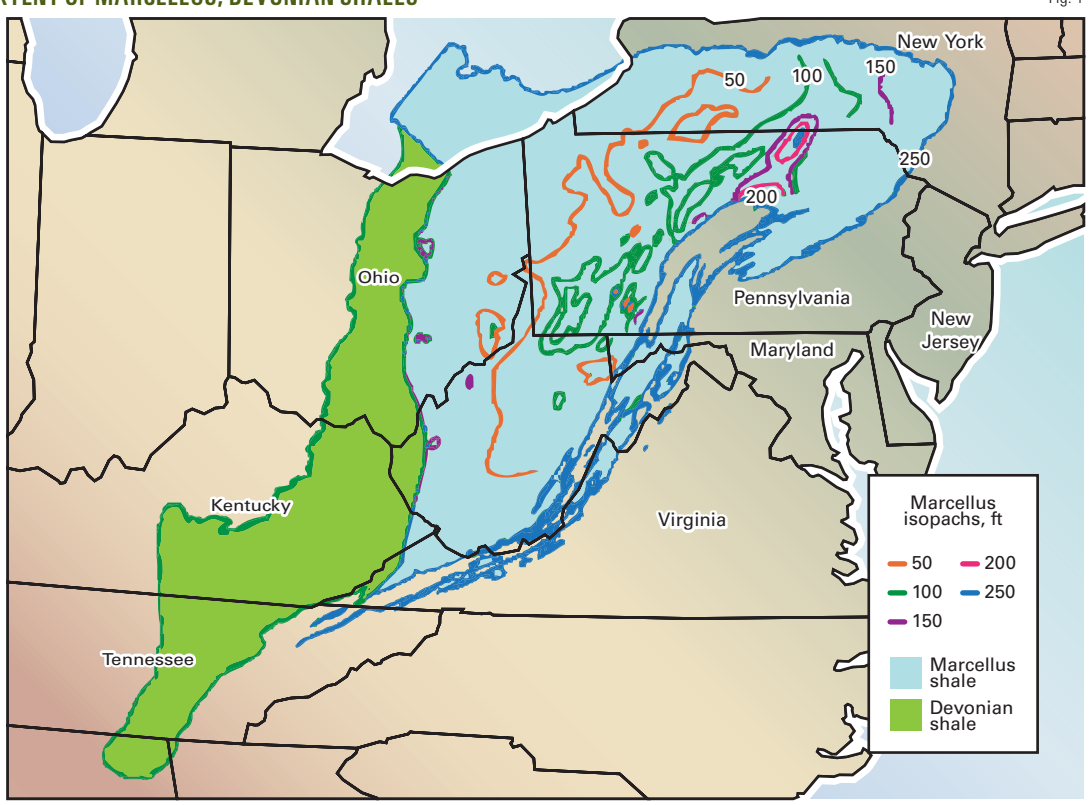
Natural gas drilling

Since 2002, US land drilling activity has increased along with gas prices, with about 1,900 rigs working in the US in August 2008, up from about 700 rigs in mid-2002.

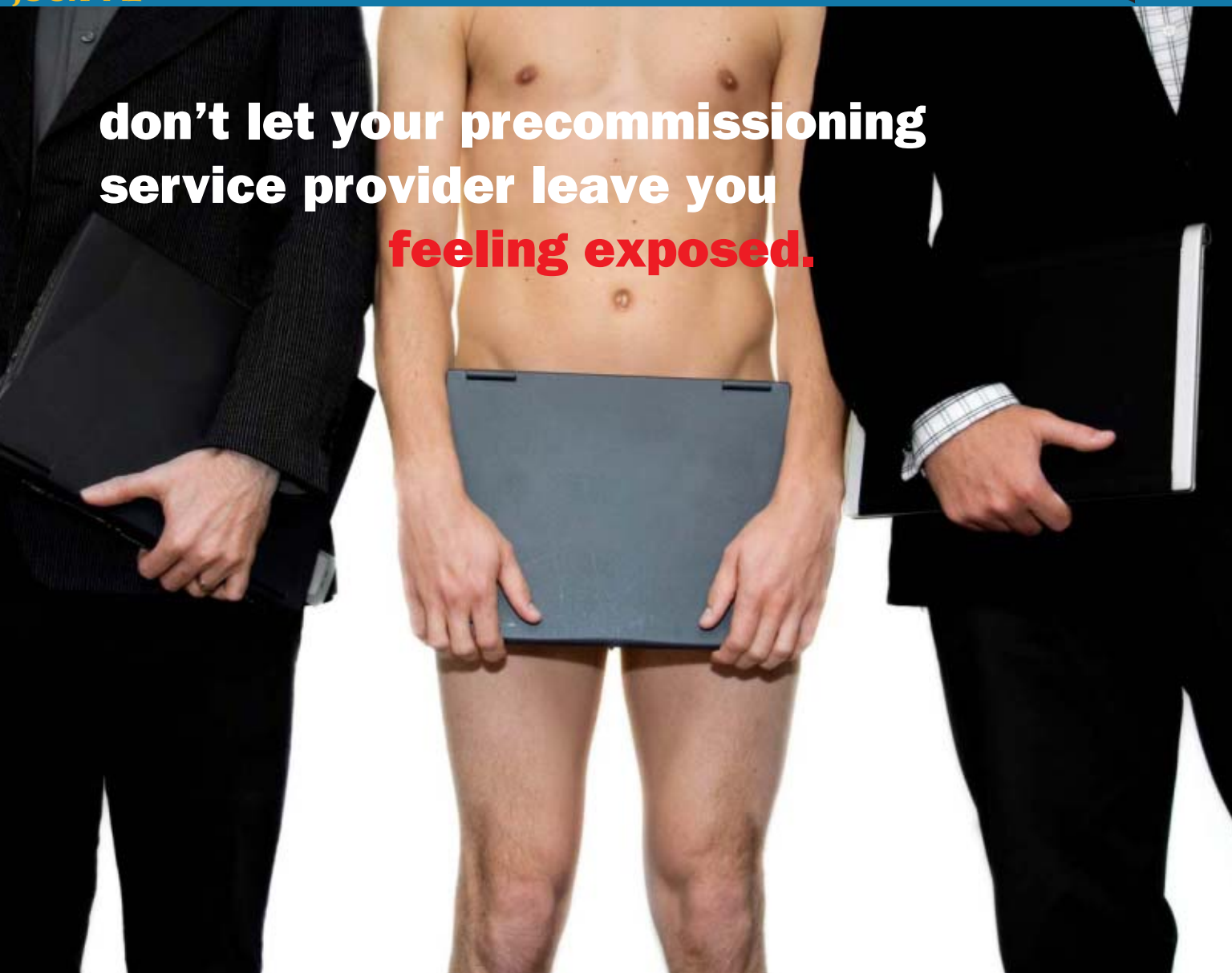
Drilling companies have consolidated. Based on 2007 results, The Land Rig Newsletter noted that the five larg-

EXTENT OF MARCELLUS, DEVONIAN SHALES

Fig. 1



Source: US Geological Survey, Open-file Report 2006-1237



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Yost Drilling, a unit of Chesapeake Energy, drills one of several wells for the company in Bradford Co., Pa., in June 2008 (Fig. 2; photo from Chesapeake Energy Corp.).

est drilling contractors now drill most (72%) wells in the US:

- Patterson-UTI Energy Inc., 25%.
- Nabors Industries Ltd., 18%.
- Helmerich & Payne International Drilling Co., 13%.
- Unit Drilling Co., 8%.
- Grey Wolf Drilling Co., 8%.

About 10% of US natural gas currently comes from unconventional shale gas plays.

At the Lehman Bros. conference in September, Douglas Wall, CEO of Houston-based Patterson-UTI, said he expects natural gas from shales to increase to 20% of US gas production over the next 3 years.

The shale plays are not all the same and can require different types of rigs to drill vertical or horizontal wells. Most of Patterson-UTI's recently announced newbuild rigs will go to drill the Fayetteville and Marcellus shales.

Shale has naturally occurring fractures, enhanced by hydraulic fracture stimulation, which improves drainage. In some cases, horizontal drilling can benefit recovery.

According to Equitable Resources Inc., Pittsburgh, a company that focuses on Appalachian natural gas operations, a typical Appalachian well is 2,500-7,500 ft deep; drilled horizontally; into a reservoir section 200-2,000 ft thick; at low reservoir pressure (500-3,400 psi); and costs about $1.2 million to drill. Equitable Resources uses air drilling (no mud) and EM-MWD tools.

Infill drilling in shales is low risk with high yield (e.g., easily provable and auditable reserves). Shales lend themselves to exploitation-style development

Weatherford estimated about 31 rigs drilling in the Marcellus in April 2008. Well depths ranged 2,500-8,000 ft and well costs ranged $1.5 million to $3 million.

Issues

Increased drilling brings new issues to Appalachian states.

In August, Chesapeake Energy Corp. CEO Aubrey McClendon cautioned gas market observers not to "expect the Barnett-style ramp up of gas production from the Marcellus. There are way too many regulatory, topographic, water, and infrastructure issues that will keep the Marcellus from making a meaningful contribution to our country's gas production until at least 2013-15."[2]

In New York and Pennsylvania, governmental bodies update legislation and citizens' watchdog organizations have formed task groups and raise awareness of potential environmental effects.[3 4]

New York recently passed legislation adjusting well-spacing requirements and setbacks for horizontal wells and started a review of environmental impact statement requirements.

Two interstate watershed protection commissions are faced with new applications to drill.

New York

According to the New York State Department of Environmental Conservation (NYSDEC), operators have drilled about 75,000 wells in the state since the late 1800s; about 14,000 wells are still active.

In June, the New York State Assembly and Senate voted to approve NY State Senate Bill S08169, amending Article 23 of the State's Environmental Conservation Law and Title 5 of the Oil, Gas, and Solution Mining Law.[5]

On July 23, New York State Gov. David A. Paterson signed the bill, which specifically amends Title 5 of the oil and gas law, expanding the definition of statewide spacing to address oil wells and horizontal wells.

The new provisions include a uniform well-spacing system to accommodate horizontal wells and update the 16-year-old law.

Public review

NYSDEC's Lori O'Connell told OGJ, "Separate permits are not required for hydraulic fracturing. The department reviewed hydraulic fracturing as part of the action of drilling a well within the context of a generic environmental impact statement (GEIS) that was finalized in 1992. Past hydraulic fracturing has been consistent with the GEIS, so no further environmental review was required. Because of the scale of anticipated Marcellus operations, the department is beginning a public process to supplement the GEIS."

Two days after Gov. Paterson signed the bill, Commissioner Pete Grannis of the NYSDEC announced that the DEC would hold a series of public hearings to discuss drilling for oil and natural

gas in New York. This public process will supplement the generic environmental review of horizontal natural gas drilling activities stipulated by Gov. Paterson.

New York drilling

Fourteen different operators have filed 77 permits to drill wells targeting the Marcellus shale in New York state. The state approved 48 of these permits and nine different operators have drilled 31 Marcellus shale wells (Table 1).

MARCELLUS SHALE WELLS, NEW YORK STATE*

Table 1

Operator	Well permits applied for	Well permits granted	Wells drilled
Chesapeake Appalachia LLC	7	5	2
Houghton College	1	1	1
Petroleum Development Corp.	1	—	—
Texas Keystone Inc.	1	1	—
East Resources Inc.	2	1	1
Nornew Inc.	11	1	—
Frontier-Kempner/Flatiron JV	6	6	6
EOG Resources Inc.	13	12	5
Fortuna Energy Inc.	19	12	11
East Resources Inc.	3	1	—
Eastern American Energy Corp.	1	1	1
PetroEdge Resources LLC	9	6	3
Glenn O. Tiffany	1	1	1
MegaEnergy Operating Inc.	2	—	—
Total	**77**	**48**	**31**

*Based on New York State Dept. of Environmental Conservation wells database search, July 28, 2008.

Fortuna Energy Inc., based in Horseheads, NY, has applied to drill 19 wells and has drilled 11 of them, more than any other operator. EOG Resources Inc. has applied to drill 13 wells and has drilled 5 of them. A joint venture between Frontier-Kempner and Flatiron has drilled six Marcellus wells. The six other operators have each drilled only one to three Marcellus shale wells in New York, although some have experience drilling Black River shale.

Three companies have already applied for permits to drill horizontal Marcellus wells in New York:

- Chesapeake Appalachia LLC, a subsidiary of Oklahoma City-based Chesapeake Energy Corp.
- Houston-based Nornew Inc.
- Fortuna Energy Inc.

Chesapeake has filed 527 permits to drill in New York, 7 of which target the Marcellus shale (5 vertical, 2 horizontal wells). The company drilled two vertical wells in 2007, in Broome and Chemung Counties (Table 2), but recently moved several rigs out of state.

Watersheds

Two interstate commissions are involved in planning and development and have regulatory responsibility in two large catchment areas underlain by the Marcellus shale.

The Delaware River Basin Commission (DRBC) was formed in a federal-interstate compact in 1961 between President John F. Kennedy and the governors of the four basin states forming the watershed of the Delaware River: Delaware, New Jersey, New York, and Pennsylvania (www.state.nj.us/drbc).

Marcellus shale underlies about 36% of the Delaware River basin. The DRBC identified three major points of concern:

1. Gas drilling projects in the Marcellus shale or other formations may have a substantial effect on the water resources of the basin by reducing the flow in streams and aquifers used to supply the significant amounts of fresh water.
2. Drilling operations may potentially add, discharge, or cause the release of pollutants into the ground water or surface water.
3. Recovered frac water must be treated and disposed of properly.

In June, the DRBC notified operators that water used in drilling operations requires approval.[6]

Susquehanna River Basin Commission (SRBC) is a governing agency established under a 100-year compact signed on Dec. 24, 1970, by the federal government and the states of New York, Pennsylvania, and Maryland "to protect and wisely manage the water resources of the Susquehanna River Basin." The Susquehanna River starts in Cooperstown, NY, and flows 444 miles to Havre de Grace, Md., where the river enters Chesapeake Bay.

More than 72% of the tristate Susquehanna watershed is underlain by the Marcellus and other organic-rich shale formations (www.srbc.net).

In June, the SRBC notified 23 companies that they needed approvals to use water in developing natural gas wells in the Susquehanna basin. In August, the SRBC notified natural gas well operators of a new regulation, effective Oct. 15, requiring advance approval for any amount of water "withdrawn or consumptively used" to develop wells in the Marcellus, Utica, or other shale formations in the Susquehanna watershed (18 CFR, Section 806.5).

Pennsylvania operators

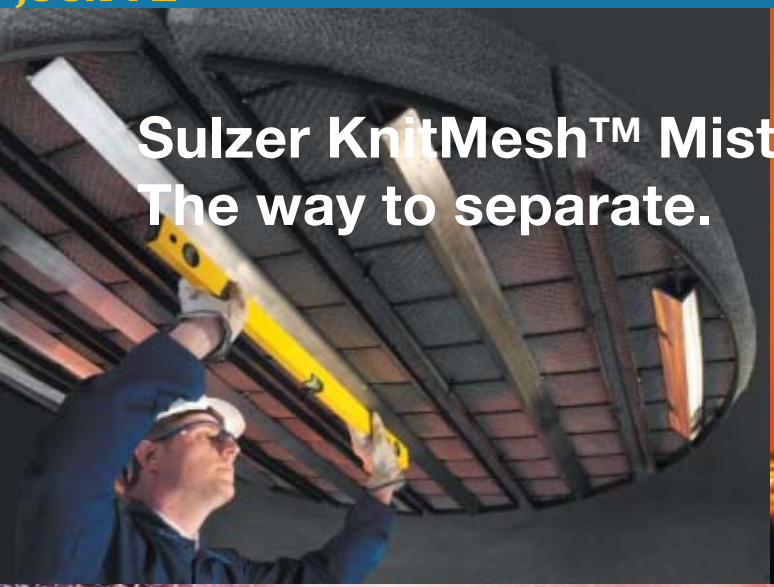
The Pennsylvania Department of Environmental Protection oversees drilling permits. A review of the wells database shows that permit applications have been increasing since 2005, with particular activity in the Marcellus shale.

Earlier this year, Prof. Gary Lash, Fredonia State College, said vertical wells cost about $750,000 to drill and horizontal wells can cost $3.5 million to drill. He said that a well operated by Texas-based Range Resources Corp. near Pittsburgh produces 5.8 MMcfd.[3]

Lash said that some operators offer landowners as little as $25/acre royalty, but $3,000/acre is prevalent throughout northeastern Pennsylvania.

According to Jeffries analyst Subash Chandra, Houston-based Carrizo Oil & Gas Inc. picked up 850 acres in Clearfield County, Penn., for $1,500/acre, 15% royalty, and 5-year lease term.[7] Chandra said Western Maryland is also "in the Marcellus mix." Fort Worth-based Lodge Energy LP recently leased 36,000 acres in western Maryland for $1,150/acre and 16% royalty.[7]

Houston-based Seneca Resources Corp, a subsidiary of Williamsville, NY-based National Fuel Gas Co., was the most active driller in the region last year. According to the company's web-



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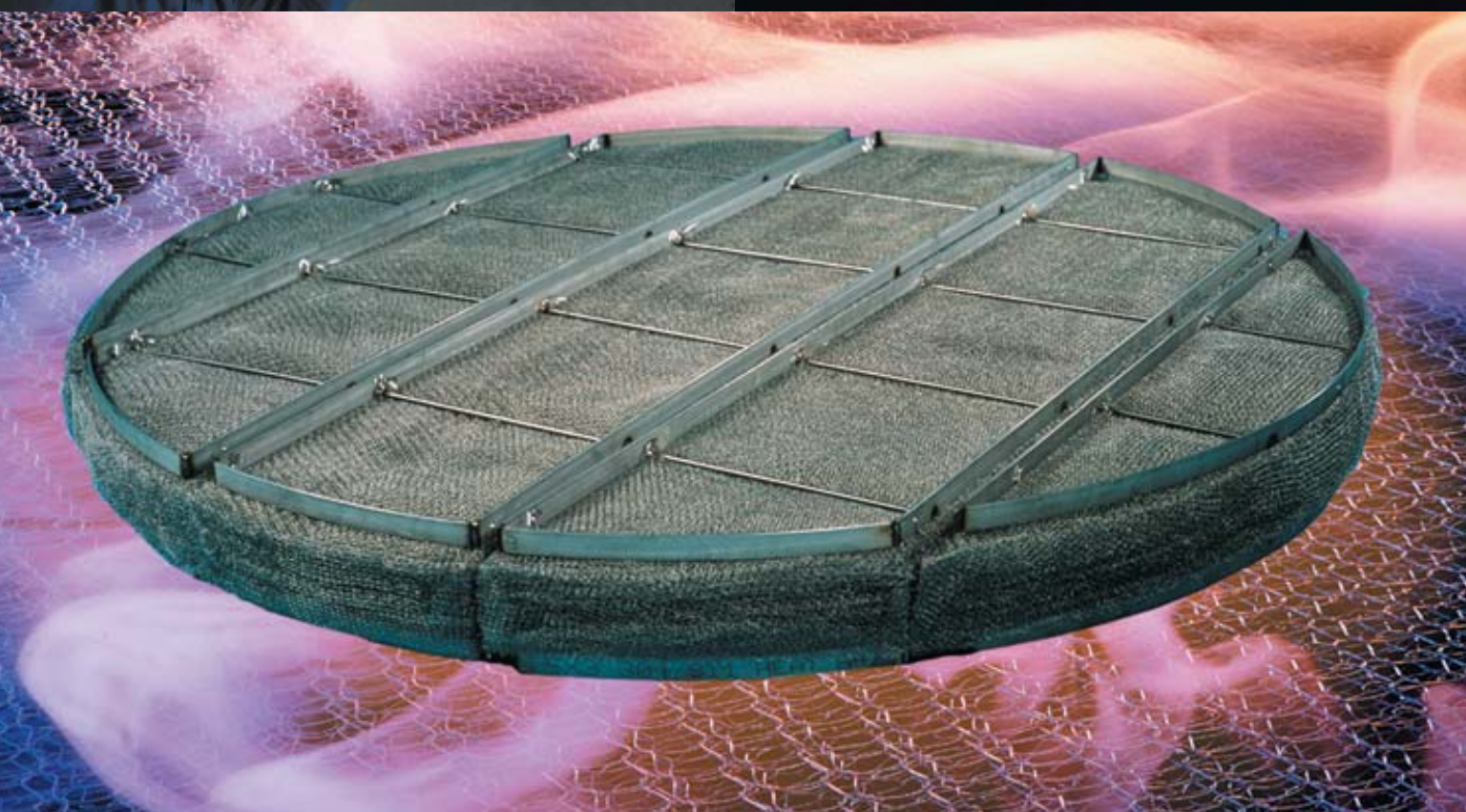

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CHESAPEAKE APPALACHIA'S MARCELLUS SHALE WELLS*

Table 2

Well name	County	Type	Proposed TD, ft	Permit application filed	Permit application approved	Well spud	Confidental?
Beagell 2-B	Broome	Vertical	4,800	Aug. 17, 2007	Oct. 17, 2007	Oct. 25, 2007	No
Butkowsky 1-B	Broome	Vertical	4,800	Aug. 17, 2007	Oct. 17, 2007	—	No
Trimber 1-B	Chemung	Vertical	3,900	July 13, 2007	July 23, 2007	Aug. 20, 2007	Yes
Bartlett 1-A	Chemung	Horiz.	3,702	Feb. 15, 2008	—	—	Yes
Bartlett 2	Chemung	Horiz.	3,785	Feb. 15, 2008	—	—	Yes
Manwaring 1-B	Tioga	Vertical	7,850	Feb. 5, 2008	Feb. 28, 2008	—	Yes
TGS Holdings	Tioga	Vertical	4,050	May 7, 2008	May 13, 2008	—	Yes

*Data from New York State Dept. of Environmental Conservation, wells database search, July 28, 2008.

site, Seneca operates about 2,500 wells in western New York and northwestern Pennsylvania, and owns about 720,000 acres of fee minerals, 270,000 acres of leased minerals, and 100,000 acres of surface and timber rights throughout the region.

During the 6 months ending Mar. 31, 2008, Seneca spudded 6 exploratory wells and 75 development wells. During the same period, it completed 5 exploratory wells and plugged 1, and completed 103 development wells.

Seneca Resources formed a joint venture with EOG Resources in 2007 to develop the Marcellus shale and the JV planned to drill 18 wells in 2008.

In 2007, Patterson-UTI moved three rigs to drill the Marcellus in Pennsylvania. By the end of 2009, Doug Wall said the company will have a fleet of 16 fit-for-purpose rigs working in the Marcellus shale, where they are drilling horizontal wells.

Chesapeake Appalachia is drilling actively in Pennsylvania, using rigs from Yost Drilling, another Chesapeake Energy subsidiary (Fig. 2).

Earlier this year, Houston-based Southwestern Energy Production Co. announced it would "invest $26 million in various exploration and new ventures projects, including drilling as many as three vertical wells targeting the Marcellus shale in Pennsylvania" (OGJ, June 2, 2008, p. 43).

Anadarko Petroleum Corp. holds about 625,000 gross acres in the Marcellus shale play and anticipates drilling 5-10 wells in five pilot areas this year.[8]

Anadarko spud and cored two vertical wells in first-quarter 2008, in Bradford and Clinton Counties, in Pennsylvania. In July, the company spud two more Marcellus wells in Bradford County.

Fort Worth-based Range Resources Corp. reported on its Marcellus operations on Sept. 1. The company is using three rigs in its 2008 Marcellus development project in Pennsylvania, and the 40-well horizontal program "is progressing with encouraging results." Range plans to steadily increase drilling operations to 8 rigs by yearend 2009.

The company reported in July that it had drilled more than 100 wells in the Marcellus, including 20 horizontal wells, and increased its high-graded acreage position to 850,000 net acres out of 1.4 million acres total (OGJ, July 21, 2008, p. 10).

Range is building pipelines and processing plants and continues to acquire acreage.

In June, Rex Energy Corp., based in State College, Pa., announced it had amassed 88,000 gross (57,000 net) acres in the Marcellus play. The company completed hydraulic fracture stimulation of its second Marcellus vertical well in western Pennsylvania. James Watson is vice-president of drilling for Rex Energy's Appalachian basin region (OGJ, May 19, 2008, p. 35).

West Virginia

In August 2008, 15 operators were running 77 rigs in West Virginia.

Chesapeake Appalachia, based in Charleston, WV, has drilled "two very nice horizontal Marcellus wells" in that state, according to CEO McClendon in a second-quarter conference call. As of Aug. 1, the wells were producing a total of 7 MMcfd. McClendon said Chesapeake believes the wells "have a combined EUR of about 11 bcf" equivalent. Chesapeake is running two rigs in the state.

Other operators in West Virginia include: Equitable Resources; Atlas America; Fortuna; XTO Energy Inc.; Dominion E&P; Columbia Gas; Northcoast/EXCO; PC Exploration; Daugherty Petroleum Inc.; Vinland energy Operations-Nami Resources Co. LLC; Samson Resources Co.; Anadarko Petroleum; Penn Virginia Oil & Gas Corp.; and Marathon Oil Corp.

Future drilling?

About 150 rigs are drilling the Marcellus and other shales in Pennsylvania and West Virginia, according to Weatherford, which expects the number to increase slightly in 2009

In addition to several companies that have already drilled hundreds of wells each, many smaller players are drilling just a few wells each.

Some service companies have had local offices for many years. BJ Services Co.'s district office in Dunbar, WV provides hydraulic fracturing and cementing services to Chesapeake, Equitable Resources, Cabot Oil & Gas, and others. BJ also services the region from a district office in eastern Kentucky.

The demand for hydraulic fracturing services in the Appalachian basin is causing some delays in Marcellus production. Weatherford Technology Solutions is building two new facilities in Del Barton and Buckannon, W.Va. The company has already opened a new di-

rectional drilling facility in Elkview, W. Va., providing EM-MWD tools needed to support air-drilling operations (mud-pulse telemetry being ineffective without fluid in the wellbore).

Why drill now? Gas prices are higher and expected to remain so. New technologies and tools are increasing drilling efficiency. New price incentives make hydraulic fracturing more affordable in the Appalachian basin, as stimulation services become commoditized. ✦

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Magnus runs drilling program in South Texas

Nina M. Rach
Drilling Editor

Magnus Oil & Gas Corp. is halfway through a 50-well drilling program that is delineating the new Powder River Consolidated field in Goliad County, Tex.

John Ehrman, chairman of privately held Magnus, told OGJ the field is defined by a 3D seismic survey. He began the 50-well drilling program in February 2006 and expects to finish in mid-2010, drilling one to two wells/month.

Magnus began operating in 2004, after Ehrman saw a deep prospect at a time when Chesapeake was drilling 18,000-ft wells in the area. He noted a lot of shallow potential on seismic.

The company's strategy has been to line up multiple 3D seismic events in the Frio sands (now called Powder River Consolidated) and the Yegua at 5,100 ft on some prospects.

Drilling

Magnus is currently using a rig from Titan Drilling Co., based in Luling, Tex.

Rig No. 3 is rated to 5,500 ft, runs doubles, and will drill a 10-well contract, using two crews on 12-hr shifts. Magnus Vice-Pres. Steve Sportsman monitors operations from Corpus Christi.

The vertical wells are drilled with lightweight mud, ramped from 9.1-10.3 ppg.

Typically, the company runs Baker Hughes triple combo, dual-induction logs, and always runs formation tests to make sure it has virgin pressures in shallow zones.

Third-party Fesco Ltd. certifies five-point production tests of Magnus's wells.

Omni Laboratories Inc. processes cores on all wells and turns around results on gas samples in 3-4 days from its Corpus Christi office.

The typical TD is 4,000 ft and most require about a week to drill, from spud to TD, Ehrman said. The completion takes about another week, provided there is a meter in place (to sell into). Otherwise, the wait on a meter can be 3-4 weeks.

Magnus spud the vertical Dohmann A-3 well on the North Dohmann lease on Aug. 25 and reached TD on Sept. 2 (Fig. 1). The well logged 86 ft of pay in the Frio sand series. The company set 4½-in. casing and dual-completed the well as a gas well on Sept. 9.

The well is number 26 out of the 50-well program, upon which Magnus received the new field designation from the Texas Railroad Commission.

The company recently completed the Loest No. 2 well, which encountered numerous Frio sands. The Loest No. 2 well is a single completion in a 4-ft section of pay sand and is producing more than 330 MMcfd from a single completion in a 2⅞-in. slimhole completion.

Production is sold into DCP (Duke–Chevron-Phillips) interstate pipeline system on the spot market.

Titan Drilling Co.'s Rig No. 3 is drilling 10 wells for Magnus Oil & Gas Corp. in a new gas field in Goliad County, Tex. (photo from Magnus; Fig. 1).

East McFadden project

Ehrman told OGJ the company's next focus is a 5-year project covering 4,860 acres in Victoria County, Tex. This will include new drilling as well as recompleting old wells in the East McFadden field, adding 20 electric submersible pumps.

Weatherford installed two ESP units in old wells during the summer, working out of its Midland office. Ehrman said the wells produced 25 bo/d, up from 4 bo/d, on 700 bbl of fluid.

The company plans additional drilling based on vintage seismic, including 79 wells to drill to an average TD of 6,500 ft. There are 31 "proven and productive" sands to 6,900 ft, including a package of 5,600-ft reservoir sands.

Magnus also has four saltwater disposal units about to go online. ✦

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LNGINFO

Worldwide Construction Projects — List of planned construction products updated in May and November each year.

	Current	Historical 1996–Current
Refinery	E1340	E1340C
Pipeline	E1342	E1342C
Petrochemical	E1341	E1341C
Gas Processing	E1344	E1344C

U.S. Pipeline Study — There are 14 categories of operating and financial data on the liquids pipeline worksheet and 13 on the natural gas pipeline worksheet.
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SWP advances CO_2 sequestration, ECBM, EOR demos

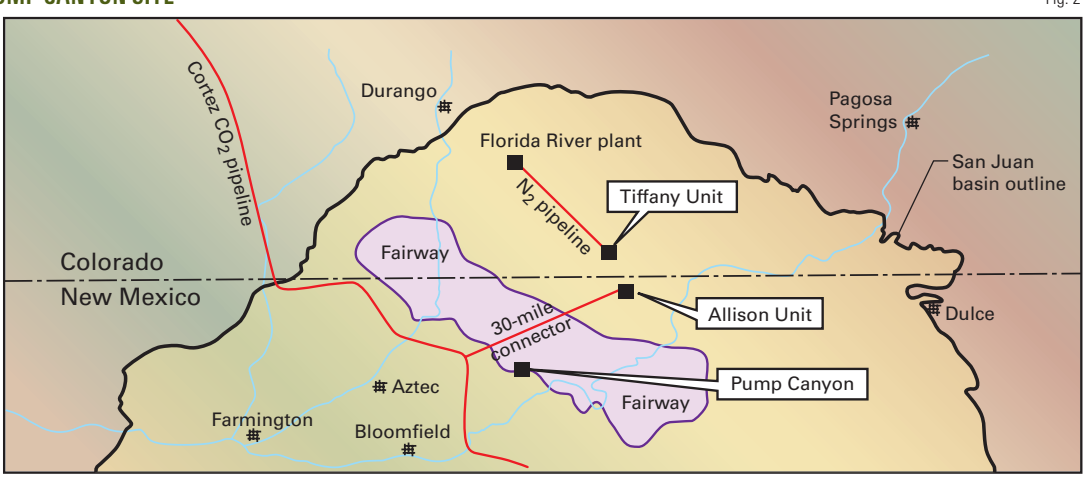
SOUTHWEST REGIONAL PARTNERSHIP AREA

Fig. 1

Source: SWP

PUMP CANYON SITE

Fig. 2



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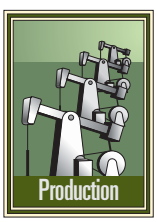
Guntis Moritis
Production Editor



Southwest Regional Partnership (SWP) of the US Department of Energy (DOE) continues its Phase 2 and 3 carbon dioxide projects for validating the feasibility of sequestering CO_2 in saline aquifers, coalbeds, and oil fields.

As part of Phase 2, SWP started injecting CO_2 at the end of July in the Fruitland coalbeds of the San Juan basin in New Mexico. Its San Juan Pump Canyon test aims to demonstrate whether CO_2 can enhance methane production from coalbeds (ECBM) as well as the potential of coalbeds to sequester injected CO_2.[1]

Another part of Phase 2 will investigate whether Pump Canyon water, produced from the coalbeds, can if desalinated restore vegetation near streams.

Two other parts of Phase 2 involve CO_2 injection in oil fields.[2] One is in Aneth oil field in the Paradox basin of Utah that will test CO_2 injection in a saline zone and the other is in the SACROC Unit in the Permian basin of West Texas that will test CO_2 enhanced oil

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recovery concurrent with CO_2 storage in the reservoir.

SWP also has started Phase 3 of the project that involves injecting CO_2 into saline water zones in the Farnham dome in Utah. It plans to drill the injection well toward yearend 2008.

SWP is one of seven regional partnerships organized by DOE in 2003 to validate and demonstrate the feasibility of CO_2 sequestration underground. New Mexico Institute of Mining and Technology leads the companies and organization involved in SWP.

Reid Grigg, senior engineer for New Mexico Petroleum Recovery Research Center at the New Mexico Tech, Socorro, said the total cost of the three phases will be about $130 million of which DOE will provide $90 million. The remaining $40 million comes from industry, state governments, and other sources.

Grigg estimated the cost of each phase as:

- *Phase 1*—$10 million. The phase involved characterization of the sequestration potential of the region that includes Colorado, Oklahoma, New Mexico, Utah, and parts of Arizona, Kansas, and Wyoming (Fig. 1). Phase 1 started in 2003 and finished in 2005.
- *Phase 2*—$20 million. The phase has the four parts mentioned previous. It started in 2005 and goes through 2009.
- *Phase 3*—$90 million. For this saline aquifer injection phase, DOE will provide $65 million while other sources will provide $35 million. The phase started in 2008 and will continue at least through 2017.

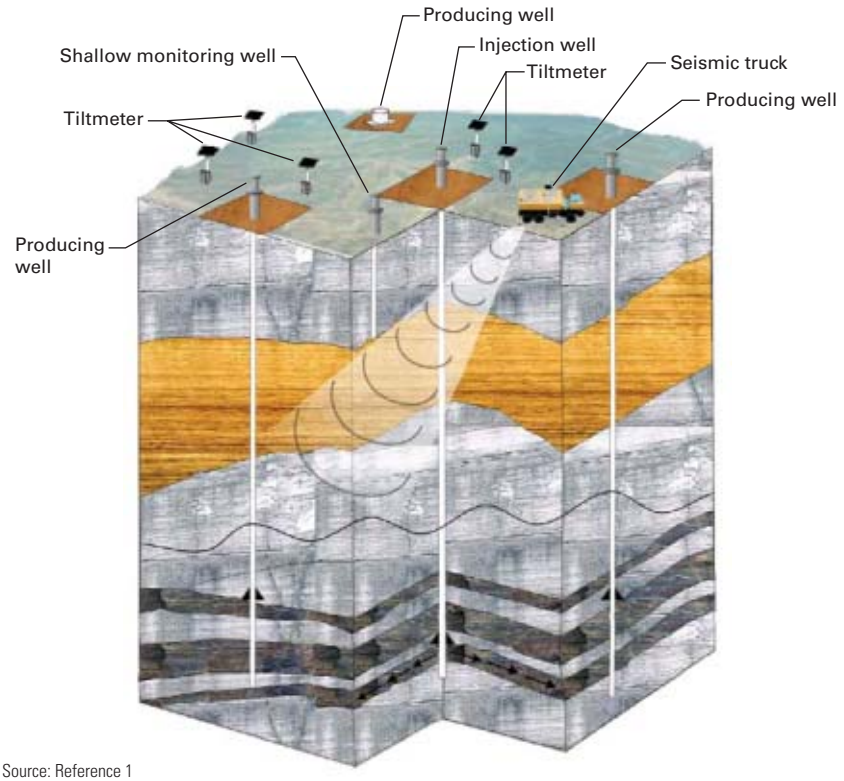
Aneth

Injection in the deep saline sequestration test at Aneth oil field near Bluff Utah started in November 2005 and will conclude in 2009.

Resolute Natural Recourses Co. and Navajo Nation Oil and Gas Co. operate the field.

SWP's plan is to inject about 150,000 tons of CO_2 during 3.5 years and to conduct extensive monitoring, measurement, and verification (MMV) studies, including a suite of direct techniques (direct CO_2 flux measures)and indirect techniques (seismic models).

PUMP CANYON CONCEPT Fig. 3



Source: Reference 1

SACROC

In SACROC, SWP will evaluate CO_2 enhanced oil recovery with concurrent CO_2 sequestration. Pilot injection may begin by yearend 2008.

SWP will evaluate 2D and 3D seismic for monitoring injected CO_2 and also evaluated various MMV approaches.

Kinder Morgan CO_2 Co. LP operates the unit.

Pump Canyon

The Pump Canyon test is near the completed Allison Unit ECBM test (Fig. 2), but as explained by Scott R. Reeves, executive vice-president Advanced Resources International Inc. (ARI), the Pump Canyon test is in highly permeable coals whereas the Allison Unit test was in tight coals. The injectivity is also high, about 1 MMcfd at 300 psi, he said. He also added that unlike in the Allison Unit test, the coalbeds in Pump Canyon are at low pressure and nearly depleted.

The Allison ECBM test was in the early 2000s while the nearby Tiffany ECBM test with Nitrogen took place in 1990s (OGJ, July 14, 2003, p. 49).

ConocoPhillips operates Pump Canyon and ARI is the CO_2 project coordinator.

The project involves three coalbed methane producing wells and a centrally located injection well on a 640-acre section. The three coal seams are at 3,000 ft and have a 75 ft thickness each over a 175-ft interval.

SWP plans to inject about 35,000 tons of CO_2 during 6 months and evaluate an extensive list of MMV approaches including a 36 static tilt meter array (Fig. 3) as well as checks for CO_2 leakage on the surface.

A separate part of the test will evaluate the use of desalinated coalbed

produced water for restoring vegetation along a streambed.

Farnham dome

Farnham Dome in an anticline in east-central Utah in which CO_2 was discovered in the 1920s and 1930s. Currently Savoy Energy produces CO_2 from the field for industrial uses. SWP also expects that in the future CO_2 from the dome will be used for EOR projects in the Unita basin.

Grigg said that SWP plans to complete the injection well with dual tubing strings for injecting CO_2 into saline aquifer formations at 3,500 and 5,500 ft.

The industrial partners for the project include Savoy Energy Corp., Rocky Mountain Power , Questar Gas Corp., and Blue Source LLC. ✦

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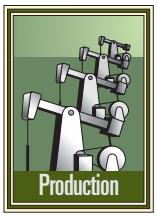
1. Advanced Resources International Inc., "Pump Canyon CO_2-ECBM/Sequestration Demonstration, San Juan Basin SWP Phase 2 Program Project Overview & Status," Coal-Seq VI Forum, Houston, Apr. 10-11, 2008.

2. McPherson, B., "Southwest Phase II Overview," DE- FC26-05NT42591, Pittsburgh, May 9, 2007.

Carbon-fiber material bonded on pipe centralizes tubular strings



A composite carbon-fiber material bonded directly on the pipe surface provides an alternative for obtaining standoff for completion and drilling tools, production riser systems, pipe-in-pipe flowlines, and road and river crossings.

Halliburton in 2008 acquired Protech Centerform, Protech has a license to manufacture the material from ENI SPA,the developer and holder of the patent for the material.

Halliburton notes that the first commercial application of the centralizers was on 16-in. and 13⅜-in. casing for Eni SPA in the Cascina Cardana 1 gas well in the Po Valley of Italy in 2000, and the most common application of the material is for centralizing casing and liners in highly deviated or sidetrack wells.

Carbon-fiber centralizers

Protech's website says molded-on centralizer blades or buttons greatly expand versatility while reducing overall project cost from design through completion. For example, the design engineer can now use slim-hole centralization without stop collar rings around the outside of the casing wall, providing a smooth and uninterrupted flow during circulation.

Because the elasticity of the composite is higher than for steel casing, the material reduces if not completely eliminates problems with casing centralizer stiffness, the company says.

It adds that an economic advantage is that the material allows adequate casing or liner standoff for acceptable cement placement even in deviated wells with slim hole or lean profiles such as 16-in. casing in a 17-in. hole or 13⅜-in. casing in a 14-in. borehole.

The company says that it has standardized the material for the centralizers but also can customize it. It can bond the material to pipe in various geometries or shapes such as spiral blades, staggered blades, or buttons; and it commonly applies it to tubulars at the pipe yard, although it can also do this at the rig site.

The most common applications are solid standoffs, although using the material in conjunction with close tolerance bow springs provides a technically and commercially sound alternative in underreamed holes, the company notes. It adds that in the US, 90% of the applications have been on casing and liners run in Gulf of Mexico deepwater wells.

The standardized material has a 350° F. temperature limitation.

Figs. 1-4 show the centralizers on various tubulars.

Centralizer compositions

The material for the composite centralizers consists of a combination of a bicomponent amine-cured epoxy resin compounded with a polyurethane hybrid (for flexibility), AL203 (Alumina), SiC (silicon carbide), TiN (titanium nitride) particulate, and chopped carbon fiber, along with chemically binding the

The slotted liner includes molded carbon-fiber centralizers (Fig. 1).

The carbon-fiber blades are on 11⅞ in. stress-keel joints for BP Plc's 15 well Holstein project in the Gulf of Mexico (Fig. 2).

Eni Petroleum's K-2 Gulf of Mexico development included 7¾-in. pipe inside of an 8.50-in. hole opening into a 9⅞-in. section. The centralizers have a blade shape (Fig. 3).

The predrilled liner with the centralizers is for Chevron's North Sea Alba field (Fig. 4).

fillers to the resin.

Properties of the material include:

- Direct tensile strength: 5,510 psi.
- Compressive strength: 21,021 psi.
- Flexural strength: 16,820 psi.
- Impact strength: 11 kJ/sq m.
- Specific gravity (mixed material): 1.675.
- Glass transition temperature: 152° C., following postcure.
- Dialectic strength: >29 kv @ 1 mm.
- Abrasion resistance: 6 mg.
- Hardness: 88.
- Shear bond: 4,022 psi. ✦

Saudi Aramco outlines FCC catalyst evaluation method

This article presents how Saudi Aramco evaluates the performance of selected fluid catalytic cracking catalysts and compares this performance with vendor projections in terms of gasoline yield, research octane number, and gasoline sulfur content.

The article describes Aramco's FCC catalyst evaluation process for its Jeddah refinery; results for each catalyst vendors' projections were revalidated with a microactivity test (MAT).

Based on an economic comparison and technical evaluation during the initial catalysts testing phase, we anticipated that the selected catalyst would meet the refinery's objectives of producing gasoline with highest yield and octane number.

Actual unit operating performance confirmed the conclusions from the catalyst study.

Saeed Al-Alloush
Fahad Al-Khaldi
Saudi Aramco
Jeddah

FCC UNIT REACTIONS Table 1

Reaction type	Typical reaction formula
Cracking	
Paraffins cracked to olefins and smaller paraffins	$C_{10}H_{22} \rightarrow C_4H_{10} + C_6H_{12}$
Olefins cracked to smaller olefins	$C_9H_{18} \rightarrow C_4H_8 + C_5H_{10}$
Aromatic side-chain scission	$ArC_{10}H_{21} \rightarrow ArC_5H_9 + C_5H_{12}$
Naphthenes cracked to olefins and smaller ring compounds	$Cyclo\text{-}C_{10}H_{20} \rightarrow C_6H_{12} + C_4H_8$
Isomerization	
Olefins bond shift	$1\text{-}C_4H_8 \rightarrow trans\text{-}2\text{-}C_4H_8$
Normal olefins to iso-olefins	$n\text{-}C_5H_{10} \rightarrow iso\text{-}C_5H_{10}$
Normal paraffins to isoparaffins	$n\text{-}C_4H_{10} \rightarrow iso\text{-}C_4H_{10}$
Cyclohexane to cyclopentane	$C_6H_{12} \rightarrow C_5H_9CH_3$
Hydrogen transfer	Naphthene + olefin → Aromatic + paraffin
Cycloaromatization	$C_6H_{12} + 3C_5H_{10} \rightarrow C_6H_6 + 3C_5H_{12}$
Transalkylation, alkyl-group transfer	$C_6H_4(CH_3) + C_6H_6 \rightarrow 2C_6H_5\,CH_3$
Cyclization of olefins to naphthenes	$C_7H_{14} \rightarrow CH_3\text{-}cyclo\text{-}C_6H_{11}$
Dehydrogenation	$n\text{-}C_8H_{18} \rightarrow C_8H_{16} + H_2$
Dealkylation	$Iso\text{-}C_3H_7\text{-}C_6H_5 \rightarrow C_6H_6 + C_3H_6$
Condensation	$Ar\text{-}CH = CH_2 + R_1CH = CHR_2 \rightarrow Ar\text{-}Ar + 2H$

FCC catalysts

Production of gasoline, diesel, chemicals, and other petroleum products relies heavily on catalysts. Changing FCC catalyst is one of the most common methods refiners use to improve FCC operations.

Generally, the FCC's main objective is to crack heavy oil to gasoline and,

in some cases, increase the yield of valuable light olefins, especially propylene and butylenes. Currently, FCC units supply about 30% of the world's propylene.

Enhancing gasoline octane and LPG olefins production, especially propylene, usually involves adding a ZSM-5 based additive containing a small pore zeolite to the FCC catalyst. Due to its unique pore structure, ZSM-5 can limit access to only linear or slightly branched hydrocarbon molecules within the gasoline boiling range. ZSM-5 based additive cracks C_6+ gasoline olefins to smaller olefins such as propylene and butylenes.[1]

The Jeddah FCC unit's objective, however, is to maximize gasoline yield to satisfy local market requirements.

In 2004, Saudi Aramco evaluated four different technical proposals for the FCC unit in one of its refineries in order to increase gasoline yield. Some of the selection criteria for the catalyst were:

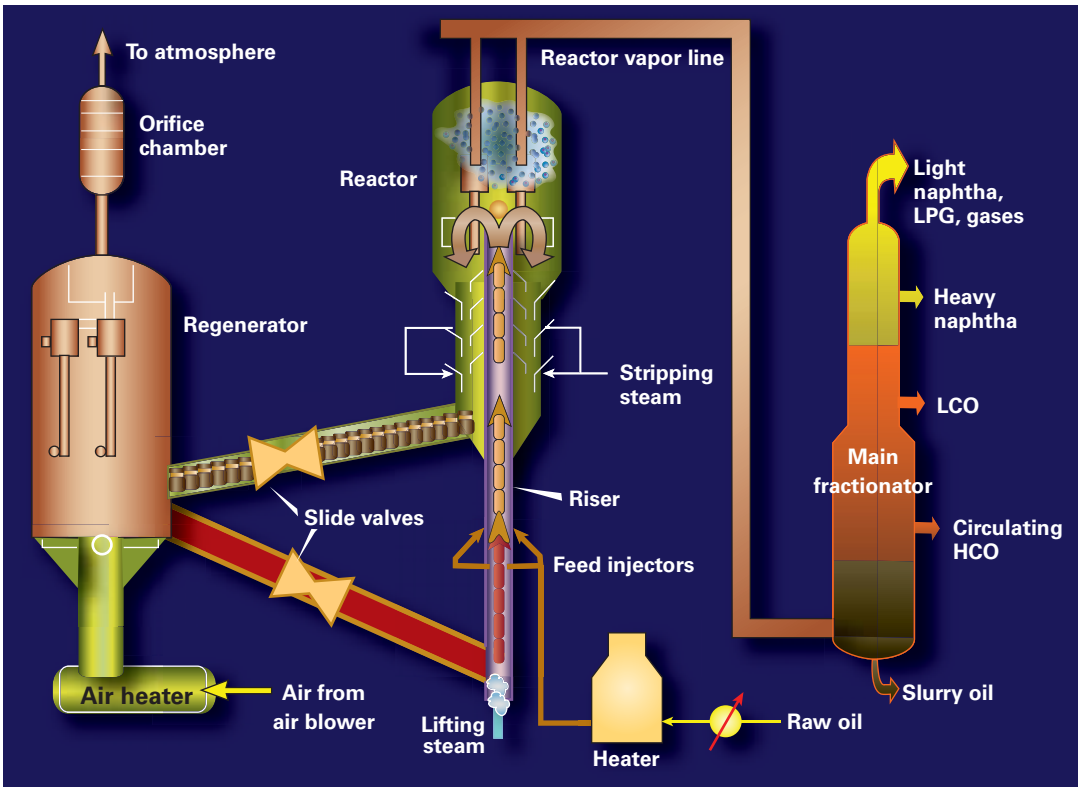
- Octane number.
- Gasoline sulfur content.
- Gasoline yield.

This article describes the catalyst evaluation process and discusses the obtained results for each catalyst.[2] As part of Saudi Aramco's evaluation procedure of new technologies, a postoperation evaluation was conducted and reported. This article also summarizes the actual operation results.[3]

The catalyst evaluation activity is part of an overall plan to optimize refinery operations and increase profitability.

TYPICAL FCC PROCESS

Fig. 1



Refineries in Saudi Aramco are being audited for energy utilization. A good example is the energy optimization effort in Jeddah refinery to maximize heat recovery and minimize fuel consumption.[4]

TYPICAL FCC FEEDSTOCK PROPERTIES

Table 2

Property	Typical value
Feed rate, 1,000 b/d	20
Feedstock type	Gas oil
Feed boiling range, °C.	240-630
Gravity at 60° F., °API	23.25
Specific gravity at 60° F.	0.91
Sulfur, wt %	2.6
Total nitrogen, ppm	630
Basic nitrogen, ppm	155
Conradson carbon, wt %	0.24
Nickel, ppm	< 1
Vanadium, ppm	< 1
Refractive index	1.52
Viscosity, cst	26

TYPICAL OPERATING CONDITIONS

Table 3

Condition	
Combined feed temperature, °C.	235
Riser outlet temperature, °C.	514
Flue-gas temperature, °C.	736
Regenerator dilute phase temperature, °C.	689
Catalyst circulation, tons/min	16
Catalyst addition rate, tons/day	1.0

CATALYST VENDOR DATA

Table 4

Catalyst Product	Base Yield, vol %	A	B	C1	C2
		Delta yield, vol %			
Fuel gas (C_2 and lighter)	4.33	0	–0.23	–0.07	–0.04
LPG (C_3-C_4)	14.00	2.54	0.33	–0.25	1.62
Gasoline (C_5-430° F.)	57.80	0.38	2.49	1.03	0.16
Light cycle oil	14.95	–0.74	–0.3	–0.36	–0.73
Heavy cycle oil, slurry oil	13.90	–1.05	–1.53	–0.25	–0.30
Product quality		Increase			
RONC	90	0.85	0.27	0.07	0.25
S, wt %	0.3	–0.001	–0.031	–0.006	–0.006

FCC chemical reactions

Cracking is the process whereby complex organic molecules and heavy

Suppliers raise refining, petchem catalyst prices

David N. Nakamura
Refining/Petrochemical Editor

During the past 3 months, catalyst manufacturers have announced significant price increases for refining and petrochemical catalysts in response to inflation and higher raw material and energy costs.

On July 23, Grace Davison announced that it was implementing price increases and surcharges of up to 20% across product lines due to "unprecedented raw material and energy inflationary pressures."

The increase was in addition to earlier announcements for specific product price increases. "Previous measures are insufficient against the current trend of rapidly escalating costs," according to Greg Poling, President of Grace Davison.

Haldor Topsoe, on July 25, announced that prices for its selective catalyst reduction DeNOx catalysts would rise 10-15% due to significant increases in raw material and energy costs.

On Aug. 7, Albemarle Corp. announced price increases of 20% for its FCC catalysts for both heavy feed (resid) and vacuum gas oil applications.

On Sept. 9, UOP LLC announced that it was increasing prices for all of its catalysts used in refining and petrochemical production. Increases of up to15% affect its Platforming, Penex, Unicracking, and Merox refining catalysts as well as its Parex, Isomar, Tatoray, Pacol, Oleflex, Q-Max, and EBOne petrochemical catalysts.

UOP is raising prices due to "the continued high cost of energy, packaging, and rising raw material prices." Price increases vary by the type of product.

hydrocarbons are broken into light hydrocarbons by the breaking of carbon-carbon bonds. The rate of cracking and yield of end products strongly depend on temperature and type pf catalyst used for this cracking.

Cracking is achieved with an active zeolite-based catalyst in a short-contact time vertical or upward-sloped riser. Preheated feed of heavy hydrocarbons is sprayed into the base of the riser where it contacts the hot fluidized catalyst. Hot catalyst vaporizes the feed and catalyzes cracking reactions.

Fig. 1 demonstrates the FCC process. The FCC cracking reaction is endothermic and involves thousands of elementary reactions. Table 1 lists the most important reactions that occur in an FCC unit.[5]

During the cracking process, coke deposits on cracking catalyst surfaces; this causes a significant reduction of catalyst activity and selectivity. Spent catalyst is continuously removed from the cracking reactor, regenerated, and reinjected into the cracker.

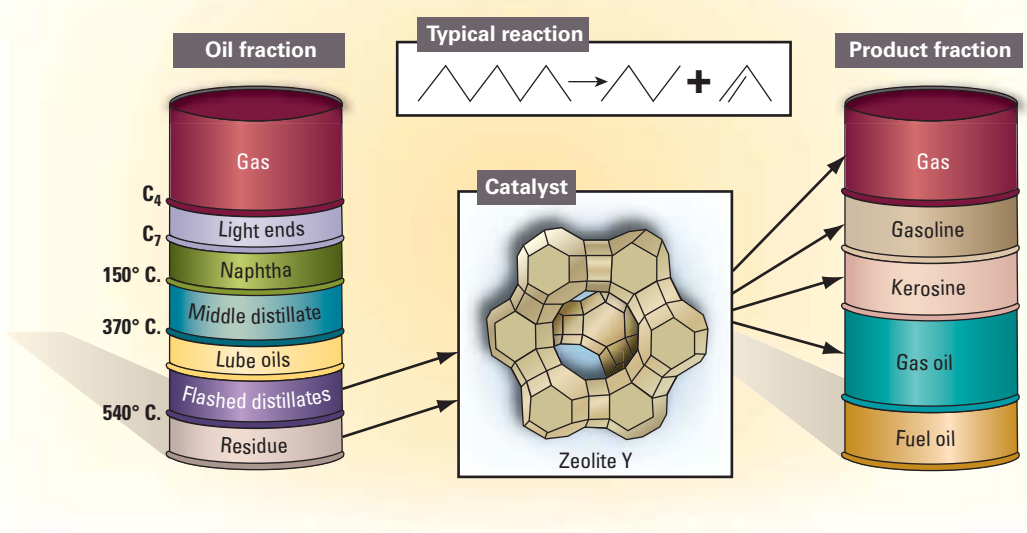
The regeneration process involves catalyst contact with steam in a stripper chamber where hydrocarbons remaining in the catalyst pores are removed. Spent catalyst then flows into a fluidized-bed regenerator where air is used to burn off the coke to restore catalyst activity and also provide the necessary heat for the next reaction cycle.

The ultrastable Y-zeolite (USY) is widely used in modern FCC catalysts. It provides the main catalyst functions: product selectivity, higher stability, and much of the catalytic activity. Catalyst normally contains 20% USY and 77% amorphous alumino-silicate matrix.

Additives to the FCC process make up no more than 5 wt % of the solids but significantly improve process flexibility and product distribution.[6]

FCC MAIN REACTANTS, PRODUCTS

Fig. 2



Yuqing investigated different USY catalysts with varying ratios of Si:Al prepared by different dealumination methods.[7] After modification via lanthanum incorporation and aging at 800° C. in 100% steam for 4 hr, Yuqing characterized the pore structure and acidic property of dealuminated Y zeolites using nitrogen adsorption and pyridine-infrared methods.

Then Yuqing used a MAT to evaluate catalytic cracking performance in an FCC unit. Results showed higher cracking activity and lower coke yield in FCC unit.

Table 2 shows typical feedstock properties for the Jeddah refinery FCC unit. The main feedstock is vacuum gas oil (VGO) from the refinery vacuum distillation unit. In addition, the refinery can receive feed with slightly different properties from a nearby joint-venture refinery.

Typical feedstock properties in Table 2 represent both feeds: the refinery and exported feed. Fig. 2 shows a general illustration for the main reactants and the catalytic products for an FCC unit.

Catalyst evaluation

Changing FCC catalyst is one of the most frequently used methods chosen to improve FCC operation. In an attempt to increase the gasoline yield and octane number, we identified potential catalyst suppliers and had them submit proposals.

The evaluation process involves many steps to select the best FCC catalyst that meets the selection criteria contained in Saudi Aramco catalyst protocol (SAES-A-207). The flowchart in Fig. 3 describes this process in general.

In the first step, typical operating data for the FCCU (Table 3) and typical feedstock data (Table 2) were sent to several approved FCC catalyst vendors. We also requested that the vendors provide catalyst samples for our evaluation.

Three vendors sent proposals with samples of their catalysts and secrecy agreements. One of the vendors sent two samples. We evaluated four catalyst samples in total.

Table 4 shows the vendor projections for the four samples.

To validate vendors' projections, we sent the four catalyst samples to King Fahd University of Petroleum and Minerals-Research Institute (KFUPM-RI) with a request to conduct laboratory pilot plant tests using a MAT.

Table 5 shows pilot plant test results. Evaluation included catalyst physical properties and stability of catalyst performance within the given operating conditions. It also included the measured selectivity by MAT and octane number of the gasoline produced.

The evaluation concluded that:

- Catalyst A claimed to increase significantly LPG production. The vendor-claimed increase in gasoline was not supported by the MAT result. In addition, this catalyst was the second most expensive among the four catalysts considered.
- Catalyst B claimed a large increase in gasoline yield. The MAT results, however, did not support this claim. In addition, this catalyst was the most expensive.
- Catalyst C1 claimed a large increase in gasoline and octane number. MAT results confirmed this claimed increase.
- Catalyst C2 claimed a large increase in LPG production, which was confirmed by MAT result. This catalyst, however, did not provide a high gasoline yield.

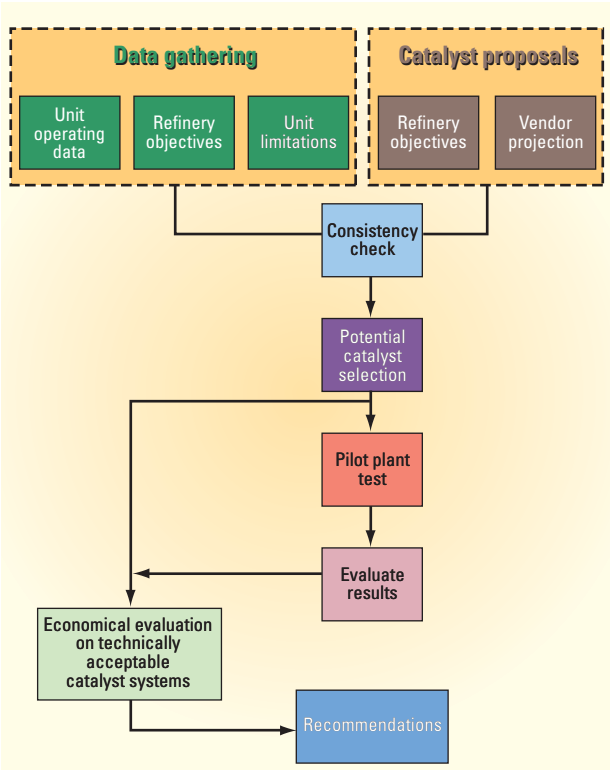
Based on the MAT conclusions, we recommended catalyst C1 due to its high octane number and gasoline yield. This catalyst also produces gasoline with a lower sulfur content.

Actual catalyst performance

Catalyst performance was reported in first-quarter 2005 to clear the recommendation of the new catalyst. The

NEW CATALYST APPROVAL PROCEDURE

Fig. 3



MICROACTIVITY TEST RESULTS

Table 5

Catalyst Component	Base	A	B	C1	C2
	Product yield, wt %				
Fuel gas	2.23	2.32	2.48	2.17	2.05
LPG	17.85	18.15	19.63	17.65	16.6
Gasoline	54.4	55.52	54.4	55.38	55.65
LCO	15.2	14.45	12.85	15.45	16.4
HCO	6.6	5.95	5.67	6.42	6.2
Coke	3.8	3.73	4.18	3.07	3.2
RONC	88.80	87.03	89.00	88.55	86.85
Gasoline sulfur, ppm	615	640	650	560	668

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second performance report is based on recent data, and was conducted to confirm the earlier report.

2005 initial performance test

We placed the selected catalyst into actual operation and the initial performance evaluation is based on data collected from October 2005 to March 2006 operating with the new catalyst.

During the performance evaluation, the regenerator blower was out of service for major maintenance. This caused the regenerator vessel to operate at a lower dense-bed temperature. The Jeddah refinery, therefore, started using torch oil continuously to minimize the dense-bed temperature's effect on catalyst regeneration.

We evaluated the new catalyst's performance based on actual operations against data obtained during the catalyst evaluation stage and vendor projections. Unavailability of the regenerator blower, however, caused two major differences in the conditions used for vendor projections and conditions used during the catalyst evaluation stage.

The two differences are the change in feedstock due to the use of torch oil and the lower operating temperature due to unavailability of additional coke burning provided by the blower.

Due to difficulties in obtaining base-case performance with the air blower down, we corrected the reported yield for the effects of low-temperature operations.

We evaluated new catalyst performance for three criteria:

- *Gasoline yield.* The vendor claimed gasoline yields of 56.68 vol % and 58.4 vol % based on two different feed qualities: with and without imported VGO, respectively. Table 6 shows the corrected gasoline yield based on adjusting the distillation end points. We added to the raw LCO all the 221+° C. materials in the raw gasoline and subtracted the 221–° C. materials in the LCO yield:

  $\text{Gasoline yield}_{\text{Corrected}} = \text{Gasoline yield}_{\text{Recorded}} + \text{LCO221+° C.} - \text{LCO221–° C.}$

  Table 6 shows a comparison between the vendor-projected yield and actual operations corrected for the low-temperature (515° C.) operating condition.

  The corrected yield was lower than projected due the use of torch oil. Operating conditions during the performance evaluation were inadequate to confirm the pilot test results for projected yield. The obtained results for the new catalyst compared with historical yields for different catalysts used in the past given the same conditions, however, supported the pilot test conclusions.

- *Research octane number.* The vendor RON projections for the new catalyst were 90.43 and 90.49 based on feed quality with and without imported VGO, respectively. Table 7 summarizes the monthly average RON compared with the vendor-projected RON.

  The average reported RON for all months are higher than the vendor projected.

- *Gasoline sulfur content.* The vendor's sulfur content projections for the new catalyst were 0.278 wt % and 0.263 wt % based on feed quality with and without imported VGO, respectively. Table 8 shows monthly average sulfur contents compared to vendor-projected figures.

  The average reported sulfur content for all months are much lower than vendor projections.

COMPARISON OF GASOLINE YIELD

Table 6

	Corrected yield, vol %	Delta corrected yield, vol %	Difference*
October 2005	45.6	(0.1)	(0.97)
November 2005	43.3	(2.4)	(3.20)
December 2005	41.0	(4.7)	(5.57)
January 2006	42.1	(3.6)	(4.47)
February 2006	41.4	(4.3)	(5.17)
March 2006	43.3	(2.4)	(3.27)

*Difference between delta corrected gasoline and vendor projection.

RON ANALYSIS

Table 7

	– Average gasoline RON – Vendor projection	Actual
October 2005	90.49	90.99
November 2005		91.83
December 2005		90.87
January 2006		90.83
February 2006		91.12
March 2006		91.12

GASOLINE SULFUR CONTENT

Table 8

	– Sulfur content, wt % – Vendor projection	Actual
October 2005	0.263	0.174
November 2005		0.191
December 2005		0.172
January 2006		0.173
February 2006		0.172
March 2006		0.177

Catalyst performance confirmation

The catalyst performance methodology we followed was based on correcting gasoline yield for different operating conditions than the ones initially used to project FCC yield. This methodology was necessary to complete a mandatory procedure set by Aramco to approve a conversion to a new catalyst.

We attempted to confirm our previous conclusions based on recent performance operating the FCCU under normal operating conditions. Table 9 shows daily average yield, RON, and gasoline sulfur content for the first 9 days in April 2007.

APRIL GASOLINE DATA

Table 9

Date, April 2006	Gasoline yield, vol %	RON	Gasoline sulfur content, wt %
1	57.8	91.0	0.16
2	57.8	91.1	0.15
3	58.6	91.3	0.13
4	59.1	91.0	0.15
5	59.3	91.0	0.14
6	58.0	91.0	0.14
7	57.4	91.0	0.13
8	57.3	91.0	0.13
9	56.6	91.0	0.14
Average	58.0	91.0	0.141
Vendor projection	56.68-58.40	90.49	0.263

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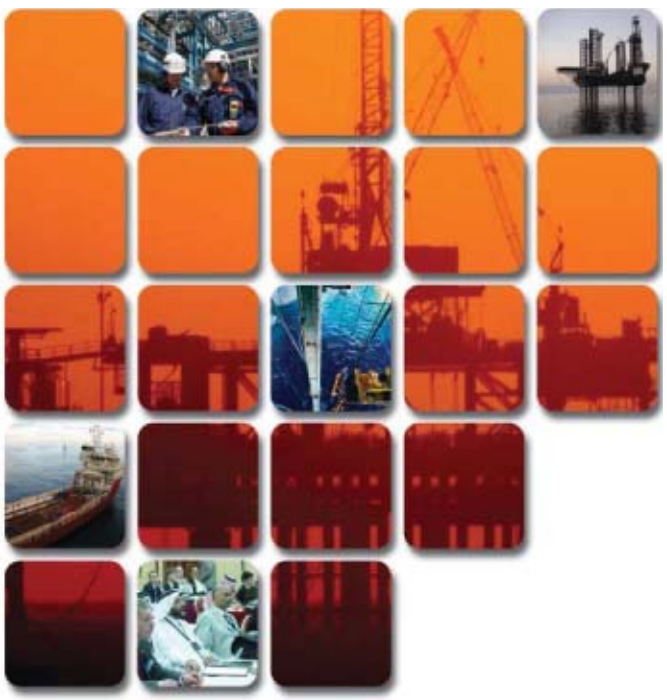

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These data show that the new catalyst performance meets and even exceeds vendor projections. Gasoline yields during this period were 56.6 wt % to 59.3 wt %.

The variation in gasoline yields is due to different blends of local and imported VGO feeds. Imported VGO slightly reduces the gasoline yields. Yields using the new catalyst are higher than the original catalyst's yield, which was less than 57.8 wt %.

The new catalyst provides a higher RON (91) compared with the vendor projection (90.4). The new catalyst improved gasoline quality compared with the original catalyst RON of 90.

Actual measured sulfur content of 0.14 vol % is much lower than the vendor projection of 0.263 vol % and original catalyst performance of 0.3 vol %.

Economic benefits

The four catalysts showed different projections and, based on Saudi Aramco's selection criteria, we selected the catalyst that satisfied most of the refinery criteria. The selected catalyst, therefore, might not be the best choice for another refinery with different target product.

This article shows that many factors influence gasoline yield, including riser outlet temperature, feedstock quality, and catalyst formulation.

Based on an economic comparison and technical evaluation during the initial catalyst testing phase, we anticipated that the selected catalyst would meet the refinery's objectives of the highest yield and octane number for the gasoline stream. Actual performance confirmed the conclusion that we reached during the study phase.

Acknowledgments

The authors acknowledge the support and cooperation provided by the downstream process engineering division, process and control systems department; FCC engineers from the operation engineering unit, Jeddah refinery department; and KFUPM-Research Institute. ✦

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NELSON-FARRAR COST INDEXES

Refinery construction (1946 Basis)

(Explained on p.145 of the Dec. 30, 1985, issue)

	1962	1980	2005	2006	2007	June 2007	May 2008	June 2008
Pumps, compressors, etc.	222.5	777.3	1,685.5	1,758.2	1,844.4	1,846.5	1,923.0	1,938.2
Electrical machinery	189.5	394.7	513.6	520.2	517.3	517.7	515.0	515.9
Internal-comb. engines	183.4	512.6	931.1	959.7	974.6	973.9	980.8	984.6
Instruments	214.8	587.3	1,108.0	1,166.0	1,267.9	1,267.5	1,338.2	1,341.5
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	1,196.1	1,226.4	1,231.0
Materials component	205.9	629.2	1,179.8	1,273.5	1,364.8	1,389.2	1,669.1	1,727.6
Labor component	258.8	951.9	2,411.6	2,497.8	2,601.4	2,593.6	2,669.4	2,674.3
Refinery (Inflation) Index	237.6	822.8	1,918.8	2,008.1	2,106.7	2,111.8	2,269.3	2,295.6

Refinery operating (1956 Basis)

(Explained on p.145 of the Dec. 30, 1985, issue)

	1962	1980	2005	2006	2007	June 2007	May 2008	June 2008
Fuel cost	100.9	810.5	1,360.2	1,569.0	1,530.7	1,611.4	2,435.3	2,587.4
Labor cost	93.9	200.5	201.9	204.2	215.8	216.8	221.1	228.6
Wages	123.9	439.9	1,007.4	1,015.4	1,042.8	1,027.5	1,065.9	1,104.2
Productivity	131.8	226.3	501.1	497.5	483.4	474.0	482.1	483.0
Invest., maint., etc.	121.7	324.8	716.0	743.7	777.4	779.3	837.4	847.1
Chemical costs	96.7	229.2	310.5	365.4	385.9	390.2	478.0	489.3
Operating indexes								
Refinery	103.7	312.7	542.1	579.0	596.5	605.4	714.7	736.5
*Process units**	103.6	457.5	787.2	870.7	872.6	901.8	1,211.8	1,270.6

**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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Equipment costs rise moderately

Gary Farrar
Contributing Editor

Costs for the five equipment items that make up the Nelson-Farrar miscellaneous equipment cost index were mixed during the 2006-07 period. The miscellaneous equipment index average rose to 1,205.5 from 1,075.6 in 24 months.

The greatest increase among the components making up the equipment average was for heat exchangers, which rose to 1,374.7 in December 2007 from 1,079.2 in January 2006.

Engines increased only slightly during the period. Instruments gained 177.7 during the 2006-07 period examined.

Electrical machinery remained mostly the same, rising to 513.2 in December 2007 from 509.1 in February 2006.

The pumps and compressors average increased to 1,867.3 in December 2007 from 1,727.4 in January 2006. ✦

VARIATION OF NELSON-FARRAR MISCELLANEOUS EQUIPMENT INDEX

Year and month	Code 1141 Pumps compressors	Code 117 Electrical machinery	Code 1194 Engines	Instru-ments	Heat exchangers	Misc. equipment average
2006						
Jan.	1,727.4	510.9	944.3	1,116.1	1,079.2	1,075.6
Feb.	1,736.9	509.1	953.1	1,115.6	1,079.2	1,078.8
Mar.	1,744.4	510.5	960.7	1,119.2	1,179.4	1,102.8
Apr.	1,738.8	513.2	956.9	1,132.7	1,179.4	1,104.2
May	1,747.3	514.6	956.9	1,148.5	1,179.4	1,109.3
June	1,751.1	522.3	958.8	1,156.9	1,179.4	1,113.7
July	1,751.1	523.2	961.9	1,173.4	1,179.4	1,117.8
Aug.	1,758.6	524.6	965.7	1,178.1	1,179.4	1,121.3
Sept.	1,777.5	530.5	965.7	1,199.4	1,179.4	1,130.5
Oct.	1,787.0	527.7	964.5	1,205.5	1,179.4	1,133.0
Nov.	1,787.0	527.3	963.8	1,220.4	1,179.4	1,135.6
Dec.	1,791.7	528.2	963.8	1,224.8	1,179.4	1,137.6
Year	**1,758.2**	**520.2**	**959.7**	**1,165.9**	**1,162.7**	**1,113.4**
2007						
Jan.	1,799.2	527.7	969.5	1,239.9	1,179.4	1,143.2
Feb.	1,829.5	526.8	969.5	1,246.9	1,179.4	1,150.4
Mar.	1,833.3	516.8	969.5	1,251.5	1,374.7	1,189.2
Apr.	1,841.8	517.7	969.5	1,261.4	1,374.7	1,193.0
May	1,840.8	515.0	973.9	1,261.3	1,374.7	1,193.1
June	1,846.5	517.7	973.9	1,267.5	1,374.7	1,196.1
July	1,846.5	517.3	974.5	1,272.4	1,374.7	1,197.1
Aug.	1,850.3	514.6	980.8	1,272.4	1,374.7	1,198.6
Sept.	1,853.1	514.1	980.8	1,282.4	1,374.7	1,201.0
Oct.	1,861.6	514.1	977.7	1,283.5	1,374.7	1,202.3
Nov.	1,862.6	511.9	977.7	1,281.4	1,374.7	1,201.6
Dec.	1,867.3	513.2	978.3	1,293.8	1,374.7	1,205.5
Year	**1,844.4**	**517.2**	**974.6**	**1,267.9**	**1,342.2**	**1,189.3**

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	May 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	945.1	Code 0543	No. 13, May 19, 1958
Fuel, refinery price	85.5	152.0	1,288.9	1,523.6	1,497.0	2,317.6	OGJ	No. 4, Mar. 17, 1958
Gulf cargoes	85.0	130.4	1,635.4	2,023.9	1,968.0	3,065.6	OGJ	No. 4, Mar. 17, 1958
NY barges	82.6	169.6	1,539.6	1,837.5	2,066.9	3,201.7	OGJ	No. 4, Mar. 17, 1958
Chicago low sulfur	—	—	1,478.4	1,765.8	2,046.7	3,132.4	OGJ	July 7, 1975
Western US	84.3	168.1	1,941.5	2,358.1	2,704.2	4,130.0	OGJ	No. 4, Mar. 17, 1958
Central US	60.2	128.1	1,274.0	1,765.9	1,886.9	2,617.2	OGJ	No. 4, Mar. 17, 1958
Natural gas at wellhead	83.5	190.3	7,010.6	6,306.5	6,118.7	9,511.6	Code 531-10-1	No. 4, Mar. 17, 1958
Inorganic chemicals	96.0	123.1	562.9	686.8	743.6	1,041.2	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	1,768.7	Code 1022-02-73	July 5, 1965, p. 117
Sodium carbonate	90.9	119.4	357.3	452.4	490.1	686.1	Code 613-01-03	No. 58, Oct. 12, 1959
Sodium hydroxide	95.5	136.2	529.6	620.1	671.6	940.1	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	967.1	Code 614	Oct. 5, 1964
Furfural	94.5	137.5	961.9	1,103.1	1,174.1	1,395.8	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	May 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	1,065.9	Employ & Earn	No. 41, Feb. 16, 1969
Productivity	97.2	197.0	501.1	497.5	483.4	482.1	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	2,410.6	Eng. News Record	No. 55, Nov. 3, 1949
Common labor	192.1	630.6	2,863.5	2,971.7	3,083.0	3,150.0	Eng. News Record	No. 55, Nov. 3, 1949
Refinery cost	183.3	545.9	2,411.6	2,497.8	2,601.4	2,669.4	OGJ	May 15, 1967
Equipment or materials (1946 = 100):								
Bubble tray	161.4	324.4	1,409.4	1,484.0	1,561.4	1,753.0	Computed	July 8, 1962, p. 113
Building materials (nonmetallic)	143.6	212.4	886.4	969.6	1,003.2	1,037.7	Code 13	No. 61, Dec. 15, 1949
Brick—building	144.7	252.5	1,301.7	1,408.6	1,429.1	1,425.3	Code 1342	No. 20, Mar. 3, 1949
Brick—fireclay	193.1	322.8	1,441.1	1,540.5	1,616.2	1,738.9	Code 135	May 30, 1955
Castings, iron	188.1	274.9	1,290.0	1,351.3	1,414.3	1,544.6	Code 1015	Apr. 1, 1963
Clay products (structural, etc.)	159.1	342.0	893.8	951.6	963.2	966.3	Code 134	No. 20, Mar. 3, 1949
Concrete ingredients	141.1	218.4	985.5	1,092.0	1,172.2	1,226.8	Code 132	No. 22, March 17, 1949
Concrete products	138.5	199.6	841.3	921.1	961.6	993.9	Code 133	Oct. 2, 1967, p. 112
Electrical machinery	159.9	216.3	513.6	520.2	517.3	515.0	Code 117	May 2, 1955
Motors and generators	157.7	211.0	839.2	880.3	917.1	953.6	Code 1173	May 2, 1955
Switchgear	171.2	271.0	1,090.0	1,147.3	1,212.2	1,239.2	Code 1175	May 2, 1955
Transformers	161.9	149.3	537.1	612.5	696.9	772.5	Code 1174	No. 31, May 19, 1949
Engines (combustion)	150.5	233.3	931.1	959.7	974.6	980.8	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	1,376.9	Computed	June 8, 1963, p. 133
Hand tools	173.8	346.5	1,722.1	1,792.5	1,830.6	1,888.2	Code 1042	June 27, 1955
Instruments (composite)	154.6	328.4	1,108.0	1,166.0	1,267.9	1,338.2	Computed	No. 34, June 9, 1949
Insulation (composite)	198.5	272.4	2,228.6	2,257.4	2,258.6	2,191.0	Manufacturer	July 4, 1988, p. 193
Lumber (composite):	197.8	353.4	1,359.6	1,309.8	1,204.1	1,171.7	Code 81	No. 7, Dec. 2, 1948
Southern pine	181.2	303.9	998.6	984.3	846.4	819.0	Code 81102	No. 7, Dec. 2, 1948
Redwood, all heart	238.0	310.6	2,057.9	1,948.1	1,744.3	1,687.9	Code 811-0332	July 5, 1965, p. 117
Machinery								
General purpose	159.9	278.5	1,163.6	1,213.7	1,271.8	1,320.9	Code 114	Feb. 17, 1949
Construction	165.9	324.4	1,499.2	1,559.7	1,594.4	1,627.9	Code 112	Apr. 1, 1968, p. 184
Oil field	161.9	269.1	1,454.8	1,599.1	1,715.8	1,854.1	Code 1191	Oct. 10, 1955
Paints—prepared	159.0	231.8	975.3	1,040.8	1,078.5	1,123.2	Code 621	May 16, 1955
Pipe								
Gray iron pressure	195.0	346.9	2,580.2	2,687.9	2,730.8	2,706.3	Code 1015-0239	Jan. 3, 1983
Standard carbon	182.7	319.9	2,217.3	2,306.9	2,299.2	2,849.0	Code 1017-0611	Jan. 3, 1983
Pumps, compressors, etc.	166.5	337.5	1,685.5	1,758.2	1,844.4	1,923.0	Code 1141	No. 29, May 5, 1949
Steel-mill products	187.1	330.6	1,409.1	1,527.5	1,620.0	2,034.6	Code 1017	Jan. 3, 1983
Alloy bars	198.7	349.4	1,146.8	1,311.8	1,239.7	1,528.1	Code 1017-0831	Apr. 1, 1963
Cold-rolled sheets	187.0	365.5	1,462.5	1,658.4	1,916.6	2,105.7	Code 1017-0711	Jan. 3, 1983
Alloy sheets	177.0	225.9	760.3	862.4	996.7	1,095.0	Code 1017-0733	Jan. 3, 1983
Stainless strip	169.0	221.2	811.6	920.7	1,064.2	1,168.9	Code 1017-0755	Jan. 3, 1983
Structural carbon, plates	193.4	386.7	1,654.5	1,766.6	1,945.3	2,475.0	Code 1017-0400	Jan. 3, 1983
Welded carbon tubing	180.0	265.5	2,246.8	2,337.3	2,329.6	2,886.2	Code 1017-0622	Jan. 3, 1983
Tanks and pressure vessels	147.3	246.4	974.4	1,014.3	1,076.4	1,153.0	Code 1072	No. 5, Nov. 18, 1949
Tube stills	123.0	125.3	540.5	579.9	612.0	727.7	Computed	Oct. 1, 1962
Valves and fittings	197.0	350.9	1,738.2	1,839.6	1,943.9	2,035.5	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	2,269.3	OGJ	May 15, 1969
Nelson-Farrar Refinery Operation								
(1956)	88.7	118.5	542.1	579.0	596.5	714.7	OGJ	No. 2, Mar. 3, 1958
Nelson-Farrar Refinery Process								
(1956)	88.4	147.0	787.2	870.7	872.6	1,211.8	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.

DEFECT ASSESSMENT—1

Modified equation aids integrity management

John F. Kiefner
Kiefner & Associates
Worthington, Ohio

A modified Ln-Sec equation should replace the original Ln-Sec equation for all grades of pipe through X80 with full-size Charpy energies of 15 ft-lb and higher. This first part of two articles reviews development of the original Ln-Sec equation and examines its shortcomings.

The concluding article (next week) will present a modified Ln-Sec equation and explain how it improves the original.

Background

Bill Maxey conceived the Ln-Sec equation, also known as the NG-18 Surface Flaw equation, at Battelle in the late 1960s while conducting research on failures in pressurized pipes and pipelines. He first developed a surface flaw equation empirically curve-fit to the results of burst tests on stainless steel nuclear power piping. He subsequently found that a theoretical equation developed by E.S. Folias satisfactorily accounted for the effect of axial flaw length in his empirical equation.[1]

In attempting to apply his surface flaw equation to carbon steel pipes such as those used in natural gas pipelines, Maxey found the Dugdale model for crack opening displacement in the form of an Ln-Secant function presented a reasonable means of correcting for reduced failure pressures associated with pipe materials of suboptimal toughness.

The Ln-Secant-corrected equation eventually became known as the NG-18 Surface Flaw equation because most validating full-scale pipe tests were sponsored by the NG-18 Line Pipe Research Committee of the American Gas Association (the forerunner of PRCI).

The Ln-Sec equation is still highly regarded as a method for predicting failure pressure for axially-oriented surface flaws in pipelines despite the development of other quite-satisfactory methods (PAFFC, CorLas, and API RP 579). The simplicity of the Ln-Sec equation and its validation by numerous full-scale experiments probably account for its continued use despite known limitations.

This article introduces a modification to the Ln-Sec equation eliminating the main limitation of the original equation: its tendency to underestimate failure pressures of long, shallow defects. The original equation had severe limits regarding remaining life predictions for crack-like defects in materials with suboptimal toughness. The modified version, however, satisfactorily overcomes this limitation, allowing it to be used with confidence for both remaining life assessments and failure stress predictions.

Equation 1 gives satisfactory predictions of failure stress for axial surface flaws in extremely tough materials such as stainless steel, and for blunt axial flaws in carbon steel materials such as corrosion-caused metal loss irrespective of toughness. It provides the basis for most equations used by the pipeline industry to evaluate the remaining strength of corroded pipe (B31G, Modified B31G, RSTRENG, API RP 579 Level I assessment for locally-thinned areas, and DNV RP F101).

Full-scale testing of line pipe materials containing crack-like flaws, however, showed that Equation 1 tended to overestimate the hoop stress at failure, especially for large-diameter pipe (24-42 in. OD). The degree of overestimation correlated with the Charpy V-notch upper shelf energies of the materials.

Equations

$$\frac{\sigma_{fs}}{\overline{\sigma}} = \frac{A_o - A}{Ao - A\left(\frac{1}{M_T}\right)} \quad (1)$$

$$\frac{12\frac{CVN}{A}E\pi}{8c\overline{\sigma}^2} = \left[\ln \sec\left(\frac{\pi M_T \sigma_{fs}}{2\overline{\sigma}}\right)\right] \quad (2)$$

$$M_T = \left(1 + 1.255\frac{c_2}{Rt} - 0.0135\frac{c^4}{R^2t^2}\right)^{\frac{1}{2}} \quad (3)$$

$$\frac{12\frac{CVN}{A_c}E\pi}{8c\overline{\sigma}^2} = \left[\ln \sec\left(\frac{\pi M_P \sigma_{fs}}{2\overline{\sigma}}\right)\right] \quad (4)$$

$$M_P = \left[\frac{1 - \left(\frac{A}{A_o}\right)\left(\frac{1}{M_T}\right)}{1 - \left(\frac{A}{A_o}\right)}\right] \quad (5)$$

where:

CVN = the upper shelf energy as determined from tests of Charpy V-notch impact specimens (ft-lb).

A_c = the cross-sectional area of the Charpy specimen used (sq in.)

(The constant 12 in Equations 2 and 4 reconciles mixed units where the Charpy impact energy is in ft-lb and all other terms are consistent with inch units. The constant 12 is not a fundamental part of the relationships given by Equations 2 and 4.)

$$\sigma_{fs} = \left(\frac{\overline{\sigma}}{M_P}\right)\left(\frac{2}{\pi}\right)\cos^{-1}(e^{-x}) \quad (6)$$

Where:

$$x = \left(\frac{12\frac{CVN}{A_c}E\pi}{8c\overline{\sigma}^2}\right)$$

$$\overline{\sigma} = \sigma_{YS} + 10{,}000\text{psi} \quad (7)$$

Original Ln-Sec

Acting on the observation that Equation 1 tended to give less and less accurate predictions as the level of Charpy energy of the material decreased, Maxey postulated Charpy upper-shelf energy should be proportional to the ductile fracture resistance of a material with suboptimal toughness. He showed the Charpy energy of a carbon steel pipe material to be roughly equal to the strain energy release rate of crack formation, G, which Irwin had shown to equal K_{Ic}^2/E, where K_{Ic} is the plane strain fracture toughness and E is the elastic modulus of the material.

Maxey further postulated Equation 1 could be corrected for materials that failed in a ductile manner but which exhibited suboptimal toughness by means of the Dugdale model.[2] The Dugdale model embodies a Ln-Secant functional representation of crack-tip opening displacement for a material exhibiting plastic strain at the tips of flaws before fracturing. Combining the concepts of Charpy energy, the Dugdale model, and Equation 1 yielded two failure criteria, one for through-wall flaws (Equations 2-3) and one for surface flaws (Equations 4-5).

Equation 6 shows σfs, the predicted hoop stress at failure for a surface flaw.

Maxey's review of full-scale test data showed the most appropriate value of flow stress for line pipe material as described by Equation 7.

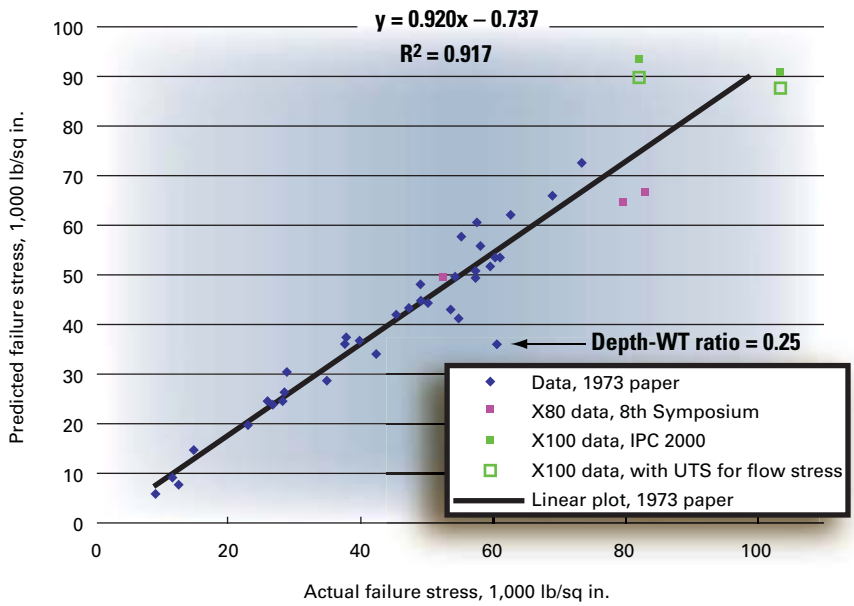
He also suggested a three-term Folias factor (Equation 3) be used as it is less conservative than the original Folias factor. Equations 2 and 4 became known as the Ln-Sec equations and are often also referred to as the NG-18 Surface Flaw equations.[3]

Validation for line pipe materials involved burst tests of 35 end-capped pipes containing longitudinally oriented uniform-depth V-shaped notches of various lengths and depth-to-thickness ratios.

The 35 materials' exhibited ⅔-size Charpy upper-shelf energy levels ranging from 10 ft-lb to 34 ft-lb (full-size equivalents of 15 ft-lb to 51 ft-lb).[3]

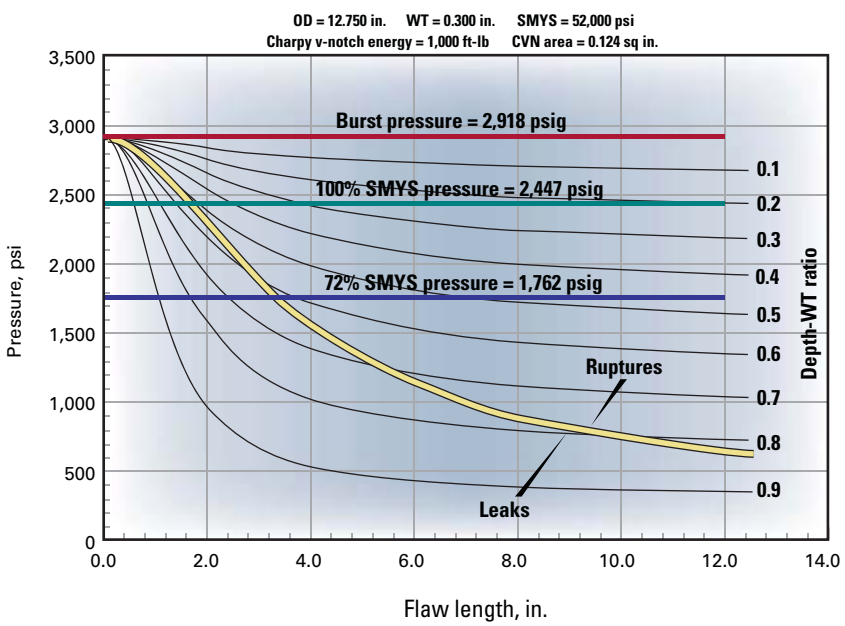
FAILURE PRESSURE COMPARISON, ORIGINAL LN-SEC EQUATION

Fig. 1



FAILURE VS. DEFECT SIZE, 1,000 FT-LB CHARPY ENERGY

Fig. 2

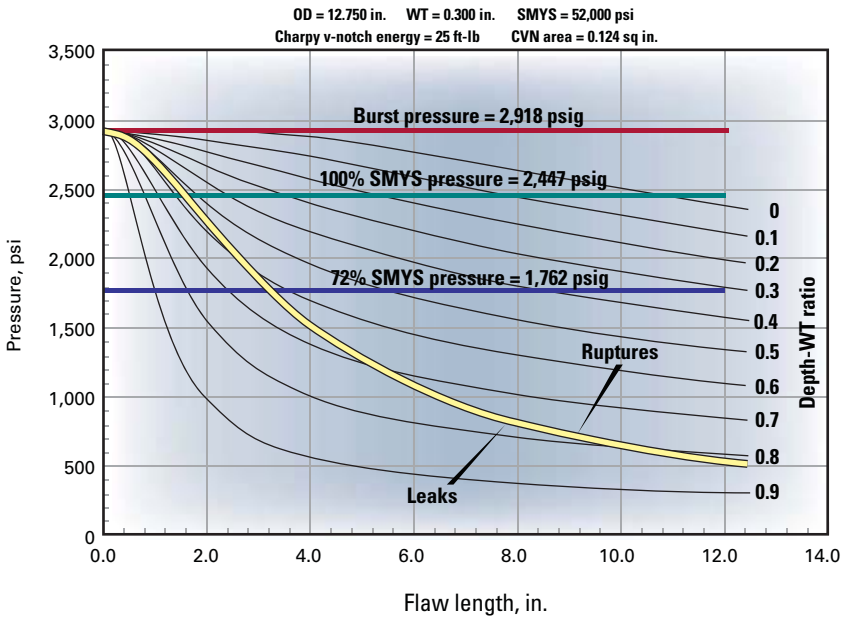


The material's grade ranged from X52 through X65, with actual yield strengths of 55,000-73,900 psi. Fig. 1 shows the correlation between predicted and actual failure pressures for the 35 experiments.

One experiment, with a notch-depth-to-WT ratio of 0.25, deserves particular attention due to its implications regarding use of the original Ln-Sec Equation with shallow defects. This was the only experiment in which the notch had such a low depth-WT ratio. The other experiments involved notches

FAILURE VS. DEFECT SIZE, 25 FT-LB CHARPY ENERGY

Fig. 3



with depth-WT ratios of 0.38-0.92. The failure pressure of the pipe with the 0.25-ratio flaw stands as an outlier (Fig. 1).

Regression fitting the data including this result yields an R^2 value of 0.92. Excluding the one shallow-flaw experiment, however, changes the R^2 to 0.96, suggesting the original Ln-Sec Equation tends to give excessively conservative predictions for failure stress of shallow flaws.

The lack of additional shallow-flaw results and early use of this equation for predicting failure pressure led this deficiency to be regarded as unimportant. Because of little interest in shallow flaws not posing an imminent threat to the integrity of a pipeline at normal operating stresses, the inaccuracy of the model for shallow flaws was not viewed as a detriment, nor did much incentive exist to perform expensive burst tests of pipe samples with shallow flaws.

shallow flaws becomes important,

the flaws surviving a hydrostatic test or remaining undetected by in-line inspection are relatively shallow. Equation 4 becomes particularly problematic in cases involving line pipe materials with suboptimal toughness.

Additional testing

Additional full-scale tests have followed publication of these data. Three tests conducted on X80 material[4] and two on X100 material[5] hold particular interest. The X80 data fit the original correlation but one of the X100 results does not.

The model overestimates the failure pressure for one of the X100 tests. The X100 test which appears to fit the trend involved a shallow-defect test (depth-WT = 0.2), prompting expectations the original Ln-Sec Equation would underestimate the failure pressure. At the 100,000-psi strength level, however, the use of yield strength plus 10,000 psi for flow stress was inappropriate and could have contributed to the unexpected result by causing the flow stress to be higher than the ultimate tensile strength of the material.

Even when replotted with ultimate tensile strength as flow stress, however, one point still lies above the trendline of the original data and the other would as well if not for representing a shallow-flaw experiment.

The nature of the shallow-flaw deficiency emerges most clearly by comparing Fig. 2 with Fig. 3. Fig. 2 shows rectangular surface flaws with depth-WT ratios of 0.1-0.9 for a 12.75-in. OD, 0.3-in. WT, X52 pipe material with 1,000 ft-lb or higher full-size Charpy V-notch upper shelf energy.

This level of Charpy energy stands well beyond any level expected for actual line pipe material, showing that, for a material of optimum toughness, failure pressure level for any given defect is independent of toughness, depending instead entirely on flow-stress, and therefore, predictable by means of Maxey's surface flaw equation (Equation 1). The inverse Ln-Secant correction for a 1,000 ft-lb material is essentially $\pi/2$, reducing Equation 6 to Equation 1.

Fig. 3 shows a set of curves for pipe material with the same geometry and same grade steel shown in Fig. 2 but exhibiting a full-size Charpy upper shelf energy of 25 ft-lb.

Predicted failure pressures for the 25 ft-lb material are in all cases less than those predicted for the 1,000 ft-lb material. The fact the depth-WT = 0 curve does not coincide with the burst pressure of a defect-free pipe (labeled burst pressure = 2,918 psig) makes Equation 4's problem clear.

Logic suggests the pipe should fail at its burst pressure for a zero-depth defect. The original Ln-Sec equation, however, allows correction for any

nonzero defect length even though the defect depth is zero. The lack of perceived threat from such deficiencies has allowed it to be largely ignored, despite general recognition of the original equation's limitations. Fig. 1 shows a good fit for experiments with depth-to-thickness ratios of 0.38 or more; defects that would pose a potential threat to the integrity of a pipeline at operating stress levels.

The original Ln-Sec equation gives conservative estimations of failure pressure, but its use with materials having suboptimal toughness can result in underestimation of the depths of defects that could survive such pressure, potentially leading to overestimation of remaining life in a remaining-life assessment.

Fig. 3 shows such a circumstance, suggesting an 11-in. long flaw with essentially zero depth would barely survive a hydrostatic test to 100% of SMYS and yielding the absurd conclusion that a test to 100% of SMYS ensures the pipe is free of defects longer than 11 in. In reality, however, the incorrectness of the shallow-flaw curves prevents use of the original Ln-Sec equation for remaining-life assessments of materials with less-than-optimum toughness. ✦

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The author

John F. Kiefner (jkiefner@columbus.rr.com) is a senior advisor at Kiefner & Associates, a firm he founded in 1990. Although officially retired, he still works part-time for the company. During his 40-year career, Kiefner has specialized in developing and using analytical methods for assessing pipeline integrity and in conducting research on pipeline material behavior and pipeline defects and repair methods. Kiefner received his BS and MS degrees in civil engineering from Purdue University in West Lafayette, Ind., and his PhD from the University of Illinois in Champaign-Urbana, Ill. He is a registered professional engineer in Ohio and a member of ASME.

Correction

In the article "Natural gas pipeline profits surge; oil flat," by Christopher E. Smith, Tables 4 and 7 (OGJ, Sept. 1, 2008, p. 58 and 62) contained errors. Below are corrected versions of the affected portions of each table. The corresponding data have also been updated in the OGJ Energy Database.

US PIPELINE COSTS, ESTIMATED

Table 4

Size, in.	Location[1]	Length, miles	$ Material	Labor	Misc.[2]	ROW & damages	Total	$/mile
Total projects—land		898.66	$939,860,184	$1,208,148,741	$752,538,319	$139,070,285	$3,039,617,529	$3,382,389
TOTAL—ALL PROJECTS		898.66	$939,860,184	$1,208,148,741	$752,538,319	$139,070,285	$3,039,617,529	$3,382,389

US PIPELINE COSTS: ESTIMATED VS. ACTUAL, 2007-08[1]

Table 7

Size, in.	Location[1]	Length, miles	$ Materials	Labor	Misc.[2]	ROW & damages	Total	$/mile
Subtotal offshore, miles Estimated		22.33	$19,636,632	$108,669,458	$66,128,710	$2,428,700	$196,863,500	$12,227,547
Total land and offshore, miles Estimated		1,019.73	$652,227,937	$701,406,438	$597,881,281	$106,653,794	$2,058,169,450	$2,030,955

Equipment/Software/Literature

New cable withstands downhole temperature to 300° C.

This new high performance SureSight fiber optic distributed temperature cable withstands extreme heat and operates in high temperature wellbore monitoring.

Cables withstand temperatures as high as 300° C., which are often experienced in steam assisted gravity drainage and cyclic steam injection wells in steamflood reservoirs. Cables have been designed and optimized with double ended measurement capabilities.

The company says that cable construction provides a number of benefits over the use of standard fiber optic technology. While multiple layers provide a pressure barrier to prevent damaging hydrogen ingress, the latest generation of optical fibers helps minimize the effects of hydrogen darkening with chemical composition and coatings.

The cable design means the integrity of the distributed temperature sensing system can be monitored during installation and information sourced on stimulant-frac fluid placement.

Source: **Sensornet,** Sensornet House, 340 Centennial Park, Elstree, Hertfordshire, WD6 3TJ, UK.

New high-speed refinery gas analyzers

Two new high-speed refinery gas analyzers incorporate special column sets to accommodate the use of hydrogen carrier gas to optimize throughput.

New Models 1117 and 1317 analyzers are based on the Clarus 600 gas chromatograph.

The Model 1117 is a three-channel system providing guaranteed analysis of helium, hydrogen, oxygen, nitrogen, CO_2, CO, H_2S, C_1 through C_5 hydrocarbons including olefins and C_5=, C_6+ composite in less than 7.5 min using two thermal conductivity detectors (TCD/TCD) and a flame ionization detector (FID).

The Model 1317, also a three-channel system, provides guaranteed gas sample analysis of helium, hydrogen, oxygen, nitrogen, CO_2, CO, H_2S, C_1 through C_5 hydrocarbons including olefins and C_5=, C_6+ composite in less than 7.5 min using two TCDs and an FID as well as the additional capability of sampling pressurized liquids through the use of a liquid sampling valve.

Source: **PerkinElmer Life & Analytical Sciences Inc.,** 940 Winter St., Waltham, MA 02451.

T.D. Williamson Inc.,

Tulsa, has promoted Bruce Binkley to president and CEO. Binkley replaces Dick Williamson, who has led the company for the past 16 years and who will continue as chairman of the board. Since 2005, Binkley has served as president and COO for TDW. Prior to that, he was senior vice-president and general manager of TDW's Western Hemisphere region. He has 29 years of experience in financial and operational management for companies such as Phillips Petroleum and Unit Rig & Equipment, including 21 years in various roles with TDW. He joined the TDW board on December 9, 2004. A CPA, Binkley also has a BBA from Harding University, a Master's in tax, and an MBA in international business from the University of Tulsa.


Binkley

TDW provides a wide range of integrity solutions to the global pipeline industry.

Acergy SA,

London, has been awarded a $60 million contract from BP Norge AS for the installation of 10 dynamic flexible riser systems, two dynamic umbilicals, and a direct electrical heating dynamic cable for BP's Skarv oil field development project off Norway. Installation is to begin in second half 2010.

Acergy is a seabed-to-surface engineering and construction contractor for the offshore oil and gas industry worldwide.

Expro,

Aberdeen, has won a contract from Talisman Energy (UK) Ltd. for slickline, well testing, and subsea landing string services on Talisman's platforms and modules. The 5-year contract is worth about £32 million. Expro will provide mechanical wireline intervention services; subsea safety systems, including its large bore landing strings; and drill stem testing well test and clean-up packages.

Expro is a market leader in providing services and products that measure, improve, control, and process flow from high-value oil and gas wells.

BJ Services,

Houston, has formalized its global shale technology team, a group of experts focused on the research, development, and delivery of technology solutions to customers operating in shale oil and gas reservoirs worldwide. This group will support BJ's regional teams currently in place in the US and Canada and add new technologies to the company's arsenal as they are identified. Randy LaFollette serves as BJ Services' manager of shale technology. The team, based at Tomball, Tex., comprises geological, geomechanical, and engineering services focused on understanding the reservoir stresses and rock-pore system properties before recommending a fit-for-purpose completion technique. The group works with regional teams in gathering data, performing field studies, and developing a network solutions to the challenges of shale oil and gas reservoirs. BJ Services' geological, geomechanical, and special core analysis laboratories are a critical part of this team. The laboratories are being expanded to include some of the most sophisticated reservoir characterization tools available and will provide a clearer understanding of the unique reservoir properties that ultimately drive completion optimization.


LaFollette

BJ Services is a leading provider of field development and production enhancement services to the energy industry.

AMEC PLC,

London, has been awarded a 5-year program management consultancy (PMC) contract by Zakum Development Co. (ZADCO) in Abu Dhabi. The reimbursable contract is estimated to be worth $75 million—the largest oil-related PMC contract ever awarded by ZADCO. AMEC will provide engineering, consultancy, and project management services extending from concept stage through front-end engineering design, design, construction, and commissioning of several projects on the multibillion-dollar Upper Zakum full field development program. The program began in 2007 and is expected to be completed by 2013. Among the projects in which AMEC will be involved are the replacement of the 60-km main subsea oil pipeline, expansion of onshore/offshore gas treatment facilities, development of the east and west areas of the field, and a major program of work to increase offshore crude production capacity from 500,000 b/d to 750,000 b/d.

AMEC supplies consultancy, engineering, and project management services to the world's energy, power, and process industries.

Tenaris,

Luxembourg, has announced plans to increase its production capacity for seamless pipe by installing a 450,000 ton/year small-diameter (up to 7 in.) rolling mill in Veracruz, Mexico. Cost of the mill, together with associated iron and steel making and finishing facilities, is pegged at $1.6 billion. Start-up is slated for 2011.

Tenaris is a leading global supplier of steel tubes and related services for the world's energy industry and certain other industrial applications.

Global Foresight Group,

Minneapolis, has named Peter Vincent senior consultant. He has more than 3 decades of experience in process instrumentation engineering, sales, marketing, and general management. Previously, Vincent was engineering manager at Rosemount and engineering director and sales and marketing director at Thermo Measurement. He will head up the effort to expand Global Foresight's ReMaP assessment program to the UK and ultimately the rest of Europe.


Vincent

Global Foresight Group provides management consulting and market research studies to the instrumentation and automation industries.

MAN Turbo AG,

Oberhausen, Germany, has agreed to acquire HB Turbo, a privately held turbomachinery service specialist with workshops in Deer Park and Corpus Christi, Tex., that

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caters to the oil and gas, chemical, and petrochemical industries in the US Gulf Coast region. Terms weren't disclosed.

HB Turbo provides repairs, revamps, and commissioning, as well as manufacture of spare parts for turbocompressors and steam and gas turbines.

MAN Turbo offers a comprehensive product line of compressors and turbines.

ITT Corp.,

Rochester, NY, has announced that Northern Natural Gas (NNG) has selected its Airborne Natural Gas Emission LIDAR (ANGEL) Services to perform pipeline leak surveys and corridor monitoring work in New Mexico, Texas, Wisconsin, Minnesota, Kansas, and Michigan. The contract also includes a new application of ITT's ANGEL Services: aerial leak surveys and mapping of NNG's 30,000-acre, 62 bcf Cunningham, Kan., storage field. Since 2006, ITT's ANGEL Services has flown and collected more than 3,000 miles of pipeline leak surveys and corridor mapping imagery for NNG, from the Permian basin in Texas to the upper Midwest. More than 30 unaccounted-for pipeline leaks and facility emissions have been detected, including multiple underground pipeline leaks. ITT's ANGEL Services utilizes differential absorption LIDAR laser technology to pinpoint otherwise undetected gas pipeline leaks.

ITT is a diversified high-technology engineering and manufacturing company dedicated to creating more livable environments, enabling communications, and providing protection and safety.

Rosen Group,

Stans, Switzerland, has appointed Daryl Ronsky general manager for Rosen Canada. He will be responsible for the overall success of Rosen Canada, which provides inspection and cleaning services, as well as asset integrity management support to the oil and gas industry. Ronsky has a strong background in engineering, consultancy, and pipeline integrity-related issues

Rosen provides integrity solutions to the oil and gas industry, including inspection, rehabilitation, and monitoring of pipelines, storage tanks, and plants.

Senscient Inc.,

League City, Tex., has elected John S. Filla chairman of the board. He has over 15 years of global experience in the field of instrumentation and controls, with a focus on health, safety, and environmental applications. Filla is also active in the funding, M&A activities, and management of several other early-stage companies where he provides guidance on a broad spectrum of strategic, financial, and operational matters. He has been involved with Senscient since participating in the company's 2006 Series A investment round and joining as an outside director. He has specified and sold fire and gas detection systems in the hydrocarbon processing and power industries throughout his career, which included assignments at companies such as Invensys and ABB.


Filla

Senscient was established in 2004 to develop, manufacture, and market advanced gas detection products for industrial safety, environmental monitoring, and process analysis applications.

Nalco Holding Co.,

Naperville, Ill., has formed a 50-50 joint venture with Stepan Co., Northfield, Ill., to globally market custom-engineered, integrated chemical enhanced oil and gas recovery technologies. Operating under the Tiorco brand, the JV provides an integrated sales and service channel that benefits from Nalco's extensive reach in global upstream energy markets, its recently acquired EOR polymer and reservoir expertise, and Stepan's global surfactant technology and manufacturing capabilities. Tiorco will also serve as a primary sales and engineering service channel for Nalco's BrightWater reservoir efficiency technology.

Nalco is a leading water treatment and process improvement company.

Stepan Company is a leading producer of specialty and intermediate chemicals used in industrial and other products.

KBC PLC,

London, has introduced an alternative fuels and feedstocks service to companies considering building or operating alternative fuel plants or utilizing alternative feedstocks. The service addresses the need to optimize designs and operations to maximize yields of high-value products, minimize energy consumption and carbon dioxide emissions, ensure reliability, and operate at optimum staffing levels using best practice systems, work processes, procedures, and tools.

KBC is a leading independent consulting, process engineering, and software group that delivers improved operating performance to the oil refining, petrochemical, and other process industries worldwide.

InterMoor Inc.,

Houston, has named Randy Mautz quality, health, safety, and environment (QHSE) director. Based at InterMoor's Houston office, Mautz has over 20 years of experience in quality management. He will be responsible for the coordination of all of InterMoor's QHSE issues worldwide. Prior to joining InterMoor, Mautz worked at HMT Inc. as general manager of quality programs. He also served as the QHSE manager for Vetco Gray Controls Inc., where he implemented corporate QHSE policies and procedures.


Mautz

In addition, InterMoor has appointed Chuck Fontenot quality assistance and quality control manager. Based in InterMoor's Amelia, La., office, he has 13 years of experience and will be responsible for the oversight of the day-to-day functioning of the company's US quality program. Previously, Fontenot worked as a corporate human resource representative at Gulf Island Fabrication.


Fontenot

InterMoor, an Acteon company, designs, provides, and installs integrated mooring systems worldwide for the offshore oil and gas industry. Acteon is a group of specialist engineering companies serving the global oil and gas industry.

Imports of crude and products

	Districts 1-4		District 5		Total US		
	9-12 2008	9-5 2008	9-12 2008	9-5 2008	9-12 2008	9-5 2008	*9-14 2007
	1,000 b/d						
Total motor gasoline	970	1,109	7	12	977	1,121	1,011
Mo. gas. blending comp.	628	837	7	12	635	849	663
Distillate	131	117	0	0	131	117	307
Residual	170	156	88	169	258	325	335
Jet fuel-kerosine	70	22	9	4	79	26	200
Propane-propylene	168	157	6	6	174	163	360
Other	615	67	(9)	140	606	207	268
Total products	**2,752**	**2,465**	**108**	**343**	**2,860**	**2,808**	**3,144**
Total crude	**6,766**	**7,981**	**1,744**	**600**	**8,510**	**8,581**	**9,805**
Total imports	**9,518**	**10,446**	**1,852**	**943**	**11,370**	**11,389**	**12,949**

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

Purvin & Gertz LNG netbacks—Sept. 19, 2008

Receiving terminal	Liquefaction plant					
	Algeria	Malaysia	Nigeria	Austr. NW Shelf	Qatar	Trinidad
	$/MMbtu					
Barcelona	10.13	7.69	9.14	7.56	8.40	9.05
Everett	6.41	4.28	5.99	4.35	4.69	6.75
Isle of Grain	12.27	11.56	11.46	11.72	10.61	11.49
Lake Charles	4.62	2.69	4.40	2.88	3.18	5.33
Sodegaura	9.44	12.12	9.69	11.75	10.89	8.67
Zeebrugge	11.37	8.83	10.58	8.71	9.51	10.59

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	13,387	46,388	27,301	9,335	49,499	13,369	4,522
PADD 2	58,511	48,559	18,493	7,706	29,949	1,389	22,596
PADD 3	155,461	57,884	28,269	11,467	34,103	16,395	25,806
PADD 4	14,500	6,136	1,920	542	2,937	303	[1]2,555
PADD 5	49,847	25,667	19,376	10,034	13,137	4,524	—
Sept. 12, 2008	**291,706**	**184,634**	**95,359**	**39,084**	**129,625**	**35,980**	**55,479**
Sept. 5, 2008	**298,034**	**187,942**	**96,054**	**39,815**	**130,460**	**36,695**	**54,451**
Sept. 14, 2007[2]	**318,775**	**190,834**	**85,809**	**41,602**	**135,527**	**37,115**	**58,066**

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

Refinery report—Sept. 12, 2008

District	Refinery operations		Refinery output				
	Gross inputs	Crude oil inputs	Total motor gasoline	Jet fuel, kerosine	Fuel oils		Propane-propylene
					Distillate	Residual	
	1,000 b/d						
PADD 1	1,418	1,422	2,111	84	488	109	60
PADD 2	3,202	3,161	2,270	207	907	51	205
PADD 3	5,716	5,433	2,256	493	1,647	176	560
PADD 4	535	535	252	31	171	12	[1]131
PADD 5	2,761	2,686	1,437	508	587	104	—
Sept. 12, 2008	**13,632**	**13,237**	**8,326**	**1,323**	**3,800**	**452**	**956**
Sept. 5, 2008	**13,783**	**13,483**	**8,398**	**1,410**	**3,921**	**520**	**935**
Sept. 14, 2007[2]	**15,627**	**15,357**	**9,070**	**1,435**	**4,105**	**700**	**1,020**
	17,610 Operable capacity		**77.4 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

	*9-19-08	*9-21-07	Change $/bbl	Change, %
SPOT PRICES				
Product value	116.90	91.48	25.42	27.8
Brent crude	92.42	77.88	14.54	18.7
Crack spread	24.47	13.60	10.87	79.9
FUTURES MARKET PRICES				
One month				
Product value	110.13	90.40	19.73	21.8
Light sweet crude	97.29	81.79	15.50	19.0
Crack spread	12.84	8.61	4.23	49.1
Six month				
Product value	109.65	90.00	19.65	21.8
Light sweet crude	97.46	77.51	19.95	25.7
Crack spread	12.19	12.49	–0.30	–2.4

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

OGJ GASOLINE PRICES

	Price ex tax 9-17-08	Pump price* 9-17-08	Pump price 9-19-07
	¢/gal		
(Approx. prices for self-service unleaded gasoline)			
Atlanta	324.4	368.8	277.3
Baltimore	330.8	372.7	267.5
Boston	327.2	369.1	264.5
Buffalo	304.3	363.9	280.5
Miami	314.1	365.7	297.7
Newark	325.8	358.7	261.9
New York	309.2	368.8	279.7
Norfolk	325.1	363.1	262.2
Philadelphia	320.4	371.1	277.0
Pittsburgh	317.0	367.7	276.5
Wash., DC	327.6	366.0	279.5
PAD I avg	320.6	366.9	274.9
Chicago	344.1	402.0	318.0
Cleveland	323.5	369.9	282.9
Des Moines	323.8	363.9	274.1
Detroit	319.1	373.5	306.5
Indianapolis	316.4	366.5	292.7
Kansas City	328.5	364.5	281.4
Louisville	339.0	375.9	294.2
Memphis	321.1	360.9	262.1
Milwaukee	321.6	372.9	300.8
Minn.-St. Paul	328.5	368.9	293.1
Oklahoma City	321.9	357.3	279.8
Omaha	323.6	365.9	280.1
St. Louis	325.5	361.5	265.0
Tulsa	320.4	355.8	277.8
Wichita	315.1	358.5	274.6
PAD II avg	324.8	367.9	285.6
Albuquerque	326.5	362.9	276.1
Birmingham	323.0	361.6	266.4
Dallas-Fort Worth	310.9	349.3	265.4
Houston	326.6	365.0	271.7
Little Rock	322.4	362.6	267.7
New Orleans	330.5	368.9	272.3
San Antonio	325.2	363.6	266.4
PAD III avg	323.6	362.0	269.4
Cheyenne	320.4	352.8	279.3
Denver	345.0	385.4	287.0
Salt Lake City	327.9	370.8	284.4
PAD IV avg	331.1	369.7	283.6
Los Angeles	313.9	377.8	276.6
Phoenix	321.9	359.3	285.7
Portland	320.3	363.7	284.6
San Diego	321.2	385.1	288.0
San Francisco	329.7	393.6	284.1
Seattle	315.6	370.0	280.7
PAD V avg	320.4	374.9	283.3
Week's avg.	**323.3**	**367.8**	**279.6**
Aug. avg.	**330.8**	**375.3**	**280.8**
July avg.	**361.3**	**405.7**	**295.2**
2008 to date	**310.1**	**354.0**	—
2007 to date	**229.3**	**272.9**	—

*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

	9-12-08 ¢/gal		9-12-08 ¢/gal
Spot market product prices			
Motor gasoline (Conventional-regular)		Heating oil No. 2	
New York Harbor	326.25	New York Harbor	291.81
Gulf Coast	487.25	Gulf Coast	293.68
Los Angeles	309.13	Gas oil	
Amsterdam-Rotterdam-Antwerp (ARA)	280.45	ARA	300.26
Singapore	261.10	Singapore	282.48
Motor gasoline (Reformulated-regular)		Residual fuel oil	
New York Harbor	323.75	New York Harbor	192.93
Gulf Coast	487.25	Gulf Coast	205.07
Los Angeles	315.13	Los Angeles	252.53
		ARA	208.10
		Singapore	213.98

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

BAKER HUGHES RIG COUNT

	9-19-08	9-21-07
Alabama	5	3
Alaska	11	5
Arkansas	59	48
California	47	36
Land	46	35
Offshore	1	1
Colorado	116	114
Florida	3	0
Illinois	0	1
Indiana	2	1
Kansas	10	15
Kentucky	12	11
Louisiana	191	164
N. Land	89	61
S. Inland waters	21	25
S. Land	25	26
Offshore	56	52
Maryland	0	1
Michigan	2	1
Mississippi	17	11
Montana	10	13
Nebraska	0	0
New Mexico	91	72
New York	7	6
North Dakota	73	44
Ohio	10	15
Oklahoma	211	194
Pennsylvania	27	16
South Dakota	1	2
Texas	947	832
Offshore	11	6
Inland waters	0	0
Dist. 1	27	26
Dist. 2	35	32
Dist. 3	59	56
Dist. 4	93	85
Dist. 5	185	186
Dist. 6	135	116
Dist. 7B	29	38
Dist. 7C	71	59
Dist. 8	130	115
Dist. 8A	29	18
Dist. 9	43	38
Dist. 10	100	57
Utah	42	41
West Virginia	28	33
Wyoming	83	79
Others—NV-3; OR-1; TN-2; VA-6; WA-1	13	11
Total US	**2,018**	**1,769**
Total Canada	**425**	**359**
Grand total	**2,443**	**2,128**
Oil rigs	417	305
Gas rigs	1,589	1,458
Total offshore	74	60
Total cum. avg. YTD	**1,871**	**1,760**

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	9-19-08 Percent footage*	Rig count	9-21-07 Percent footage*
0-2,500	93	3.2	60	8.3
2,501-5,000	123	52.0	107	62.6
5,001-7,500	275	16.7	223	21.5
7,501-10,000	466	2.1	412	3.8
10,001-12,500	445	1.5	433	2.3
12,501-15,000	352	—	284	0.7
15,001-17,500	141	—	108	—
17,501-20,000	84	—	64	—
20,001-over	22	—	35	—
Total	**2,001**	**6.4**	**1,726**	**8.5**
INLAND	16		38	
LAND	1,970		1,634	
OFFSHORE	15		54	

*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]9-19-08	[2]9-21-07
	1,000 b/d	
(Crude oil and lease condensate)		
Alabama	19	21
Alaska	668	634
California	643	666
Colorado	63	66
Florida	5	6
Illinois	26	27
Kansas	105	104
Louisiana	395	1,162
Michigan	14	14
Mississippi	56	58
Montana	95	94
New Mexico	160	158
North Dakota	126	126
Oklahoma	170	171
Texas	1,163	1,321
Utah	53	54
Wyoming	149	149
All others	62	73
Total	**3,972**	**4,904**

[1]OGJ estimate. [2]Revised.
Source: Oil & Gas Journal.
Data available in OGJ Online Research Center.

US CRUDE PRICES

	9-19-08 $/bbl*
Alaska-North Slope 27°	129.55
South Louisiana Sweet	107.00
California-Kern River 13°	91.75
Lost Hills 30°	100.20
Wyoming Sweet	90.55
East Texas Sweet	100.50
West Texas Sour 34°	93.50
West Texas Intermediate	101.00
Oklahoma Sweet	101.00
Texas Upper Gulf Coast	97.50
Michigan Sour	94.00
Kansas Common	100.00
North Dakota Sweet	91.50

*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]	9-12-08
United Kingdom-Brent 38°	101.61
Russia-Urals 32°	97.76
Saudi Light 34°	97.08
Dubai Fateh 32°	98.91
Algeria Saharan 44°	101.34
Nigeria-Bonny Light 37°	103.87
Indonesia-Minas 34°	103.75
Venezuela-Tia Juana Light 31°	99.74
Mexico-Isthmus 33°	99.63
OPEC basket	100.62
Total OPEC[2]	98.62
Total non-OPEC[2]	98.41
Total world[2]	98.53
US imports[3]	96.46

[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]

	9-12-08	9-5-08	9-12-07	Change, %
	bcf			
Producing region	802	795	931	–13.9
Consuming region east	1,771	1,723	1,787	–0.9
Consuming region west	399	387	414	–3.6
Total US	**2,972**	**2,905**	**3,132**	**–5.1**
	June 08	**June 07**	**Change, %**	
Total US[2]	**2,171**	**2,580**	**–15.9**	

[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		
	9-19 2008	9-12 2008	9-19 2008	9-12 2008	9-19 2008	9-12 2008	*9-21 2007
	1,000 b/d						
Total motor gasoline	1,211	970	0	7	1,211	977	1,052
Mo. gas. blending comp.	766	628	0	7	766	635	549
Distillate	199	131	0	0	199	131	314
Residual	352	170	88	88	440	258	348
Jet fuel-kerosine	59	70	9	9	68	79	268
Propane-propylene	241	168	17	6	258	174	167
Other	293	615	129	(9)	422	606	623
Total products	**3,121**	**2,752**	**243**	**108**	**3,364**	**2,860**	**3,321**
Total crude	**5,956**	**6,766**	**1,187**	**1,744**	**7,143**	**8,510**	**10,442**
Total imports	**9,077**	**9,518**	**1,430**	**1,852**	**10,507**	**11,370**	**13,763**

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

Purvin & Gertz LNG netbacks—Sept. 26, 2008

Receiving terminal	Liquefaction plant					
	Algeria	Malaysia	Nigeria	Austr. NW Shelf	Qatar	Trinidad
	$/MMbtu					
Barcelona	10.13	7.71	9.15	8.30	8.41	9.06
Everett	6.70	4.53	6.28	4.59	5.18	7.04
Isle of Grain	12.17	12.83	11.77	12.70	12.72	11.58
Lake Charles	5.00	2.92	4.78	3.12	3.45	5.63
Sodegaura	9.74	12.12	9.99	11.76	10.90	8.88
Zeebrugge	11.37	8.90	10.62	8.76	9.59	10.62

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	12,764	44,803	26,187	8,057	48,086	13,011	4,569
PADD 2	58,867	47,134	18,274	7,223	29,102	1,432	22,988
PADD 3	152,336	54,657	25,999	11,410	33,117	16,432	25,472
PADD 4	14,261	6,245	2,111	528	2,914	305	[1]2,586
PADD 5	51,958	25,900	20,228	9,869	12,230	4,433	—
Sept. 19, 2008	**290,186**	**178,739**	**92,799**	**37,087**	**125,449**	**35,613**	**55,615**
Sept. 12, 2008	**291,706**	**184,634**	**95,359**	**39,084**	**129,625**	**35,980**	**55,526**
Sept. 21, 2007[2]	**320,617**	**191,366**	**87,321**	**41,751**	**137,060**	**37,960**	**58,912**

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

Refinery report—Sept. 19, 2008

District	REFINERY OPERATIONS		REFINERY OUTPUT				
	Gross inputs	Crude oil inputs	Total motor gasoline	Jet fuel, kerosine	Fuel oils		Propane-propylene
					Distillate	Residual	
	1,000 b/d						
PADD 1	1,512	1,515	2,093	96	436	108	58
PADD 2	3,279	3,252	2,398	220	962	50	199
PADD 3	3,616	3,468	1,802	310	1,097	89	195
PADD 4	544	541	265	23	175	10	[1]133
PADD 5	2,796	2,728	1,396	503	588	135	—
Sept. 19, 2008	**11,747**	**11,504**	**7,954**	**1,152**	**3,258**	**392**	**585**
Sept. 12, 2008	**13,632**	**13,237**	**8,326**	**1,323**	**3,800**	**452**	**956**
Sept. 21, 2007[2]	**15,165**	**15,018**	**8,722**	**1,372**	**4,131**	**664**	**999**
	17,610 Operable capacity		**66.7 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.

OGJ crack spread

	*9-26-08	*9-28-07	Change $/bbl	Change, %
SPOT PRICES				
Product value	117.70	90.15	27.55	30.6
Brent crude	103.17	78.27	24.90	31.8
Crack spread	14.53	11.88	2.65	22.3
FUTURES MARKET PRICES				
One month				
Product value	117.46	89.21	28.25	31.7
Light sweet crude	107.32	81.06	26.26	32.4
Crack spread	10.13	8.15	1.99	24.4
Six month				
Product value	118.70	89.91	28.78	32.0
Light sweet crude	106.70	77.64	29.06	37.4
Crack spread	12.00	12.27	–0.27	–2.2

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

OGJ GASOLINE PRICES

	Price ex tax 9-24-08	Pump price* 9-24-08	Pump price 9-26-07
	¢/gal		
(Approx. prices for self-service unleaded gasoline)			
Atlanta	325.8	370.2	278.4
Baltimore	332.3	374.2	267.1
Boston	328.4	370.3	264.1
Buffalo	305.6	365.2	280.1
Miami	315.6	367.2	299.2
Newark	327.3	360.2	261.2
New York	310.6	370.2	279.2
Norfolk	326.3	364.3	262.0
Philadelphia	321.6	372.3	276.3
Pittsburgh	318.5	369.2	276.1
Wash., DC	328.9	367.3	279.1
PAD I avg	321.9	368.2	274.8
Chicago	346.7	404.6	264.4
Cleveland	327.5	373.9	215.5
Des Moines	327.8	367.9	204.6
Detroit	320.7	375.1	226.6
Indianapolis	319.3	369.4	216.5
Kansas City	332.8	368.8	212.7
Louisville	343.7	380.6	209.6
Memphis	324.4	364.2	228.5
Milwaukee	323.6	374.9	246.5
Minn.-St. Paul	331.8	372.2	222.7
Oklahoma City	324.3	359.7	210.6
Omaha	324.9	367.2	221.4
St. Louis	328.4	364.4	222.9
Tulsa	323.8	359.2	208.6
Wichita	318.7	362.1	215.6
PAD II avg	327.9	371.0	221.8
Albuquerque	327.8	364.2	237.8
Birmingham	323.9	362.5	214.1
Dallas-Fort Worth	312.0	350.4	209.3
Houston	333.9	372.3	213.2
Little Rock	323.9	364.1	217.1
New Orleans	333.2	371.6	239.1
San Antonio	327.4	365.8	232.4
PAD III avg	326.0	364.4	223.3
Cheyenne	319.1	351.5	251.3
Denver	344.0	384.4	262.8
Salt Lake City	324.6	367.5	272.2
PAD IV avg	329.3	367.8	262.1
Los Angeles	309.3	373.2	264.0
Phoenix	319.6	357.0	236.4
Portland	318.4	361.8	263.7
San Diego	318.4	382.3	267.9
San Francisco	327.2	391.1	279.2
Seattle	312.9	367.3	273.5
PAD V avg	317.6	372.1	264.1
Week's avg.	**324.6**	**369.1**	**238.2**
Sept. avg.	**322.7**	**367.2**	**253.3**
Aug. avg.	**330.8**	**375.3**	**296.7**
2008 to date	**310.4**	**354.4**	—
2007 to date	**229.5**	**273.1**	—

*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

	9-19-08 ¢/gal		9-19-08 ¢/gal
Spot market product prices			
Motor gasoline (Conventional-regular)		Heating oil No. 2	
New York Harbor	269.00	New York Harbor	286.61
Gulf Coast	279.00	Gulf Coast	289.61
Los Angeles	274.00	Gas oil	
Amsterdam-Rotterdam-Antwerp (ARA)	240.79	ARA	301.06
Singapore	245.60	Singapore	274.62
Motor gasoline (Reformulated-regular)		Residual fuel oil	
New York Harbor	266.00	New York Harbor	191.74
Gulf Coast	469.00	Gulf Coast	206.48
Los Angeles	280.00	Los Angeles	241.22
		ARA	205.29
		Singapore	202.16

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

BAKER HUGHES RIG COUNT

	9-26-08	9-28-07
Alabama	5	6
Alaska	11	5
Arkansas	59	49
California	47	34
Land	46	33
Offshore	1	1
Colorado	109	119
Florida	3	0
Illinois	1	0
Indiana	2	2
Kansas	12	14
Kentucky	12	11
Louisiana	176	154
N. Land	85	60
S. Inland waters	14	25
S. Land	26	26
Offshore	51	43
Maryland	0	1
Michigan	2	1
Mississippi	16	11
Montana	10	13
Nebraska	0	0
New Mexico	91	69
New York	8	7
North Dakota	75	44
Ohio	10	13
Oklahoma	202	194
Pennsylvania	27	16
South Dakota	2	1
Texas	950	830
Offshore	11	5
Inland waters	0	1
Dist. 1	25	26
Dist. 2	38	32
Dist. 3	61	57
Dist. 4	87	86
Dist. 5	189	179
Dist. 6	141	118
Dist. 7B	30	35
Dist. 7C	69	58
Dist. 8	129	113
Dist. 8A	26	19
Dist. 9	44	37
Dist. 10	100	64
Utah	43	44
West Virginia	28	33
Wyoming	80	78
Others—NV-4; OR-1; TN-2; VA-6; WA-1	14	11
Total US	**1,995**	**1,760**
Total Canada	**465**	**347**
Grand total	**2,460**	**2,107**
Oil rigs	423	311
Gas rigs	1,559	1,443
Total offshore	69	50
Total cum. avg. YTD	**1,871**	**1,760**

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	9-26-08 Percent footage*	Rig count	9-28-07 Percent footage*
0-2,500	93	6.4	60	8.3
2,501-5,000	131	48.8	103	62.1
5,001-7,500	270	16.6	223	22.4
7,501-10,000	485	2.4	427	3.2
10,001-12,500	441	1.5	429	2.3
12,501-15,000	361	—	273	—
15,001-17,500	153	—	113	—
17,501-20,000	88	—	66	—
20,001-over	28	—	34	—
Total	**2,050**	**6.5**	**1,728**	**8.2**
INLAND	16		38	
LAND	1,970		1,634	
OFFSHORE	15		54	

*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]9-26-08	[2]9-28-07
	1,000 b/d	
(Crude oil and lease condensate)		
Alabama	19	21
Alaska	665	642
California	640	657
Colorado	63	66
Florida	5	6
Illinois	26	27
Kansas	104	102
Louisiana	723	1,147
Michigan	15	14
Mississippi	56	58
Montana	94	94
New Mexico	160	158
North Dakota	124	127
Oklahoma	169	171
Texas	1,189	1,319
Utah	52	54
Wyoming	147	149
All others	61	72
Total	**4,312**	**4,884**

[1]OGJ estimate. [2]Revised.
Source: Oil & Gas Journal.
Data available in OGJ Online Research Center.

US CRUDE PRICES

	9-26-08 $/bbl*
Alaska-North Slope 27°	129.55
South Louisiana Sweet	109.50
California-Kern River 13°	94.00
Lost Hills 30°	102.55
Wyoming Sweet	92.89
East Texas Sweet	103.00
West Texas Sour 34°	96.00
West Texas Intermediate	103.50
Oklahoma Sweet	103.50
Texas Upper Gulf Coast	100.00
Michigan Sour	96.50
Kansas Common	102.25
North Dakota Sweet	93.75

*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]	9-19-08
United Kingdom-Brent 38°	92.89
Russia-Urals 32°	89.38
Saudi Light 34°	89.08
Dubai Fateh 32°	89.62
Algeria Saharan 44°	92.44
Nigeria-Bonny Light 37°	95.43
Indonesia-Minas 34°	94.14
Venezuela-Tia Juana Light 31°	92.53
Mexico-Isthmus 33°	92.42
OPEC basket	92.24
Total OPEC[2]	90.21
Total non-OPEC[2]	90.41
Total world[2]	90.30
US imports[3]	88.73

[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]

	9-19-08	9-12-08	9-19-07	Change, %
	bcf			
Producing region	808	802	945	–14.5
Consuming region east	1,804	1,771	1,818	–0.8
Consuming region west	411	399	421	–2.4
Total US	**3,023**	**2,972**	**3,184**	**–5.1**
	July 08	**July 07**	**Change, %**	
Total US[2]	**2,516**	**2,894**	**–13.1**	

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

PACE REFINING MARGINS

	July 2008	Aug. 2008	Sept. 2008	Sept. 2007	Change	Change, %
	$/bbl					
US Gulf Coast						
West Texas Sour	10.03	10.75	13.73	13.12	0.61	4.7
Composite US Gulf Refinery	14.05	9.96	11.41	13.13	–1.72	–13.1
Arabian Light	6.84	8.58	6.95	10.86	–3.92	–36.0
Bonny Light	0.52	5.12	4.19	7.24	–3.05	–42.1
US PADD II						
Chicago (WTI)	8.68	14.82	20.54	15.64	4.90	31.3
US East Coast						
NY Harbor (Arab Med)	12.26	11.96	8.79	7.50	1.28	17.1
East Coast Comp–RFG	8.22	10.84	10.51	10.08	0.43	4.3
US West Coast						
Los Angeles (ANS)	7.31	9.20	16.35	9.26	7.09	76.6
NW Europe						
Rotterdam (Brent)	2.17	4.93	8.98	4.89	4.09	83.7
Mediterranean						
Italy (Urals)	3.66	4.10	10.46	5.42	5.04	92.9
Far East						
Singapore (Dubai)	2.26	–1.19	4.37	2.60	1.77	68.1

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

US NATURAL GAS BALANCE DEMAND/SUPPLY SCOREBOARD

	July 2008	June 2008	July 2007	July 2008–2007 change	Total YTD 2008	Total YTD 2007	YTD 2008–2007 change
	bcf						
DEMAND							
Consumption	1,773	1,593	1,662	111	14,225	13,681	544
Addition to storage	430	420	397	33	1,858	1,934	–76
Exports	64	65	71	–7	602	443	159
Canada	29	30	38	–9	348	261	87
Mexico	30	30	29	1	227	153	74
LNG	5	5	4	1	27	29	–2
Total demand	**2,267**	**2,078**	**2,130**	**137**	**16,685**	**16,058**	**627**
SUPPLY							
Production (dry gas)	1,785	1,715	1,643	142	11,994	11,033	961
Supplemental gas	4	5	5	–1	29	37	–8
Storage withdrawal	88	80	84	4	2,221	2,116	105
Imports	313	283	418	–105	2,285	2,734	–449
Canada	282	247	315	–33	2,081	2,133	–52
Mexico	NA	3	5	–5	NA	39	–39
LNG	31	33	98	–67	204	562	–358
Total supply	**2,190**	**2,083**	**2,150**	**40**	**16,529**	**15,920**	**609**

NATURAL GAS IN UNDERGROUND STORAGE

	July 2008	June 2008	May 2008	July 2007	Change
	bcf				
Base gas	4,228	4,230	4,226	4,229	–1
Working gas	2,516	2,171	1,836	2,894	–378
Total gas	**6,744**	**6,401**	**6,062**	**7,123**	**–379**

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

WORLDWIDE NGL PRODUCTION

	June 2008	May 2008	6 month average Production 2008	6 month average Production 2007	Change vs. previous year Volume	Change vs. previous year %
			1,000 b/d			
Brazil	87	86	87	84	3	3.4
Canada	580	630	661	704	–43	–6.1
Mexico	372	371	369	414	–45	–10.8
United States	1,810	1,908	1,843	1,742	101	5.8
Venezuela	200	200	200	200	—	—
Other Western Hemisphere	201	189	198	206	–8	–3.6
Western Hemisphere	**3,249**	**3,384**	**3,358**	**3,349**	**8**	**0.3**
Norway	270	305	292	291	1	0.3
United Kingdom	171	175	177	154	23	14.7
Other Western Europe	10	10	10	10	—	1.4
Western Europe	**451**	**490**	**479**	**455**	**24**	**5.2**
Russia	423	419	420	426	–6	–1.3
Other FSU	150	150	150	160	–10	–6.3
Other Eastern Europe	15	15	16	15	—	2.2
Eastern Europe	**588**	**584**	**586**	**601**	**–15**	**–2.5**
Algeria	358	356	354	340	14	4.1
Egypt	70	70	70	70	—	—
Libya	80	80	80	80	—	—
Other Africa	127	126	130	127	4	3.1
Africa	**635**	**632**	**634**	**617**	**18**	**2.9**
Saudi Arabia	1,440	1,440	1,440	1,440	—	—
United Arab Emirates	250	250	250	250	—	—
Other Middle East	880	880	877	870	7	0.8
Middle East	**2,570**	**2,570**	**2,567**	**2,560**	**7**	**0.3**
Australia	71	68	63	74	–10	–14.0
China	620	620	620	612	8	1.4
India	0	0	0	6	–6	–100.0
Other Asia-Pacific	175	179	179	179	—	—
Asia-Pacific	**866**	**867**	**862**	**871**	**–8**	**–1.0**
TOTAL WORLD	**8,360**	**8,526**	**8,487**	**8,453**	**33**	**0.4**

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

OXYGENATES

	July 2008	June 2008	Change	YTD 2008	YTD 2007	Change
			1,000 bbl			
Fuel ethanol						
Production	19,042	17,544	1,498	120,227	84,201	36,026
Stocks	13,186	12,304	882	13,186	9,696	3,490
MTBE						
Production	1,671	1,501	170	11,169	13,639	–2,470
Stocks	1,252	1,456	–204	1,252	1,480	–228

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

US COOLING DEGREE–DAYS

	Aug. 2008	Aug. 2007	Normal	2008 % change from normal	Total degree–days Jan. 1 through Aug. 31 2008	2007	Normal	% change from normal
New England	85	172	146	–41.8	440	474	395	11.4
Middle Atlantic	154	245	205	–24.9	650	696	592	9.8
East North Central	163	281	197	–17.3	579	745	641	–9.7
West North Central	220	344	255	–13.7	721	959	828	–12.9
South Atlantic	389	504	393	–1.0	1,596	1,663	1,498	6.5
East South Central	361	562	376	–4.0	1,325	1,562	1,277	3.8
West South Central	509	571	527	–3.4	2,036	1,905	1,930	5.5
Mountain	315	371	302	4.3	1,063	1,262	1,017	4.5
Pacific	263	261	193	36.3	716	667	538	33.1
US average*	**280**	**368**	**290**	**–3.4**	**1,042**	**111**	**987**	**5.6**

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

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JOINT VENTURE

Joint Venture «Asia Trans Gas» Limited Liability Company calls for Tender on the SCADA & TELECOMMUNICATION Systems for Uzbekistan – China Gas Pipeline Project:

The Uzbekistan-China Gas Pipeline Project (UCGP), which is a part of the Central Asia Gas Pipeline project, begins from the border of Uzbekistan and Turkmenistan, and terminates at the border of Uzbekistan and Kazakhstan. The total length of the trunk line is 490km. The pipeline has double line which is laid in parallel, with diameter of 1067mm (X70) and pressure of 9.81MPa. There are 33 valve chambers and 3 compression stations and 2 metering stations.

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- The key parameters of such projects are defined as: Contract value not less than US$ 20 million. A length in a remote location of at least 300km Involvement of high-speed Communication (Gigabit Ethernet: SDH) via FOC and satellite backup communication. Providing local and remote operation of no less than five stations.
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Federal rules don't align with private sector's courtesies

The inspector general's report that's knocking over desks at the US Minerals Management Service recalls for this writer an encounter years ago with a petroleum engineer employed by the Department of Energy.

In a hotel grill between the end of a conference and flights home, an Oil & Gas Journal colleague and I saw the engineer, whom we both knew, and invited him to

The Editor's Perspective

by Bob Tippee, Editor

join us for lunch. He did.

When I reached for the check, the engineer insisted on paying for his hamburger and coffee. Rules, he explained.

The lesson: Federal rules don't always align with the private sector's standard courtesies.

Oil company employees need to remember that.

The report of Department of the Interior Inspector General Earl E. Devaney is devastating on many fronts (OGJ Online, Sept. 12 and Sept. 18, 2008). One former MMS employee already has pled guilty to a criminal charge. Other employees named in Devaney's report must be having night sweats.

The oil industry, meanwhile, looks complicit in corruption.

"The whole sordid affair shows how much sway Big Oil holds over the government," said Bill Nelson (D-Fla.) while introducing legislation specifying how government officials should behave with the oil and gas business.

In fact, Devaney's report reads differently from Nelson's interpretation. It details many instances in which four companies—Chevron, Shell, Hess, and Gary Williams Energy Co.—treated officials of the MMS Royalty-in-Kind (RIK) Program as they would private business associates.

The IG report says company representatives bought the RIK officials occasional meals and drinks and included them in appreciation dinners and golf, ski, and paintball outings. As business behavior, none of that sounds illicit. But the RIK officials don't work for business.

The government says federal employees shouldn't accept gifts worth more than $20 apiece or totaling $50 in any given year.

Apparently, the company and RIK officials targeted in Devaney's report thought those rules didn't apply or chose to ignore them.

And the oil industry has a political problem likely to cost much more than the few thousand dollars four companies spent showing MMS marketers that they appreciated their business.

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

Market Journal

by Sam Fletcher, Senior Writer

Record spike in crude price

On its last day of trade Sept. 22, the October contract for benchmark US light, sweet crudes shot up $16.37 to $120.92/bbl in the largest 1-day price jump ever on the New York Mercantile Exchange, prompting an investigation by the Commodity Futures Trading Commission.

Stephen J. Obie, acting director of CFTC's enforcement division, promised his staff would "scour" trading activity for that day in search of illegal manipulative activity. CFTC can compel testimony under oath and subpoena oil market records, including recent trading. But some traders blamed the spike on an unidentified large oil company scrambling to cover its short positions. Analysts in the Houston office of Raymond James & Associates Inc. said, "Traders that were short oil were desperately trying to unwind positions or find physical oil before the October crude futures contract expired."

Olivier Jakob at Petromatrix, Zug, Switzerland, described it as "the largest squeeze ever" on a front-month contract. "It does raise a few question marks as to what has really happened to the West Texas Intermediate delivery mechanism," he said. Prior to the contract's expiration, he said, "Open interest was absolutely in line with previous months, so it was not the case of too large a position going into the last day of trading."

He earlier pointed out "abnormal trading patterns" of "a $4.30/bbl rally in the last 10 minutes" of the Sept. 19 NYMEX session and a $14.74/bbl difference between bottom and top intraday prices Sept. 15-19. "Open interest in WTI futures has been in a declining trend since last year," Jakob said. The price spike surpassed the previous 1-day price-gain record of $10.75/bbl on June 6. The highest percentage rise in price in a single day was 20.9% Jan. 3, 1994. The front-month November crude contract lost $3.64/bbl over the next two sessions, then regained $2.29 to $108.02/bbl Sept. 25. It closed at $106.89/bbl Sept. 26 amid uncertainties about the international economy, the US dollar, and world demand for energy through next year. Despite strong price fluctuations over that period, the November contract for benchmark crude finished the week $4.14/bbl higher than it started.

Bailout package

Treasury Secretary Henry Paulson and Federal Reserve Chairman Ben Bernanke met Sept. 18 with House and Senate leaders to recommend a $700 billion capital injection to purchase bad mortgage debt from financial companies. A favorable vote was expected that week, but discussions dragged through Sept. 28 before federal officials reached a bailout agreement that would allow the US government to purchase devalued mortgage related assets from financial institutions in order to unfreeze the credit markets.

The initial bailout agreement "seemed to be a done deal until the candidates [Sen. John McCain (R-Ariz.) and Sen. Barack Obama (D-Ill.)] invited themselves to the show," said Olivier Jakob at Petromatrix, Zug, Switzerland. "The easiest way to become an overnight leader is to break a deal and then become the savior of it. The latest political debacle will not help consumer sentiment."

The agreement went to Congress on Sept. 29 for a vote. But NYMEX oil futures prices dropped more than 4% in pre-market trade that day as the US dollar gained against the euro. "The broader market remains skeptical as to whether the package will be enough to prevent the economic downturn from persisting or even spreading to other major economies, further pressuring oil prices," said Raymond James analysts. Critics point out the plan does nothing to improve oil demand. "This plan is a rescue plan to prevent a collapse of the financial system and not a plan to boost the economy," Jakob said. "The rescue plan's impact on the economy will be a lengthy process and will not immediately put the US driver back on the road."

Meanwhile, he said, "The Washington soap opera is taking so much of traders' attention that market liquidity is coming off." Jakob said, "Open interest continues to decline to new lows for the year and soon to new lows for 2 years. All the main commodities are in a declining trend of open interest. With so much public outrage on the Wall Street bailout, we see little chance that the commodity futures market will be able to escape a regulatory change, and the more commodity prices increase, the more immediate the risk becomes."

In another sign of a troubled economy, federal regulators seized Washington Mutual Inc. (WaMu) Sept. 25 in the largest bank failure in US history. The government then agreed to sell WaMu's $307 billion in assets and $188 billion in deposits to J.P. Morgan Chase & Co.

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

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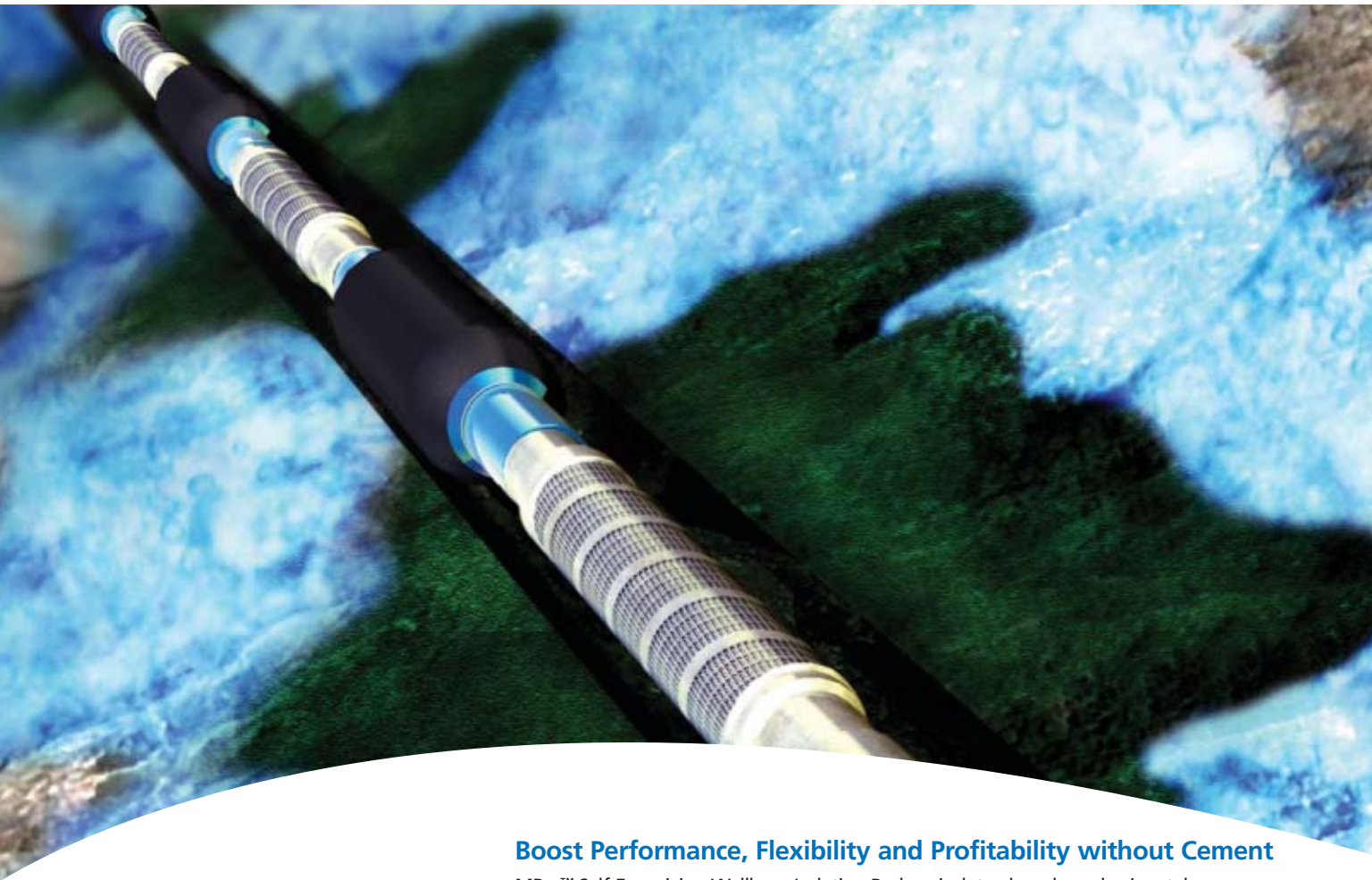

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Technology Forum

Processing Technologies

Supplement to *Oil & Gas Journal* • October 6, 2008

Staffing and environmental concerns top the list of challenges for the global hydrocarbon processing industry today, as is detailed in the articles in this special supplement. Shown on the cover is BP Petronas Acetyls' acetic acid plant owned by the joint venture of BP PLC and Malaysia's state oil company Petronas in Kerteh, Malaysia. Photo courtesy of BP.

Oil & Gas Journal's Technology Forum series, produced by the OGJ Group Publisher, supplements the magazine with topical features on cutting-edge technology, services, and equipment, all expertly written from the technology provider's perspective. Inquiries should be directed to Bill Wageneck, Group Publisher, at billw@pennwell.com.

Environmental, staff issues top HC process industry concerns

The global hydrocarbon processing industries face a daunting mix of challenges and opportunities in the years to come.

Chief among those challenges are shortages of qualified personnel, mounting pressures to switch to alternative fuels, and health, safety, and environment (HSE) concerns.

At the same time, proliferating mandates to redesign the world's energy supply create many new opportunities as well as challenges, according to downstream service and supply company executives interviewed for this report.

Those mandates, coming atop an already burdensome regulatory regime, could mean some countries' downstream sectors will emerge as winners and others as losers. "Although there has been a lot of investment in the refining industry over the past 5 years, much of it has been overseas," notes Carlos Cabrera, UOP LLC president and CEO. "Faced with increased installation costs and lengthy permitting requirements, many US refiners are investing in overseas assets rather than in the US. While this can be attractive with respect to near-term business returns, it definitely raises a concern with respect to security of the future US refining industry."

Carlos Cabrera

Staffing challenges

Topping the list of concerns for most downstream companies is operating and maintaining processing facilities with an aging workforce and infrastructure.

"The scramble for experienced workers has already started. Over the next years, many facilities will struggle to attract and retain the expertise needed to secure a safe and efficient operation," says Hartmut Wuttig, manager of ABB's oil, gas, and petrochemical business unit. "We foresee a need for new technologies and work processes to manage this development. The service/supply sector will also scramble for expertise, and at the same time, be challenged with developing and delivering the requested new technologies."

According to Wuttig, these new technologies will include infrastructure technologies, such as wireless communication, sensors, and cameras; efficient data management such as data modeling and other means to make information efficiently available locally and remotely; and solutions that use this information to push higher availability and throughput at a lower operational cost.

Some examples of these enabling solutions Wuttig cites are:

- Performance and equipment condition monitoring to hike availability and cut operational cost.
- Production optimization to increase throughput.
- Energy optimization to reduce energy cost.
- Use of electrical drives to increase availability and reduce operational cost and energy consumption vs. use of gas turbines.
- Use of "robotized" solutions for inspections and monitoring in hazardous areas.
- Extended service environments enabling efficient remote support and collaboration from a global network of suppliers; this drives up response time and reduces HSE impact with less traveling and site work

Hartmut Wuttig

Wuttig also sees the staffing pressures creating a new workflow paradigm—or rather emulating one in the upstream oil and gas sector: "The upstream industry has been driving strategic initiatives to prepare for the new future, and the term 'integrated operations' has been adopted globally. The [upstream] industry is already implementing new technologies along with new work processes to enable more work being done remotely with a smaller workforce. We believe the downstream sector will follow the same trend."

Documentation

Quantapoint CEO Eric Hoffman stresses the need for hydrocarbon processing plant operators to maintain accurate, updated documentation of plant engineering design and construction data.

"With oil prices at record levels and fuel consumption needs escalating in the United States and many parts of the world, the hydrocarbon processing industries are being revamped to ensure production levels are as high as possible," he notes. "Unfortunately, most owners and operators have little or no as-built (or 'existing condition') documentation on which to base revamp designs. Further, the as-built documentation that does exist is typically out-of-date or of questionable integrity."

Hoffman contends that inaccurate or nonexistent as-built documentation can cause many issues during revamps, including having more personnel in the plant, increased design time, clashes between the new piping and existing piping and equipment, and field routing of pipe (contributing to additional inaccurate as-built documentation), to name a few: "The cost is time and money in the form of field changes, missed schedules, project delays, construction rework, hot work, and lost production."




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Modularization

Modularization is another solution for an industry pressed to the limit, according to Dan McCarthy, executive vice-president of CB&I company Lummus Technology.

"It seems clear that for the foreseeable future we will continue to experience a high demand for engineering services, material supply, and construction labor," he says. "CB&I believes that an important solution to this challenge is to modularize designs and fabricate modules in a shop, which improves quality, simplifies the coordination of field activities, minimizes delays due to inclement weather, and reduces risk because more work can be done at ground level."

Synfuels industry impact

If anything, the push to develop alternative fuels as a substitute for fossil fuels in light of climate change concerns will exacerbate industry's staffing dilemma, according to John Hemmings, director of technology and studies, SNC-Lavalin.

"The lack of sufficient, suitably qualified people to design, construct, and operate facilities may limit the development of energy technologies and will hit the most capital- and manpower-intensive segments harder than the rest of the industry," he contends. "This may delay or even prevent the emergence of a synthetic fuels industry, since synthetic fuels plants are about four times the capital intensity of conventional oil refineries; therefore, if resources are constrained, there is four times the 'bang for the buck' in extending conventional refining assets than in building a new synthetic fuels industry."

John Hemmings

Hemmings thinks this situation may have the effect of focusing the resources into extension of conventional refineries, which will in itself drive up energy prices, creating a "space" for synthetic fuels projects that cannot be filled due to insufficient resources. "Also, high energy costs have created an environment that is ripe for new developers and new companies to pursue large, complex gasification and alternative energy projects," he adds. "Most of these entities have little experience with the complexity of the projects or of the engineering effort required to design these custom facilities. This often leads to termination of their efforts.

"This scenario continues to occur, and SNC-Lavalin has made several presentations on the turmoil in the capital projects industry and alternatives to obtaining project financing in an effort to advise and inform developers of their options."

In addition, there is a question as to whether the vehicle manufacturers will make vehicles to employ such fuels, and the question of distribution is huge, Hemmings notes.

"So this raises the question whether it is worth spending the limited R&D dollars developing technologies that make products that will never be needed—and a 'chicken-or-egg' situation between engines and fuels," he says. "Vehicle manufacturers won't make the cleaner and more efficient engines because suitable fuels are not there, and technology suppliers to the fuels industry are not developing the processes to make the fuels."

The bottom line for SNC Lavalin is that, "while we feel good about the future of the synthetic fuels industry, we need to remain flexible and to be able to deliver projects for our clients regardless of the technologies involved."

HSE concerns

The number one HSE concern will be to meet continuously increasing HSE demands from an aging workforce and infrastructure—but within increasing energy and cost constraints, Wuttig notes.

"One critical factor will be the ability to balance an efficient HSE system with trained individuals, at complex, often continuously changing facilities," he says. "From a technology perspective, a prerequisite to succeed will be availability of up-to-date information and documentation on the facility and realistic training facilities to continuously train the personnel on critical and complex situations."

Hoffman contends that the inherent safety risks of working at a plant site increase as a result of inaccurate as-built information.

"The resulting safety concern is having too many personnel in the facility for too long gathering or verifying as-built information, and the resulting hotwork and rework from inaccurate information," he says. "Traditionally, gathering this information involves team members and/or traditional surveyors visiting the facility to gather spot measurements manually with tape measures and plumb bobs, which is time-consuming and provides relatively few measurements. Then there are additional trips to the plant that are required to gather information for different disciplines or to verify previous measurements. Finally, during construction there is usually significant field routing, hot work, and rework due to missing as-built information, incorrect designs, fabrication errors, and fit-up or interference problems."

Reducing environmental hazards and emissions in processes also is a driving factor in downstream HSE regimes, according to McCarthy.

"One technology that still has a significant environmental issue is gasoline alkylation," he notes. "While alkylate is viewed as a clean fuel, the commercial processes use liquid acid catalysts. I believe that eventually we will see solid catalysts replace these liquid catalysts. Lummus Technology is currently partnering with Albermarle in the development of the AlkyClean process, which eliminates corrosive liquid acid use and the associated safety concerns, as well as mitigation/disposal costs."

Carbon footprint

McCarthy sees the dominant industry focal point on environmental issues as the drive to reduce carbon dioxide (CO_2) emissions, "which we believe will become an increasingly decisive factor in the choice of upgrading technology and in catalyst and process development."

In the short term, CO_2 recovery from stack gases remains

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a viable option, he points out: "However, new dieselization and upgrading demands will dramatically increase the need for hydrogen production. Hydrogen production involves CO_2 production as well, but the CO_2 can be directly 'captured' using commercially proven technology rather than attempting to recover it from unit stack gases."

While reducing carbon footprint is becoming a major issue throughout the energy industry, it is a much bigger issue when coal and heavy feedstocks are considered, as they are all high in carbon, Hemmings notes.


John E. Lionberger

"Synthetic fuels processes lend themselves to carbon capture and sequestration [CCS]; however, the necessary legal framework and economic driving forces are not yet in place," he says. "SNC-Lavalin has initiated a CCS forum internally to ensure it is current with legislation and technologies that can address this ever more sensitive area. It is predicted that most future capital projects will require some manner of carbon plan if not also capture. We are planning to address this issue in an upcoming Gasification Technologies Conference presentation."

John E. Lionberger, vice-president and general manager, Houston regional office of Burns & McDonnell Inc., sees the biggest technology challenges facing the hydrocarbon processing industry service and supply sector as those related issues centered on reducing facilities' carbon footprint, improving energy utilization and efficiency, and utilizing an increasing level of renewable fuels—all in ways that are sustainable in light of uncertain regulation.

"The example of these challenges in refining would be designing or redesigning hydrotreaters using more active and selective catalysts and utilizing novel process configurations that allow refiners to reduce operating severity (i.e., reduce energy consumption) but continue to produce high-quality, environmentally acceptable fuel products.

"In petrochemicals this might mean process innovations such as metallurgy or coatings for cracking furnace tubes to extend run lengths."

In most processing facilities there are energy-saving opportunities that go unrealized because attractive, high-temperature sources are few and less attractive, low-temperature sources abundant, Lionberger says.

"The challenge is to provide an integrated, plantwide approach instead of the more typical unit-by-unit analysis and evaluation to achieve better energy usage and efficiency," he explains. "A heat recovery scheme in a refinery might involve collecting low-grade heat from process streams headed for product storage and transporting it to the boiler house, where it can be used to heat makeup water and thus reduce a combustion source."

With regard to renewables, the challenge is to provide economic pathways that allow for continued and even increasing use, notes Lionberger.

"Responsible care in selecting only nonfood sources as feedstocks is essential," he says. "Absent mandates in a market-based economy, this would occur naturally. Service and supply industry leaders must be dedicated to developing renewable solutions based on nonfood alternatives."

In the end, it's critical for hydrocarbon processing industries to focus on remaining viable regardless of regulation.

"The refining industry service and supply companies know this well," Lionberger says. "Regulation will continue to be the norm, not an exception. Whether it's lead elimination, sulfur reduction, oxygenate addition, vapor pressure control, benzene reduction, or renewables content, new and changing regulation has been a constant. Service providers must be anticipatory, responsive, and innovative to be successful."]

New technologies targeting changing feeds, products challenges

Downstream service and supply companies are pressing hard to develop new technologies that can help hydrocarbon processing plant operators cope with an ever-changing mix of feedstocks and products.

Heavy hydrocarbon challenge

Dan McCarthy, executive vice-president, CB&I company Lummus Technology, believe that the biggest single challenge facing the downstream service/supply sector is the significant ramp-up in demand for heavy hydrocarbon upgrading in Canada, South America, the Middle East, and Russia that is placing tremendous pressure on the entire supply chain, from engineering services and process and catalyst development to fabrication and construction labor.

"The upgrading of conventional (heavy, sour gas oils and cracked stocks) and synthetic gas oils derived from sources such as the Athabasca oil sands, continues to constrain industry resources," he notes.

Such projects are especially difficult because of their combination of challenges—large equipment, high conver-

sion, and difficult and somewhat unfamiliar feedstocks.

"Since most of these projects involve high-pressure hydroprocessing technologies, they compete for the limited availability of high-pressure equipment in general and large-diameter forged reactors in particular," says McCarthy. "Additionally, major bottlenecks exist in high-pressure alloy piping and valving supply. These constraints generate very long lead times that put tremendous strain on project schedules and construction costs and also result in broad price swings in metal and fabrication costs, which can compromise the accuracy of project cost estimates."

In the area of heavy oil production, UOP has introduced Catalytic Crude Upgrading (CCU) technology, notes Carlos Cabrera, UOP LLC president and CEO.


Dan McCarthy

"With escalating crude prices, heavy fields that have historically been too costly to pursue are now worth developing. Many of these crudes are too viscous to meet pipeline specifications and need to be upgraded near the source," he says. "CCU is an extension of FCC-based technology to the oil field and is designed to generate its own diluent to improve the flow properties of stranded crudes to meet pipeline specifications. In addition to enabling stranded crude reserves, CCU is essentially a power plant as well, which is capable of supplying all of the fuel gas, steam, and electrical power generation to operate the entire field installation."

Vehicle fuels

Another technology challenge that McCarthy sees on the horizon is the dieselization of light-duty vehicles.

"This is well under way in Europe, and I believe the US may be on the verge of a similar transition, given the high price of motor fuel and the imminent introduction of a range of modern diesel-powered automobiles," he says.

McCarthy contends this trend would have a profound change on refinery operations. "There will be a need to install a large number of new hydrocrackers and to address the reduced gasoline demands on current FCC capacity," he notes. "Concurrent with the increase in hydrocracking capacity, there will be a need to install new hydrogen plants. It will be interesting to see if carbon sequestration will be included in these new plants."

Technologies that produce complete fuels that are fully compatible with the refining infrastructure offer many advantages to refiners, consumers, and the auto industry, contends Cabrera.

"Processes such as UOP/Eni Ecofining that produce a diesel fuel that meets all current diesel specs and even exceeds the specs for cetane create opportunities for refiners, such as allowing additional amounts of low-quality diesel to be blended into the pool," he says.

Ethanol blending continues to have an uncertain impact for North American refiners, according to Cabrera: "These [ethanol mandate] regulations will create issues that can best be solved by solutions that look across the entire naphtha complex, not just by modifying operations of a single process unit.

One potentially serious complication that ethanol blending can create is increased Reid vapor pressure (RVP), Cabrera points out.

"Adding ethanol to meet the oxygenate specification of the gasoline pool raises the vapor pressure of the gasoline. With 2 vol % ethanol in the blend, the RVP increases by approximately 1 psi. RVP rises slightly with further increases in ethanol until it declines above 20%. Because of the RVP increase with ethanol blending of 2–10%, refiners are forced to lower vapor pressure specifications for the other gasoline blending components. The immediate solution is to reduce the amount of high-vapor-pressure hydrocarbons going into the gasoline pool. However, this simple solution can cause the unintended consequence of actually reducing the volume of the available gasoline pool by excluding high-octane iso-paraffins."

Another challenge facing refiners in North America is compliance with new gasoline benzene limits.

"While many refineries are well under way with selecting or implementing solutions, many other refiners are now just starting their evaluation and selection process," says Cabrera. "The best answer is refinery- or refinery system-specific and needs to be evaluated on that basis."

FCC

With high crude oil prices and with the high price differentials between light and heavy feeds, the profitability of FCC units can be significantly improved by processing lower-value residue feedstocks, points out Harvey McQuiston, Shaw Group FCC program manager.

"The Shaw/Axens FCC Alliance has seen tremendous growth with the licensing of 12 grassroots FCC units in just the last 2 years," he says. "Also, for existing FCC units, there has been increased interest in processing more resid. To maximize the profitability of an FCC processing resid, FCC hardware becomes even more important."

The feed injection system is the heart of the FCC reaction system and is responsible for rapid vaporization of the heavy feed and even distribution across the riser, notes McQuiston.

"These two functions are critical for maximizing gasoline yield while minimizing coke and dry gas production," he says. "The feed injection system becomes even more important when processing resid in the feed. A feed injection upgrade is relatively inexpensive, with typical payouts of less than 6 months."

Another key part of the FCC reaction system is the riser termination device (RTD), whose chief function is to quickly

separate the hydrocarbon products from the catalyst and direct the hydrocarbon products to the main fractionator, minimizing the exposure time of the vapors to high temperature.

"An advanced RTD reduces thermal cracking of valuable products, such as gasoline, to less valuable products, such as dry gas," McQuiston says.

Finally, stripper performance in the reaction system is important because it ensures that valuable products are not burned in the regenerator, and good stripping minimizes regenerator air usage, he adds: "This also minimizes regenerator temperature increases when processing resid material. The use of stripper packing technology has become very common to achieve good contacting between the catalyst and steam used for stripping."


Harvey McQuiston

On the regenerator side, additional carbon is typically deposited on the catalyst with resid processing, McQuiston notes.

"This increases the importance of uniform distribution of the spent catalyst, from the stripper, across the regenerator bed," he says. "A spent catalyst distributor is used to achieve this. Uniform air distribution is also important to minimize carbon monoxide after burning in the dilute phase of the regenerator."

For an FCC unit, the need to maximize light cycle oil (LCO) for diesel production is quickly becoming a critical issue, according to Shawn A. Abrams, vice-president and general manager, Grace Davison refining technologies.

Grace Davison introduced the MIDAS series of catalysts in 2005, and the technology has been expanded to include the new FCC additive for LCO maximization, SABRE-300.

"In a commercial FCCU, at constant conditions, 1.5 lv% of slurry was shifted to LCO," Abrams notes. "SABRE-300, by converting coke precursors into liquid product, actually decreased regenerator temperatures and equilibrium catalyst coke factor.

"Using current spot economics, the addition of 10% SABRE-300 improved profitability by $1.14/bbl. Further increases in yield can be attained through a detailed unit severity optimization."

There will be a continued movement in the FCC area over the next 10 years to be more fully integrated with aromatics and petrochemicals production, claims Cabrera.

"FCC technology has seen a resurgence in technical innovation, as the focus has shifted from fuels-oriented distillation cut points to truly managing hydrocarbon species to maximize product value upgrade," he says. "Consistent with this market shift, UOP's first PetroFCC was commissioned earlier this year. As clients continue to drive for higher propylene production, UOP has continued to develop technology solutions to meet that need."

Hydrogen processes

The refinery-wide need for hydrogen continues to be a challenge for refiners worldwide, says Cabrera.

"Naphtha reformers will continue to play an important part in the refinery hydrogen balance. High-yield reforming processes and catalysts will continue to play a part in meeting this challenge.

"UOP's R-264 catalyst increases throughput and yield from a CCR Platformer. In addition, unique revamp options offer lower-cost, quicker-to-implement solutions. In a recent job, UOP was able to revamp an existing unit to increase the throughput of a CCR Platformer by 35%, eliminating the need for adding a reformer."

Cabrera contends that key solutions still needed by industry include new higher-activity catalysts with improved hydrogen utilization for distillate and vacuum gas oil hydrotreating to meet ever-tightening fuel quality specifications.

Robert H. Bullard, Grace Davison vice-president and managing director, advanced refining technologies, notes, "Our latest-generation catalyst for the SmART Catalyst System Series, ART 420 DX, has demonstrated excellent performance in industry lab testing. ART 420 DX has been qualified by a number of refiners for its ability to treat difficult feed blends in demanding ultralow-sulfur diesel (ULSD) applications. A major oil company's testing labs found ART 420 DX to be a 'top-tier ULSD catalyst.'"

Gordon Low, manager for Haldor Topsoe USA, points to refiners' desires to match hydrotreating and hydrocracking unit cycle lengths to match longer refinery turnaround cycles.

"To do this requires use of catalyst systems with the highest activity and stability," he says. "Management of pressure drop buildup in the catalyst beds can be achieved using a graded catalyst system with high void fraction and low activity at the top of the first bed, followed by catalysts with decreasing void fraction and increasing activity. Some units are installing bypassable reactors with the capability to take reactors off line for midcycle catalyst change-out."

Refiners can also consider a revamp of the unit, which may include the addition of more catalyst volume to meet the required cycle length, he adds.

Feedstock quality is another issue challenging hydroprocessing licensors and catalyst suppliers, says Low: "Refiners are using more synthetic crude from Canada, light cycle oil and light coker gas oil need to be upgraded to ULSD, and refiners want to process heavier feeds with poorer cold flow properties.

"Topsoe's TK-576BRIM CoMo ULSD catalyst extends the operating window to allow deep desulfurization of distillates and gas oils at low to moderate unit pressures."

Topsoe has focused its catalyst and process developments to produce ULSD from difficult feeds with optimal hydrogen usage, according to Low.

"A ULSD unit designed to minimize hydrogen consumption while meeting the product quality objectives will have lower capital cost and operating expenses than an ULSD unit designed with hydrogen give-away in the product," he says. "It is also important to look ahead and design ULSD units with a

defined process scheme for future revamps to produce higher cetane and lower aromatics diesel if regulations change."

Coking

The main cutting-edge developments in coking today are alternatives to traditional coking technology for conversion of asphaltenes to lighter, more valuable products, points out Cabrera.

"The emergence of new hydroprocessing technologies using slurry nano-sized catalysts will prove to be the residual oil conversion technology of choice for many feedstocks in the future," he says. "UOP's SRC-Uniflex is a proven slurry hydrocracking technology that achieves >90% conversion of resid at only 2,000 psig."

Alkylation

While alkylate is a highly desirable component for gasoline blending, permits for hydrofluoric acid or sulfuric acid alkylation units are becoming increasingly difficult to obtain.

"Solid catalyst alkylation technologies have been developed, but none have been commercialized due to marginal economics," notes Cabrera. "UOP is currently updating its Alkylene process for economics at, or superior to, sulfuric acid alkylation. The updated Alkylene process utilizes a high-activity, water-tolerant, low-Pt catalyst for capex and opex competitive with sulfuric acid alkylation."

Isomerization

Optimization of the isomerization unit must take into consideration the reforming unit as well, according to Cabrera.

"The naphtha complex as a whole should be optimized to achieve the objectives of the gasoline pool," he says. "Optimizing the naphtha complex in response to ethanol blending requires advanced technology in both the reforming and isom units.

"For example, the added octane from ethanol blending will allow a decrease in the reformer severity, but reduced reformer severity alone will still require elimination of light paraffins from the gasoline pool to maintain RVP. Further reduction in reformer severity with a corresponding use of light naphtha isomerization will allow the required ethanol and octane [levels] to be met, and the decreased RVP of the reformate will accommodate the RVP of the ethanol and isomerate as well. In addition, the reduced-severity reformer operation results in much longer cycle lengths."

Catalysts

For refiners, rapidly changing refinery margins and market drivers have increased their need for flexibility in their refining operations.

"To meet their needs, UOP has added capabilities to the workhorse of most refineries, the UOP CCR Platforming process," Cabrera says. "Improved regeneration capabilities such as the new CycleMax regenerator increase the ability to burn the greater coke generated in processing heavier crudes at increased operational severities, allowing refiners to maximize their profits.

"To add to this flexibility, a new generation of CCR catalysts, the R-200 series, has been developed that can be operated at higher feed throughputs for maximum aromatics or gasoline production, or alternatively at higher selectivity when profits are best realized by obtaining the highest yields with limited available naphthas."

The ability to design, build, and characterize catalysts at the atomic level is leading to new levels of performance, Cabrera contends.

"Catalyst breakthroughs lead to increased throughput, improved fuel quality, and longer cycles that mean better utilization of refining assets and capital avoidance," he says. "In addition, new materials are hitting the market with more robust operating characteristics, such as UOP's PI-242 and PI-244, which give very high naphtha isomerization activity, octane, and stability without the contaminant sensitivity and environmental issues of chlorided alumina."

The invention of new catalytic materials has accelerated due to improved testing (i.e., combinatorial chemistry), characterization, and modeling tools, the UOP CEO says: "Nanozeolites and novel metal functions are increasing catalyst activity, minimizing unwanted byproducts and enabling longer cycle lengths.

Petrochemicals

On the petrochemicals front, the olefins industry is struggling with the ethylene/propylene supply balance, McCarthy points out.

"Propylene has traditionally been produced as a byproduct of steam crackers and FCC units," he says. "However, with gas feeds being used in new and existing crackers and with FCC units having a lower profile in modern refineries, it has become necessary to focus on new propylene production technologies."

Lummus offers two commercial routes: Its Olefins Conversion Technology reacts byproduct butenes from olefins plants or refineries with ethylene to produce propylene at high yield.

"These plants operate at moderate temperatures and pressures in a near isothermal environment, so investment is low," McCarthy says.

The second route is propane dehydrogenation via the Catofin process, he adds: "We recently were awarded a 650,000 tonne/year [project]—the world's largest to date."]

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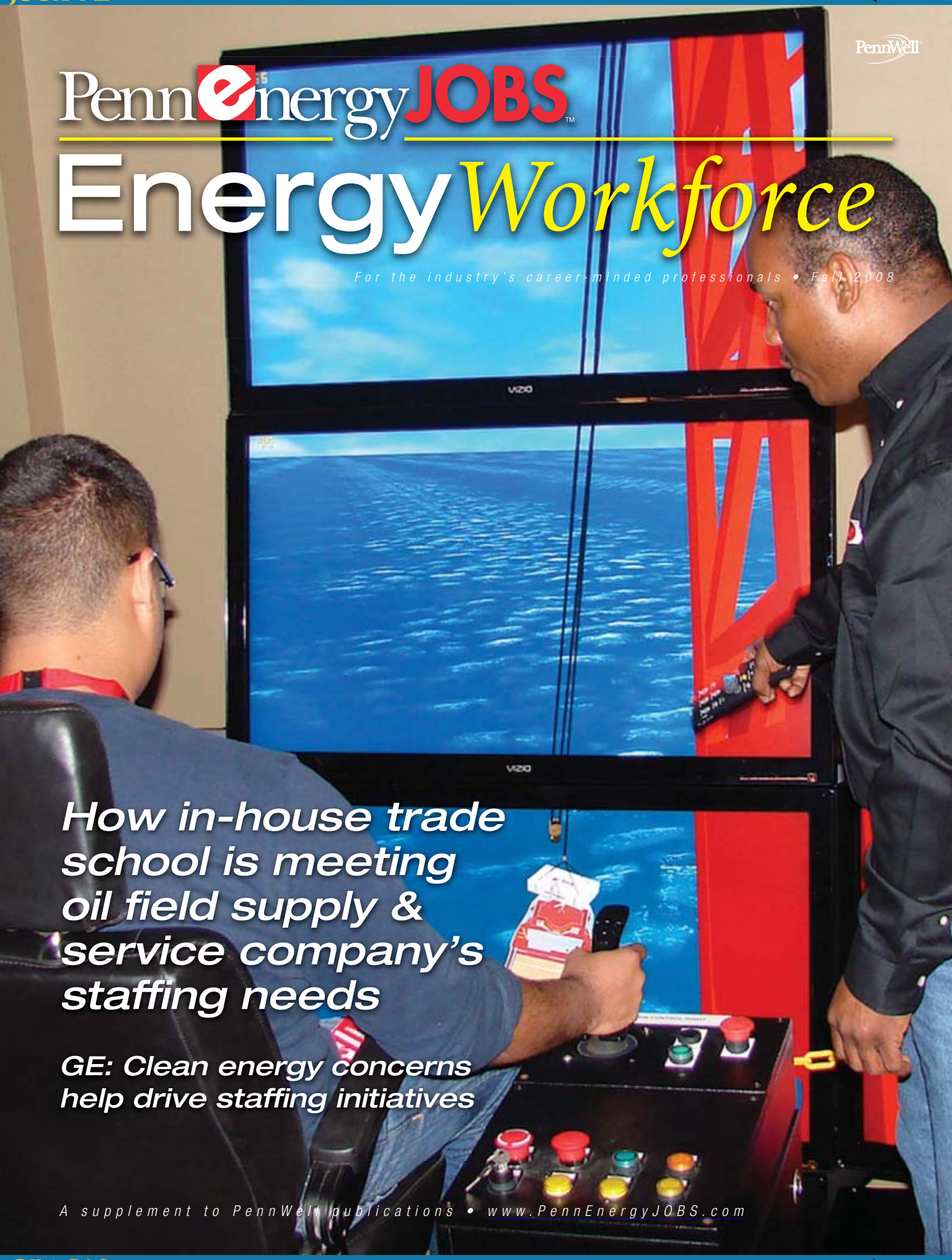

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Giving back its own career reward

Dear Reader,

Have you considered undertaking volunteer work for a deserving charitable organization?

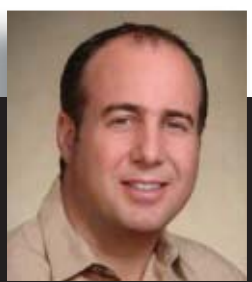
Putting altruistic and "feel-good" motives aside, have you then wondered whether volunteer work would yield tangible career benefits for you, considering the investment of time and effort often involved?

Wonder no more. Apart from its providing great opportunities for networking and ways to hone underutilized skills, there is empirical evidence to show that volunteering enhances one's career profile.

A 2005 survey of 200 top UK firms done for recruiting firm Reed Executive showed that:

- 73% of employers would recruit a candidate with volunteering experience over one without.
- 94% of employers believe that volunteering can add to skills.
- 94% of employees who volunteered to learn new skills had benefited either by getting their first job, improving their salary, or being promoted.

Companies in the energy sector have always acquitted themselves well in this area, based on my nonscientific observations. Some cynics might see this inclination as a need to compensate for the energy industry's unpopular image. But I prefer to think of volunteer work as a natural outgrowth of the entrepreneurial spirit and tough work ethic that have always defined the energy industry.



Apart from its providing great opportunities for networking and ways to hone underutilized skills, there is empirical evidence to show that volunteering enhances one's career profile.

One laudable new charitable initiative in the energy industry is Geoscientists Without Borders (GWB). This initiative, launched in May 2008, is run by the Society of Exploration Geophysicists (SEG) Foundation and received its initial $1 million funding from Schlumberger. The catalyst for GWB was the December 2004 tsunami that devastated Southeast Asia.

GWB provides funding to projects that will bring benefits to communities in need where conditions and hazards can be mitigated or removed using geoscience technology. Among the types of projects that could be funded include tsunami warning seismic site, mapping contamination from old mine sites, prospecting for fresh water in areas of scarce resources, mapping sinkholes in informal settlement areas, mapping old mine underground workings, and assisting with archaeological digs.

Individual project funding could total as much as $50,000/year for up to 2 years, and project proposals would be reviewed twice per year. More information about GWB can be found under the SEG Foundation tab at SEG's website at http://www.seg.org/. So go ahead: Make the world a better place, and advance your career at the same time.

On a separate note, I'm delighted to announce the launch of my blog, Career Ignition, which readers can find at www.PennEnergyJOBS.com/Blog. This blog is dedicated to you—the energy industry's career-minded professionals. It is our forum to share thoughts and opinions on topics that will hopefully stimulate thoughts and discussions around areas of personal and professional career development.

Sincerely,

Jamie Matlin,
Publisher & Director of Recruitment Advertising

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Energy politics vs. energy policy

We Americans are in the thick of the silly season—no, not football, for in these parts that subject is discussed in hushed, reverential tones.

This silly season in fact involves a much less rational game: US energy politics in an election year.

Note the specific reference to US energy politics, not US energy policy. The former term is the current national pastime; the latter, an oxymoron.

There is no and never has been a US energy policy. There have been occasional, piecemeal efforts to address concerns—meaning when the public gets riled up—about energy supply and prices. As in, respectively, not enough and too high. Those efforts have included white elephants (Synfuels Corp.) and the creation of a giant (is there any other kind?) agency that has "energy" in its name yet devotes 39% of its budget to maintaining the nation's nuclear weapons stockpile. But no one in the US talks about energy policy unless Joe Sixpack is getting apoplectic at the gas pump and Granny is shivering under layers of clothing because she had to choose between paying her heating bill and paying for her medicine.

There have been some fairly respectable efforts at cobbling together a US energy policy. The energy task force led by US Vice-Pres. Dick Cheney was one such effort. Unfortunately, much of the momentum the resulting task force policy report might have had was dissipated by Cheney's truculence over not disclosing the participation of energy producers in policy discussions. Gee, input on energy supply from the entities that actually supply energy. The horror.

Energy "policy" has been framed in the context of the "moral equivalent of war" that quickly lost resonance when its symbol was a cardigan sweater.

Sometimes energy "policy" initiatives are couched in terms of an Apollo Project or a Manhattan Project. But those accomplishments, however technically impressive and important, were engineering feats with a single goal in mind. Energy is such a multifaceted and all-pervasive part of an even more multifaceted world that addressing it as a single "mission" is, well, silly. Move along, no magic bullets here.

What passes for US energy policy is really the crazyquilt legacy of decades of knee-jerk measures on energy from politicians reacting—often overreacting—to an irate public that itself needs education on basic economics.

What passes for US energy policy is really the crazyquilt legacy of decades of knee-jerk measures on energy from politicians reacting—often overreacting—to an irate public that itself needs education on basic economics.

In other words, the best energy policy may be none at all. The market pretty well sorts things out by itself, as has been borne out at this writing by the nearly 30% drop in oil prices in 6 weeks owing to demand destruction.

And yet politicians still talk about taking on Big Oil—yeah, the guys who own a whopping 3% of the world's oil reserves—and smacking them with a new "windfall profits" tax. Yes, the same WPT that crippled upstream investment in US exploration and production that in turn helped get us to $147/barrel oil.

So maybe America just needs a really simple energy policy that borrows a phrase from the physician's oath:

"First, do no harm."

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NOV addresses staff shortfall with new technical college concept

Bob Williams, Managing Editor

When faced with an unprecedented level of need for skilled technical staff—having to double its targeted labor pool in 18 months—amid an industry-wide shortage of skilled-trades workers, oil field supply/service giant National Oilwell Varco opted for an ambitious and novel solution: starting its own technical college from scratch.

By all accounts, the National Oilwell Varco Technical College has been a rousing success. NOV will graduate its first class of 150 students in Houston and Kristiansand, Norway, by yearend 2008. Plans call for putting 1,000 students through the school in 2009 and for adding classes in Singapore.

NOV has pumped $30 million in the technical college concept in order to recruit, train, and ultimately employ desperately needed skilled workers in the areas of hydraulics, electrical systems, and controls/software. The new concept and training methods have worked so well that NOV's clients, mostly drilling contractors, have taken notice for their own training needs.

Rig building boom

Two years ago, NOV was looking ahead to a disconcerting scenario of worker shortages with the ongoing rig building boom.

The rig building boom would put a strain not only on NOV but on all of industry to come up with the people to commission and service and support these new drilling assets, according to Joe Rovig, group vice-president, global operations, NOV Rig Solutions,

"The traditional way that industry has worked was that it would ebb and flow, and you would hire people in ones and twos, and grow on that basis," he says. "But we were seeing a dramatic increase in activity going forward."

However, the traditional labor pools were inadequate to the task of meeting future staffing needs, Rovig notes: "Additionally, it wasn't something that was happening just to us, it was happening to everyone in the industry—where retention became an issue for everyone in the industry; everybody was trying to fish from a common pond."

Technical college genesis

So NOV assembled a team to brainstorm solutions in early 2007 and quickly came to the conclusion that a step-change concept was needed to address the trades staffing challenge, because the traditional methods of recruiting, retaining, and training workers would not give the company the number of personnel it needed to serve its customers in the years to come.

That resulted in an epiphany along the lines of "We're not going to be able to hire experienced people in the industry, so we're going to have to take it upon ourselves to go and hire individuals and train them to a competency level to where they can be able to stand on their own two feet before we put them in the field," recalls Rovig. "And that was the birthplace of the technical college."

NOV commissioned an internal group to screen, recruit, and hire employees to eventually work in the areas of hydraulics, electrical systems, and controls/software. But before they would ever be placed in a "live" work situation, they would receive 6-12 months of schooling while earning a salary.

"We went to senior management, and they funded us to the tune of $30 million in the first year. That's a significant investment," Rovig says.

The investment would go toward implementing a concept that Rovig describes as, "We're going to hire people, we're going to train them, and they're going to become competent to whichever discipline they're in the college for, before they ever start generating any revenue for the company.

"We believed we needed to double our own labor pool in a period of 18 months. That was roughly an addition of 1,000 people. And that's pretty much where we stand today."

Rovig says it was important to dedicate sufficient resources to the plan: "We needed to dedicate people, which included recruiters, trainers, and management, to go out and drive the establishment of the colleges. We needed to establish a team to go out and recruit the right level of people to go into that college. We then needed to create the curriculum and that curriculum of teaching an individual who has no oil field experience everything he needs to know about the oil field, about our company, and about the technical job that we want him to accomplish before he graduates from the technical college. So it was a significant investment up front of time and effort to get the college ready for day one, when the first students came in."

The Tech College embraces this concept: "We're going to hire people, we're going to train them, and they're going to become competent to whichever discipline they're in the college for, before they ever start generating any revenue for the company."

— Joe Rovig, National Oilwell Varco

Recruiting, screening

NOV recruits and screens carefully worldwide for its technical college, seeking students with a minimum level of competency "so that we get a high quality product in the end," says Rovig.

A special focus is military outprocessing seminars and industrial trade schools, as well as some universities. NOV also uses websites—its own and third-party—as well as specialist recruiters.

When NOV Technical College recruits come on board, they sign an agreement with the company that underscores the level of commitment NOV wants to see reciprocated.

The NOV Tech College students are paid a wage during their schooling close to what they'd start at as a technician upon graduation, excluding overtime.

"We're going to invest in them. We have a stick-and-carrot relationship," Rovig notes. "They will get a bonus upon their successful graduation, but they're also committing to a 2-year period to us for the investment that we're putting in them."

Curriculum

The NOV Technical College emphasizes all-inclusive training, says Rovig.

"We're taking in these employees, and we're training them about the industry, training them about the company, everything about doing the paperwork, about who to talk to, going into how the dynamics work…on a rig, who does what job, what their responsibilities are, who you need to go to on different types of rigs, getting into extensive safety training, and then moving into the curriculum that's tied to whether they're going to be a software engineer or an electrical engineer or a hydraulics technician."

Such a structured pre-employment training approach runs counter to the oil and gas industry's usual mode—outside of some the major multinational firms—of hiring staffers with a certain minimum level of expertise and then hoping that training on the fly happens, says Rovig.

Selling point

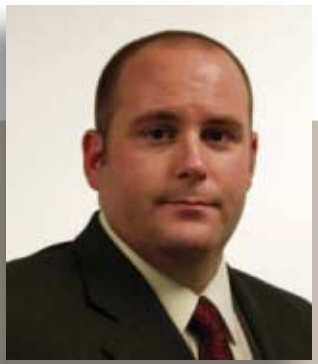
The technical college is itself a major selling point for going to work for NOV, according to Rovig.

"What we're doing for the individuals is that, from day one, we're telling them that we're investing significant time and money in them and making sure that they're competent in the job that we're hiring them to do before we ask them to do it," he explains. "And that sells real easy. It takes a lot of fear out of people. It also shows them that we are committed to having the best possible people in the field."

Ed Whitnell, director of service, Americas, for NOV Rig Solutions, elaborates on that same theme:

"Everyone is facing a manpower challenge; we're not able to go out and get qualified personnel, so by and large, everyone's fishing from the same pond. So if I'm a person who's just starting out, and I had the ability to go with a company that says we're going to put you on a rig vs. a company that says

we're willing to put 6-12 months of investment into you, we're going to train you, we're going to teach you about the oil field, we're going to teach you about safety, we're going to teach you skills, and then we're going to send you all over the world, that would be much more intriguing than to go to a rig and work as a deck hand, for example."



"Our ability to be able to get a service hand who has training already under his belt is huge for us because it allows us to focus on taking care of our customers, as supposed to taking care of our customers while at the same time having to train up a workforce and manage that internally."

— Ed Whitnell, National Oilwell Varco

Whitnell notes that a couple of decades ago it was the responsibility of senior personnel to train new employees on a rig.

"I don't know that that was a requirement, but that's the way it worked," he says. "Today I don't know that the same dynamic is in place. You have guys that may know a lot, but they may not be passing on the same knowledge. Through the technical college, we're able to give these recruits the ability to come in and get that attention, to learn those skills that in the past were passed from a senior man to a junior man, whereas today you don't see as much of that."

Outside training

NOV's new Tech College has also generated a great deal of interest among the company's primary clients.

"Very senior management at major drilling contractors are

very excited about this," Rovig says. "They could see the benefits and are asking when they could use this for [their own] people."

While the NOV Tech College is currently focused solely on the company's own needs, Rovig sees the potential for eventually using elements of the school's curriculum for training others in the industry.

"It would allow NOV to train the oil industry, or at least our part of the oil industry, to ensure a competent level of manpower to service the number of new rigs coming to the field—and it's a staggering number," he says. "We're needing to deliver—representing just our aspect of offshore rigs—another 100 rigs between now and 2012. And there's a lot more rigs out there to be delivered by others. The industry is facing a huge manpower challenge. On top of which, these new rigs are significantly more sophisticated than the last time around."

New paradigm

The NOV Tech College has turned out to be more than just a nifty solution for addressing potential staffing shortages,

"This changes the way we do business," says Rovig. "We will get to a point where our new technicians who go out and support our customer base will have come through a process that started in the college. That allows us to give them the most competent individual that they could have and for us to be able to show them the qualifications of our people. So this is changing the way we will man our operations on a going-forward basis."

Withnell concurs: "Our ability to be able to get a service hand who has training already under his belt is huge for us because it allows us to focus on taking care of our customers, as supposed to taking care of our customers while at the same time having to train up a workforce and manage that internally. It's something that has the operational folks here—well, giddy is probably too strong a word for it—but they're definitely excited about it." —EW

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Dawson Geophysical's Mears: Seismic crew chief has many duties, but a rewarding job

Bob Williams, Managing Editor

Advances in seismic technology have been the most important technological innovation in the oil and gas industry of the past several decades.

Industry's vastly expanded capability to interpret seismic data and image subsurface formations from those data have enabled oil and gas companies to make huge strides in reducing exploratory risk and improving hydrocarbon recovery rates.

This process can entail staggering displays of computing power to create sophisticated three-dimensional and even four-dimensional (3-D over time) models that would probably wow some CGI folks in Hollywood.

As dazzling as the technology is, it still falls to some rough-and-ready folks in the field to make sure all of the geophones and cables are properly placed and gathered back up in some of the world's most inhospitable locales. The work for those who were once called "jug hustlers" is physically demanding and can entail trudging through swamps, forests, or deserts for 12–14 hours per day. And because the reflected seismic waves are sometimes generated by explosions, the work can get dangerous.

It takes a special kind of person to manage that crew and make sure the job of collecting seismic data is done right. That's where Richard Mears comes in. Mears is the party manager for Geophysical Party 24 of Midland, Tex.-based Dawson Geophysical Co.

Dawson, founded in 1952, is the leading geophysical contractor in the US, maintaining the largest number of seismic crews across the Lower 48.

Party manager responsibilities

A party manager for a geophysical contractor has many responsibilities, notes Mears.

"He has to hire and keep a crew of 50–100 people. His crew will work long hours, 7 days a week, and are sure to spend long periods of time away from home and family. His crew will often move from project to project and state to state."

Party manager responsibilities include hiring new personnel, training new personnel, quality control of field data, and employee payroll and paperwork, according to Mears. He is also responsible for the crew's equipment, including more than 30 vehicles and a number of 40-ft-long semi trailers and smaller trailers for moving field equipment.

"All vehicles and trailers must be inspected and maintained for safety and good operating condition for efficient field operations," Mears adds.

The seismic crew chief also must maintain good relations with landowners, as the crew is often working on private as well as public lands. This includes coordinating with permit personnel, field surveyors, and client quality control people.

Additionally, he maintains an inventory of the millions of dollars of equipment on the crew as well as ordering and/or finding vehicle parts and geophysical equipment required keep the crew working.

Typical work day

Mears offers this rundown of his typical work day:
"The clock goes off at 3:45 a.m. Shower, make coffee, check e-mail and weather forecast. 6:00 a.m., meet crew for safety meeting and to discuss problems and plans for the day. We have a crew go out early—5:00 a.m.—to check the spread and get the vibrators ready to work. Go back to the motel and start the payroll for the day and start the daily report. Handle inquiries from human resources and operations from the main office. Go to the field. Check on layout/pickup crews, recording truck, vibrators, and transcriber. Answer questions and problems concerning operations that arise during the day. Return to my field office/motel around 6:00 p.m. Respond to any e-mails that have come in during the day. Crew finishes in the field around 7:00 p.m. and is in town by 8:30 p.m. Finish the payroll, daily report, and progress map for the day and e-mail them. In bed early in order to be ready for tomorrow—which comes early."

Personal characteristics

A geophysical party manager must be able to work with people, notes Mears—"be able to use their strengths and work around their weaknesses; everyone is different."

It's also critical for a seismic crew chief to be organized and be able to delegate in order to get the job done, he adds.

"And you have to be willing to work long hours and get satisfaction from a job well done."

For new entrants to the seismic data gathering business, Mears recommends a drive to gain experience: "Start out learning most of the jobs in the field and work up to the observer's position. Most party managers come from the ranks of the observers. Be dependable and be at work and on time every day."

Mears also notes that party managers can move up to supervising several crews or go into the operations office in several regions or the home office.

Today vs. yesterday

While tremendous advances in computing power now enable a single technician to process and interpret massive volumes of seismic data in days vs. the months it might have taken a roomful of geophysicists a couple of decades ago, that kind of productivity improvement doesn't translate to seismic crew activity, which has gotten more labor-intensive because of the relentless quest for more data.

"When I started in the geophysical industry in 1967, we used 12 and/or 24 live receiver stations for each source point acquired with 2-D recording," Mears noted. "Today, with 3-D recording, we use up to 7,000 live stations for each source point acquired.

"Back then, 12–20 people could handle the operation, including permitting and surveying. Now a field crew can have up to 100 people, plus several permit people, lead front end people, and multiple survey crews. Permitting and surveying can start 6–18 months before a project is ready to be recorded.

"Years ago, the surveyor and party manager could permit the small 2-D projects in a couple of days by going door to door and asking neighbors who owned the next property. There are stories of permits being acquired for a sack of potatoes or a fifth of whisky—'the next time you come by.'"

While the basics are still the same—dealing with people, ensuring personnel safety, making sure geophones are properly planted, etc.—the scope of operations has greatly increased for the seismic crew chief.

"There is just a whole lot more of everything to deal with," Mears says. "The quality of the equipment and end product have greatly improved since the old analog days.

"Back then, recording instruments frequently broke down, and the observer might have to pull vacuum tubes from the instruments and take them to the local store to test them on the machines used for checking television vacuum tubes. When they were bad, you had to hope they had a new one to replace the bad tube. Same problem with the old vacuum tube radios used to communicate with personnel on the crew."

"Years ago the surveyor and party manager could permit the small 2-D projects in a couple of days by going door to door and asking neighbors who owned the next property. There are stories of permits being acquired for a sack of potatoes or a fifth of whisky 'the next time you come by.'"
— Richard Mears, Dawson Geophysical

Personal profile

Mears was hired out of Tyler Junior College in Tyler, Tex., by Petty Geophysical Engineering Co. in 1967.

"I worked in a party chief's office doing interpretation," he recounts. "Back then we worked from field records. All NMO (normal move-out) corrections and dip migrations were done by hand and mechanical adding machines.

"At that time most crews had a party chief in town in the interpretation office and a party manager with the field crew running the field operations. As time went by, crews became 'bobtail'—with no interpretation office."

Mears then worked as a computer on field crews, working hand-calculated survey notes, quality checking field data, and handling general paperwork and reports.

He was promoted to party manager in West Virginia in 1972 and had the first Petty-Ray crew in Illinois 6 months before the merger of Petty Geophysical with the Ray Geophysical division of Geosource.

"I had the crew that allowed seismic crews to work on Louisiana state highways," he adds. "Their research, permit, and safety inspectors observed the crew in operation and gave us a clean bill of health."

Mears also bossed the first crew allowed to work on the Navajo Indian reservation in Arizona in 25 years and later worked overseas as a quality control consultant on seismic crews for oil companies.

Reflections

Mears reflects on a career that gave him the opportunity to see and work in a great portion of the US, as well as Colombia, Indonesia, Pakistan, and Egypt.

"I have met a great number of very interesting people," he adds. "Working outside and not having to sit in an office all day every day is a large plus. In general, as long as operations are going well, I do not have anyone messing with me every day.

"I like having a smooth running operation with people I can depend on to do the job right. "There are challenges of some sort every day, but the only drawback is being away from home most of the time."

After 41 years, Mears says he still enjoys the work.

"I have been with Dawson Geophysical Co. for the past 11 years and plan to be here until I retire—in the far distant future." —EW

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GE: Clean energy concerns help drive staffing initiatives

Bob Williams, Managing Editor

Energy concerns at the forefront of public awareness today are helping to drive staffing initiatives in the power industry.

Power production and distribution companies and the companies that serve the power industry are capitalizing on a surge of interest in the topic of energy—notably alternative and clean energy sources—to bolster sagging ranks depleted by a workforce dominated by employees approaching retirement.

General Electric is one of those companies that sees strong staffing opportunities in the media frenzy over energy.

"Today's power industry is very exciting and competitive," says Kim Warne, manager of the GE Center of Excellence supporting US recruiting and staffing operations for five GE businesses: Energy, Aviation, Transportation, Water & Process Technologies, and Oil & Gas. "Innovative shifts to alternative power sources such as renewable energy and cleaner coal, as well as traditional power sources such as natural gas and nuclear, are driving tremendous interest and activity."

"Innovative shifts to alternative power sources such as renewable energy and cleaner coal, as well as traditional power sources such as natural gas and nuclear, are driving tremendous interest and activity" in working in the power sector.

— Kim Warne, GE

Warne points out that while many talented professionals pursing careers in the power industry are joining GE, "we are also seeing a global shortage of graduates with technical degrees, so the competition is heating up for qualified engineers and scientists. In this environment, GE's goal is to recruit, develop, and retain the best available talent."

Translating 'buzz' into recruiting

The nightly news is helping to remind everyone about the need for clean, reliable energy, notes Warne, so GE needs to translate that "buzz" into more effective recruiting.

One way GE Energy attracts new college graduates is through its world-class leadership programs.

"Technical graduates (both undergrad and graduate) can apply to our Edison Engineering Development Program (design/development), Operations Management Leadership Program (manufacturing/sourcing), or Commercial Leadership Program (sales/marketing)," Warne says. "Our program members rotate through different assignments and attend formal training classes. By combining these programs with mentoring and exposure to GE leadership, we are able to develop the next generation of GE leaders."

GE also has a Renewable Energy Leadership Program for recent MBA graduates with experience in the renewable industry and a Field Engineering program for field service careers. More information about these programs can be found at www.gecareers.com.

Nontraditional recruiting

GE Energy's recruiting efforts go beyond traditional methods, such as postings on the usual internet job boards.

The company set up a new microsite (http://www.jobs.gecareers.com/whygeenergy) that provides information to candidates about its business and highlights featured jobs, with monthly updates. The site also invites viewers to a monthly webinar to learn more and allows them to sign up for more information.

"We also have a page with information about GE Energy programs to help employees balance their professional and personal obligations with flexible work arrangements

and benefits, such as paid time off, family leave and care programs, educational program's and adoption assistance," Warne says. "In addition, when we meet candidates who may be interested in GE for the future, we stay connected to them via periodic recruiter check-ins and a short newsletter."

Retention initiatives

GE Energy is focused on several key retention initiatives, according to Warne.

"First, due to the large number of new people we bring into our business each year, we find that orientation and assimilation are critical to retaining talent within the first 12 months," she says. "We have new-hire checklists that walk new employees through the first 30-60 days. We have also developed a PowerOn new employee assimilation program, which is mandatory for all new hires. We provide information on the business, our products, critical processes, and operating mechanisms. We also provide bimonthly newsletters to keep new employees up to date on tools and information that's useful as they become acclimated to GE."

Also as part of its retention initiatives, GE Energy is actively targeting its employees who have been with the business for 2-5 years.

"We have created a special program called Energized Faces, Exciting Places that highlights employees at various stages in their careers and details why they decided to come to GE and why they choose to stay," Warne says. "The program also provides a tool for employees to blog with one another about their experiences."

GE Energy also came to the conclusion that no matter "what career stage you are in, your manager plays a large role in your overall 'engagement' and therefore retention with GE Energy."

Accordingly, in 2007, GE launched a Contemporary Leadership Series for all managers.

"These sessions focused on Knowing and Connecting with Employees, Coaching Skills, Empowering Employees, Appreciating Employees, and finally Building a Global Team," Warne notes. "Retention needs to be driven at the manager-employee level and needs to be specific to each person."

HR Insights: The Executives

Kim Warne is the manager of the Center of Excellence supporting US recruiting and staffing operations for five General Electric businesses: Energy, Aviation, Transportation, Water & Process Technologies, and Oil & Gas. Her business unit hires about 4,000 new GE employees across the US annually. Kim joined GE in 1998 and has served in a variety of roles, from Six Sigma Black Belt to overseeing campus recruiting and from human resource generalist to organization and staffing manager. She has served in her present role since 2006. Kim has an MS in human resource management and a BS in industrial engineering. Prior to joining GE, Kim spent 10 years in the US Air Force as a civil engineer, assigned to various locations around the globe.

Advice to new entrants

Addressing a typical young person considering or just starting a career in the power industry, Warne's best advice is to "follow your passion."

New industry entrants should "take a job in the industry that makes you excited every day when you go to work. Push for challenges as soon as you are ready. Ask for additional responsibility once you've proven your ability to excel in your current role."

"As we explore alternative energy sources for this and future generations, the energy industry will continue to be a very exciting place to work."

Advice to seasoned employees

For the veteran employee who is approaching retirement but who wishes to remain somewhat engaged in the industry, Warne strongly urges efforts to mentor newcomers to the industry.

"We have a large population of employees who are considering retirement in the near future," she says.

"We have partnered these talented employees with less-experienced employees to share knowledge.

"In our Power Plant Systems division, we have many experienced project management professionals nearing retirement eligibility. They have a number of programs in place to transfer knowledge and expedite professional development of newer employees. For example:

- "Each new project manager hired is paired with a seasoned project manager as a mentor and personal 'go-to person' for answers.
- "We engage new project managers to lead initiatives. This drives thought leadership, expertise sharing, and management visibility.
- "The project management leadership team also holds a periodic roundtable discussion with new hires to share experiences and provide feedback and perspective."

Time conflicts

Flexibility is another key consideration for GE Energy employee retention amid the challenges of a tight staffing environment and a rapidly changing demographic profile.

"More and more companies such as GE Energy are offering formal or informal flexible work arrangements (telecommuting, remote working, flextime, reduced hours, part-time, job sharing, or any combination of these ways) to give managers and employees options to help meet the needs of the business while meeting the needs of a multigenerational employee base," Warne notes. "We have over 1,000 employees in our business unit alone using formal arrangements and many more using informal, flexible programs where it makes sense for the business, our customers, and our employees.

"The key to success is execution. We have found that our talented employees can execute in non-traditional ways. Everyone doesn't have to work an identical schedule to deliver results for the company." —EW

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Utility Achieves Success in Tackling Aging Workforce, Training, Recruitment Challenges

FirstEnergy Corp. has had to face issues common to many utilities over the last few years.

This includes the aging workforce, loss of institutional knowledge, and the lack of a steady flow of new recruits ready and able to learn the business. More recently, the company has been wrapping its collective wits around the workforce implications of the Energy Policy Act of 2005 (EPAct). Per this legislation, utilities and other power producers are now required to qualify their workforces for the different positions they hold.

"The capabilities of our employees are core to how we create value," said Dick Grigg, executive vice-president and chief operating officer for FirstEnergy. "People who perform line service and meter reading all are part of our core business. What we realize from a financial perspective is that it will cost us severely if we have to shut things down. That isn't an option."

Accordingly, FirstEnergy has worked with workforce consultancy Interliance Consulting Inc. of Santa Ana, Calif., for several years. Interliance Pres. Brad Kamph sees dire times ahead unless the energy sector takes action to resolve its most pressing workforce challenges.

"A recent study showed that employee attrition is costing the natural gas industry over $575,000,000 per year, so that means it must be costing the energy sector billions of dollars annually," said Kamph. "Without proactive steps taken both by the industry as a whole and by individual companies, the attrition-related losses are expected to swell by another 30% within 5 years."

Baby boomer retirements

As the baby boom generation gradually enteers retirement, a number of industries are finding themselves impacted.

The energy sector is one area that is hurting badly due to retirements. According to the US Department of Labor (DOL), the median age for workers in the utilities field, for example, is 3.3 years higher than the national average. And during the past 9 years, the median age of utilities industry employees has risen from 41.1 years to 43.7 years. For utilities as a whole, that means now that around 150,000 employees fall in the 55–64 age group, with another 25,000 or so over the age of 65—about 15% of the workforce—eligible for retirement.

DOL has identified a number of positions that will experience heavy retirement rates in the next few years. Between now and 2012, 22–33% of staff will retire who hold positions as electric power linemen, nuclear engineers, reactor operators, nuclear technicians, power plant operators, first-line supervisors, mechanical technicians, pipefitters, plumbers, maintenance technicians, and electrical technicians.

"Currently, there are 360,000 electrical and 23,000 registered power engineers, yet today there are only about 500 undergraduate degrees awarded annually in power engineering compared with nearly 2,000 in the 1980s," said Kamph. "When you combine that data with the retirement picture, it indicates that utilities have to elevate their workforce initiatives to a strategic level in order to guarantee the future of the organization and safeguard institutional knowledge."

Executives at FirstEnergy were among the first at utilities to recognize the problem and have been among the most aggressive in pursuing solutions.

"In the late 1990s, we recognized that we faced a serious age demographics issue," said Charlie Lasky, FirstEnergy's vice-president of fossil operations. "We know that close to 74% of our fossil operations workforce will be eligible to retire in the next 10 years. We were very concerned about sustaining the years of skills and equipment knowledge that our employees have built up over the past 25 years."

FirstEnergy is a diversified electric company headquartered in Akron, Ohio. Its subsidiaries and affiliates are involved in the generation, transmission, and distribution of electricity, as well as energy management and other energy-related services. Its seven electric utility operating companies comprise the fifth largest investor-owned electric system in the US, serving 4.5 million customers within 36,100 square miles of Ohio, Pennsylvania, and New Jersey. Its generation subsidiaries control

more than 14,000 MW of capacity.

While the company began building a strategy for dealing with the retirement bubble almost a decade ago, most other utility executives only became aware of the problem in the past 2 or 3 years. As a result, it already has a system in place to address this growing problem.

"The fossil group at FirstEnergy decided to take advantage of this opportunity to redefine what our future organization needed to be, in order to be successful," said Lasky. "Similar to other portions of our standard operation system, we developed a manual for workforce development."

This workforce development manual includes standardized employee development strategies, standardized employee skill definitions, standardized roles and responsibilities, standardized measures of success, and building a common culture of how employees are developed.

At the same time, FirstEnergy executives also began to build relationships with local colleges and universities to create a 2-year degree program for potential candidates for each of its critical skill sets.

"We felt it was critical to accelerate training in power plant basics through these schools, since they specialized in training, and then begin a hands-on training program as soon as the new employees started working in our plants," said Lasky.

Spanning entire workforce

Lasky headed the effort to standardize employee development in the fossil generation business, which has about 1,800 employees. At the same time, other leadership at FirstEnergy also began working on the problem in order to ensure the entirety of its 14,500 employee workforce was taken care of.

"In each of our operations, we have the same strategic issue," said Grigg. "We are very much focused on institutionalizing the knowledge of our employees."

Years ago, this was referred to as "tribal knowledge," he pointed

out. "It's the kind of knowledge senior employees everywhere have. But as you bring in new employees, they lack that knowledge. FirstEnergy is utilizing the same standardized methods and working with 2-year colleges to prepare people for going into the wires side of the business, our nuclear operations, and staff and technical functions."

The competition for good people is going to be intense, Grigg noted: "We have to let potential employees know why FirstEnergy is a good place to work."

The company operates an extensive intern program for students engaged in 2-year degree programs. Its aim is to provide suitable candidates with attractive employment options at good pay rates. Rather than recruiting only for technical specialties, FirstEnergy casts its net widely across the employment spectrum. This includes technology specialists as well as some of the more hands-on tasks of the traditional facility.

"The power plant of today isn't your grandfather's power plant," said Grigg. "A lot of young people don't realize that the power industry is on the leading edge of technology. We have some of the most sophisticated control systems out there for such things as water treatment and environmental control."

Tradition versus innovation

FirstEnergy soon realized that traditional methods of recruiting and training employees would not be sufficient to achieve its workforce aims. As a result, its fossil operations group hired Interliance to develop the optimum approach.

"Recruiting is the first critical step to be successful in this process," said Lasky. "Pre-employment candidate qualification and minimum hiring requirements must be well-defined to allow the interviewers to properly evaluate job candidates. Evaluating and optimizing the screening process can save significant cost associated with training."

Other areas that had to be improved or standardized included employee profiles, curricula, tasks, procedures, training, and performance criteria.

"This level of ongoing development will help us sustain new generations of the workforce focused around a questioning and performance-based culture," said Lasky.

One of the major departures from how utilities have acquired and trained employees in the past, something Interliance specializes in, is converting "knowledge" into systems and processes that enable new employees to perform at a higher level more quickly.

"We focus on standardized practices and performance-based methods being taught and passed on, rather than in-the-field, ad hoc coaching. This gets to the heart of the issue many utilities face: that much of the 'tribal knowledge' of the existing generation of employees may need to be improved upon."

— Charlie Lasky, FirstEnergy

"We focus on standardized practices and performance-based methods being taught and passed on, rather than in-the-field ad hoc coaching," said Lasky. "This gets to the heart of the issue many utilities face: that much of the 'tribal knowledge' of the existing generation of employees may need to be improved upon. Going through a comprehensive review of current training materials to assure they are accurate and performance-driven is critical to the success of any new system for bringing on replacement employees."

This increased emphasis on doing all things the best way is one of the elements of FirstEnergy's program that tends to separate it from utilities still focused on ad hoc coaching. There is no point in transferring the knowledge until it has been "scrubbed" to ensure it is the right knowledge.

"The methodology Interliance brought has created an overall implementation roadmap that identified every component required to fully implement the system," said Lasky. "It included not only what was needed for development but also for the continuing administration of the system. It addressed the organizational changes and role and responsibility changes that the organization would have to make to ensure the program was successful.

"We have completed a full set of on-the-job training modules and evaluations and are in the process of customizing them for each plant location. We also created an automated assessment process that provides real-time results for each new employee that pinpoints individual development needs."

FirstEnergy's fossil operations department also finalized on-the-job training modules with the assistance of subject matter experts to capture critical knowledge and best practices to pass on to new employees.

Of course, FirstEnergy, like other utilities, is competing for a declining pool of employees. In addition to recruiting individuals who have experience elsewhere, or whose skills naturally fit into a utility environment, FirstEnergy is promoting its college-level training programs to high school students. These recruits, through internships while they are in college, are gradually introduced to predetermined processes and best practices. When they come on the job, additional training, compiled by experts—many of them from the generation that is moving on to retirement—is available.

EPAct compliance

Due to the groundwork laid during these initiatives, First Energy is also ahead of the game with regards to Section 1103 of EPAct. This small section of the vast EPAct could send many power industry firms scrambling to get their houses in order.

Section 1103 is titled, "TRAINING GUIDELINES FOR NON-NUCLEAR ELECTRIC ENERGY INDUSTRY PERSONNEL." It calls for the development of model personnel training guidelines to support the reliability and safety of the non-nuclear electric system. It sets requirements of who is to be trained and demands that such training has to show up in terms of improved competency. Further, competence has to be demonstrated according to predesigned metrics.

"When you review most companies against the act, you find that their training programs fail to measure up," said Interliance's Kamph. "If the right workforce qualification program is in place, power producers will not only avoid falling foul of the authorities with regard to Energy Policy Act Section 1103 compliance, they will actually boost employee

performance and impact the bottom line."

One immediate factor is that power producers need to adopt some kind of standardized program for personnel training. The act notes that the National Electric Safety Code and other industry bodies can help companies with their training guidelines. The point here is not to wait for the DOL, Department of Energy, or anyone else to issue guidelines but to get to work on it now.

"The last thing you want is to be called to the carpet after a blackout or brownout is traced to operator error," said Kamph. "When an investigation reveals lack of mandated training and qualification procedures, penalties could be severe."

FirstEnergy's lead in this area is one that others could well follow. With its manual for workforce development already in hand and established partnerships with learning establishments, it is already well on the way to complying with EPAct's workforce section. For example, it has established programs with local colleges and universities to create a 2-year degree program for potential candidates for each of its critical skill sets.

"We worked closely with Interliance to develop a post-hire training process using a structured, on-the-job training approach," said Brian Wilkins, staff generation specialist at FirstEnergy. "As we tailored it to each job classification at each plant, it fits like a glove."

FirstEnergy accepts only staff with a 2-year degree in the applied science of their line of production, or equivalent. Someone who has served in a propulsion division within the US Navy, for example, would meet the qualifications for consideration.

New arrivals go through a structured, on-the-job training regimen based on well-defined modules, within 2 years or less. The modules were developed by SMEs (subject matter experts) and customized for each plant. Incentives exist for completing the required modules ahead of schedule.

"We had two employees who finished the operations modules in about 14 months," said Wilkins. "There is a clear incentive to complete the modules based on pay hikes linked to training progress."

He notes, though, that Section 1103 does not specify how frequently requalification is to be done. FirstEnergy has decided to do it every 5 years. Employees won't have to go through all the modules again. Instead, they complete a program that is about one-fifth the size of that for entry training.

"This mainly consists of carrying out specific tasks under the observation of a supervisor who verifies every step is done correctly," said Wilkins. "We begin qualifying the first 20% of our workforce next year, starting with those with least seniority. It doesn't make sense to subject soon-to-be retirees to requalification."

There is a case that can be made that quality training translates to quality operation. When FirstEnergy investigates trips, for example, if a case of operator error is determined, it can receive special focus to be incorporated into the associated module as part of ongoing training.

"The goal is continuous improvement," concluded Wilkins, "and we believe training and qualification play a vital role and that they can strongly influence plant performance."

Compliance exercise vs. ROI

One thing to avoid, however, when engaging in workforce programs in response to EPAct Section 1103 is to treat it as yet another compliance exercise and do the minimum necessary to satisfy the terms of the act. Some firms made that mistake earlier with the Sarbanes Oxley Act. A few ended up spending a fortune in compliance without realizing any real efficiency or profitability gain. Similarly, implementation of the operator qualification aspects of the Pipeline Safety Act, in some cases, has resulted in a compliance expense that doesn't translate into heightened employee performance.

The winning approach is to embrace EPAct's workforce provisions as an opportunity to improve performance across the board. Instead of a generalized "train the workers more," or "adopt computer-based training," it has to be broken down into many different job classification categories and equipment types, systems, and/or skills for each job.

"There is no substitute for training that familiarizes employees with how to perform actions on the ground and that results in heightened competence," said Kamph. "This training should be monitored based on how effective it is against such metrics as error rates and other efficiency statistics. That's the only way to make the investment in training achieve a measurable ROI." —EW

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Bechtel Power
Frederick, Maryland
Job Id: 11768396

Business Operations

Area Manager
Shell
North West England, Greater Manchester
Job Id: 12159609

Asset Manager
Chesapeake Energy
Oklahoma City, OK
Job Id: 9700728

Business Intelligence (BI) Superuser
Canadian Natural Resources Limited
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Job Id: 6011148

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Houston, Texas
Job Id: 10469696

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University of Houston
Houston, Texas
Job Id: 10634103

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IHRDC
Boston, Massachusetts
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Shell
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Houston, Texas
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Chicago, Illinois
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Hitachi America
Basking Ridge, NJ
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Bridgeport, Connecticut
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Shell
Houston, TX
Job Id: 11975383

Vice President Mergers and Acquisitions
Shell
Job Id: 11689433

Vice President, Asset Management
DTE
Ann Arbor, MI
Job Id: 11925900

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City of Anaheim
Anaheim, California
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Global Energy Concepts
Job Id: 11704829

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Benson, Arizona
Job Id: 9700537

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DNV
Calgary, AB, Canada
Job Id: 12574327

Director of Engineering
Doosan Hydro Technology
Tampa, Florida
Job Id: 12521877

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SCANA Corporation
Columbia, South Carolina
Job Id: 11861517

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Denver, Colorado
Job Id: 10470247

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Subsurface Consultants & Associates, LLC
Houston, TX
Job Id: 12072178

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Fort Mcmurray, AB, Canada
Job Id: 11554290

Engineer/Operations
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Houston/North, TX
Job Id: 11408689

Engineer/Production
Subsurface Consultants & Associates, LLC
Houston/North, TX
Job Id: 11408693

Engineering Manager
Shell
Heide, Schleswig-Holstein
Job Id: 10086131

Engineering Technician
Chesapeake Energy
Oklahoma City, OK
Job Id: 9700720

Environmental Engineer
Rio Tinto
Job Id: 12355261

Exploration Seismic Interpreter - Conventionals
Shell
Port Harcourt, Nigeria
Job Id: 12355545

I&C Change Package Esitmator
Southern California Edison
San Clemente , California
Job Id: 11584973

I&C Engineer
Washington Division of URS
Princeton, New Jersey
Job Id: 12032572

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DNV
Houston, TX
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Zoetermeer, Zuid-Holland, Netherlands
Job Id: 10403198

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Shell
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Job Id: 11576115

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Civil Planner
Day & Zimmermann NPS
Job Id: 11768970

Civil Structural Engineer
Canadian Natural Resources Limited
Fort Mcmurray, AB, Canada
Job Id: 11990576

Civil Superintendent - Rigging
Bechtel Power
Bedford, Kentucky
Job Id: 11759192

Sr. Civil Engineer
Bechtel Power
Frederick, Maryland
Job Id: 11768142

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Drilling Engineer
Occidental Petroleum Corp.
Oman
Job Id: 6722979

Engineer/Drilling
Subsurface Consultants & Associates, LLC
Houston, TX
Job Id: 6641759

Senior Drilling Engineer
Chesapeake Energy
Oklahoma City, OK
Job Id: 9700705

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Construction Leader - Electrical
Rio Tinto
Job Id: 12493656

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Washington Division of URS
Princeton, New Jersey
Job Id: 12047243

Electrical & Instrumentation Approval Engineer / Surveyor
DNV
Houston, TX
Job Id: 12452962

Electrical Engineer
Rio Tinto
Job Id: 12550004

Electrical Engineer Transmission & Distribution
Stantec Consulting, Ltd.
Charlotte, North Carolina
Job Id: 2894250

Electricial Engineer
DTE
Neville Island, PA
Job Id: 12533429

Lead Electrical Engineer -POWER
HDR Cummins & Barnard
Ann Arbor, Michigan
Job Id: 11886500

Senior Reliability Engineer, Electric Distribution
Pacific Gas & Electric Company
San Francisco, California
Job Id: 10660149

Engineering & Design (Mechanical)

Mechanical Engineer
Canadian Natural Resources Limited
Fort Mcmurray, AB, Canada
Job Id: 6011049

Engineering & Design (Reservoir)

Engineer II - Reservoir
Noble Energy, Inc.
Multiple Locations
Job Id: 10471428

Engineer Sr./Reservoir
Subsurface Consultants & Associates, LLC
Houston, TX
Job Id: 6641735

Reservoir Engineer
Shell
Multiple Locations
Job Id: 10085895

Engineering & Design (Reservoir)

Reservoir Engineer
Occidental Petroleum Corp.
Bakersfield, California
Job Id: 9230434

Senior Reservoir Engineer - Houston
Shell
Houston, TX
Job Id: 12355561

Senior Reservoir Engineer â€“ Houston
Shell
Houston, TX
Job Id: 10293795

Senior Reservoir Engineer Gas
Shell
Lagos, Nigeria
Job Id: 12355536

Senior Reservoir Engineers
Shell
Stavanger, Norway
Job Id: 12044446

Engineering & Design (Structural)

Structural Consulting Engineers
Washington Division of URS
Princeton , New Jersey
Job Id: 12032306

Structural Design Supervisor
Washington Division of URS
Princeton, New Jersey
Job Id: 12032318

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DNV
Houston, TX
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Zeetech Engineering B.V.
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Shell
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Completions Foreman
Chesapeake Energy
Haughton, LA
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Driller
Chesapeake Energy
El Reno, OK
Job Id: 11495619

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Day & Zimmermann NPS
Lancaster, Pennsylvania
Job Id: 11769202

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Chesapeake Energy
Fort Worth, TX
Job Id: 9700714

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Xcel Energy
Denver, Colorado
Job Id: 9425587

Product Manager, Global Forecasting
3TIER
Seattle, Wa
Job Id: 11704814

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Canadian Natural Resources Limited
Fort Mcmurray, AB, Canada
Job Id: 9281788

Roustabout
Chesapeake Energy
Multiple Locations
Job Id: 12057824

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Canadian Natural Resources Limited
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Day & Zimmermann NPS
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Holly Hill, South Carolina
Job Id: 10352999

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DNV
Houston, TX
Job Id: 12574329

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Canadian Natural Resources Limited
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Contract Recruiter
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Houston, TX
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DNV
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Human Resources Manager
Rio Tinto
Job Id: 11869454

Manager, Human Resources
Canadian Natural Resources Limited
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Job Id: 11458718

Recruiter - Human Resources
Canadian Natural Resources Limited
Fort Mcmurray, AB, Canada
Job Id: 12389328

Maintenance

Director of Regional Maintenance
Dynegy, Inc.
Dublin, California
Job Id: 11927199

Maintenance/Construction Services Procedure Writer Supervisor (Job Ref# JP33803-MA)
Southern California Edison
San Clemente, California
Job Id: 11328087

Preventative Maintenance Coordinator
Xcel Energy
Maple Grove, Minnesota
Job Id: 12509321

Mechanical Engineer

Mechanical Engineer (Power Plants)
Isolux Corsan
Madrid, Spain
Job Id: 10458378

Mechanical Engineer IV - Project
Sierra Southwest Cooperative Services, Inc.
Benson, Arizona
Job Id: 12135761

Mechanical Engineer- POWER
HDR Cummins & Barnard
Ann Arbor, Michigan
Job Id: 11886315

Mechanical Plant Engineer
Dynegy, Inc.
Moss Landing, California
Job Id: 11926423

Nuclear Mechanical Pipe Stress Engineer
Washington Division of URS
Warrenville, Illinois
Job Id: 12032328

Senior Static Mechanical Engineer - New Orleans
Shell
New Orleans, LA
Job Id: 10509888

Project Management

HDR, Inc Project Controls Manager
HDR, Inc
Ann Arbor, Michigan
Job Id: 11749675

Project Coordinator (Logistics)
Global Energy Concepts
Job Id: 11704817

Project Development Manager
TGS-NOPEC
Houston, Texas
Job Id: 11535970

Project Engineer
Rolls-Royce North America
Mount Vernon, Ohio
Job Id: 11556840

Project Engineer
Shell
Multiple Locations
Job Id: 10086095

Project Engineer - Extraction Level
Rio Tinto
Job Id: 12583620

Project Engineer - Mechanical / Northparkes / Parkes
Rio Tinto
Job Id: 11869548

Project Engineer - Sustaining Capital
Canadian Natural Resources Limited
Fort Mcmurray, AB, Canada
Job Id: 11458709

Project Engineer/ Project Specialist
Canadian Natural Resources Limited
Fort Mcmurray, AB, Canada
Job Id: 6011027

Project Manager
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Basking Ridge, NJ
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Dynegy, Inc.
Houston, Texas
Job Id: 11926279

Project Manager - Deepwater
Noble Energy, Inc.
Houston, Texas
Job Id: 10471425

Senior Project Manager - Electric Utilities
PPL Corporation
Allentown, Pennsylvania
Job Id: 12351214

Sales & Marketing

Business Development Manager
Shell
Multiple Locations
Job Id: 11343840

Gas Marketing Representative
Chesapeake Energy
Oklahoma City, OK
Job Id: 12057827

Power Planning Marketing Manager
City of Riverside, CA (Power Resources)
Riverside, California
Job Id: 12399211

Regional Sales Manager North Central US
Hitachi America
Basking Ridge, NJ
Job Id: 11990588

Regional Sales Manager/International-Latin America
ENOSERV, LLC
Tulsa, Oklahoma
Job Id: 10502291

Sales Consultant-Stamford, CT
SolarCity
Hartford, CT
Job Id: 11704796

Sales Manager
Bardex Corporation
Houston, Texas
Job Id: 12395714

Science

EP Geochemist
Shell
Houston, TX
Job Id: 12355527

Exploration Geoscientist & Prospect Evaluator
Shell
Houston, TX
Job Id: 10085845

Geologist
Canadian Natural Resources Limited
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Job Id: 6011117

Geologist
Rio Tinto
Job Id: 11869604

Geologist
Subsurface Consultants & Associates, LLC
Houston/Downtown, TX
Job Id: 12493800

Geologist/Exploration
Subsurface Consultants & Associates, LLC
Calgary, AB, Canada
Job Id: 6641760

Geologists - Western Canada - Multiple Opportunities
Husky Energy
Calgary, Alberta, Canada
Job Id: 12389470

Geophysical Advisor
Noble Energy, Inc.
Houston, Texas
Job Id: 10471395

Geophysicist
Subsurface Consultants & Associates, LLC
Houston/Downtown, TX
Job Id: 11976713

Geophysicist - Western Canada
Husky Energy
Calgary, Alberta, Canada
Job Id: 12389383

Head of Geological Services
Shell
Cairo Montenotte, Cairo
Job Id: 10086239

Operation Geologist, Ormen Lange
Shell
Stavanger, Norway
Job Id: 11887519

Petrophysicist
Shell
Aberdeen, Scotland
Job Id: 10509892

Petrophysicist Sr.
Subsurface Consultants & Associates, LLC
Houston/West, TX
Job Id: 10299819

Research Geoscientist
Shell
Houston, TX
Job Id: 10641968

Senior Geoscientist
Williams
Denver, Colorado
Job Id: 12125290

Senior Geotechnical Engineer
Rio Tinto
Superior, AZ
Job Id: 11923853

Senior Sedimentologist - Turbidite Specialist
Shell
Shell Tullos, Aberdeen
Job Id: 10548866

Senior Seismic Interpreter
Shell
Houston, TX
Job Id: 12552101

Senior Staff Geoscientist - Houston
Shell
Houston, TX
Job Id: 12355528

Senior Staff Geoscientist - Houston, Texas
Shell
Houston, TX
Job Id: 12355552

Senior Structural Geologist
Shell
Shell Tullos, Aberdeen
Job Id: 11408680

Sr. Geological Advisor
Noble Energy, Inc.
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