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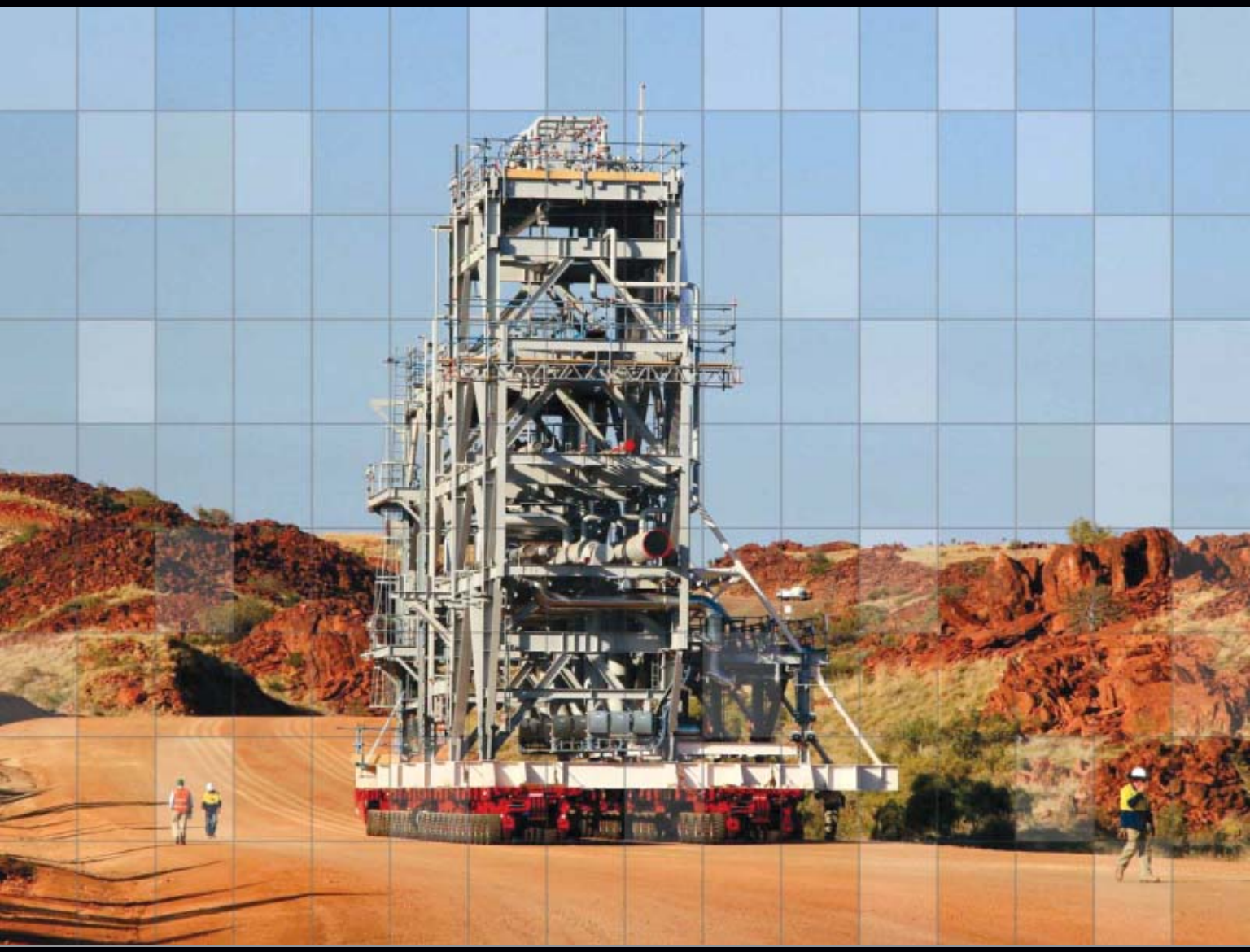

Worldwide Construction Update

East Texas Deep Bossier gas deliveries expanding
Portable VSDs, load cells aid rod pumping at Duri
Generalized equation predicts hydrocarbon acentric factors
US gas supply security requires source diversity

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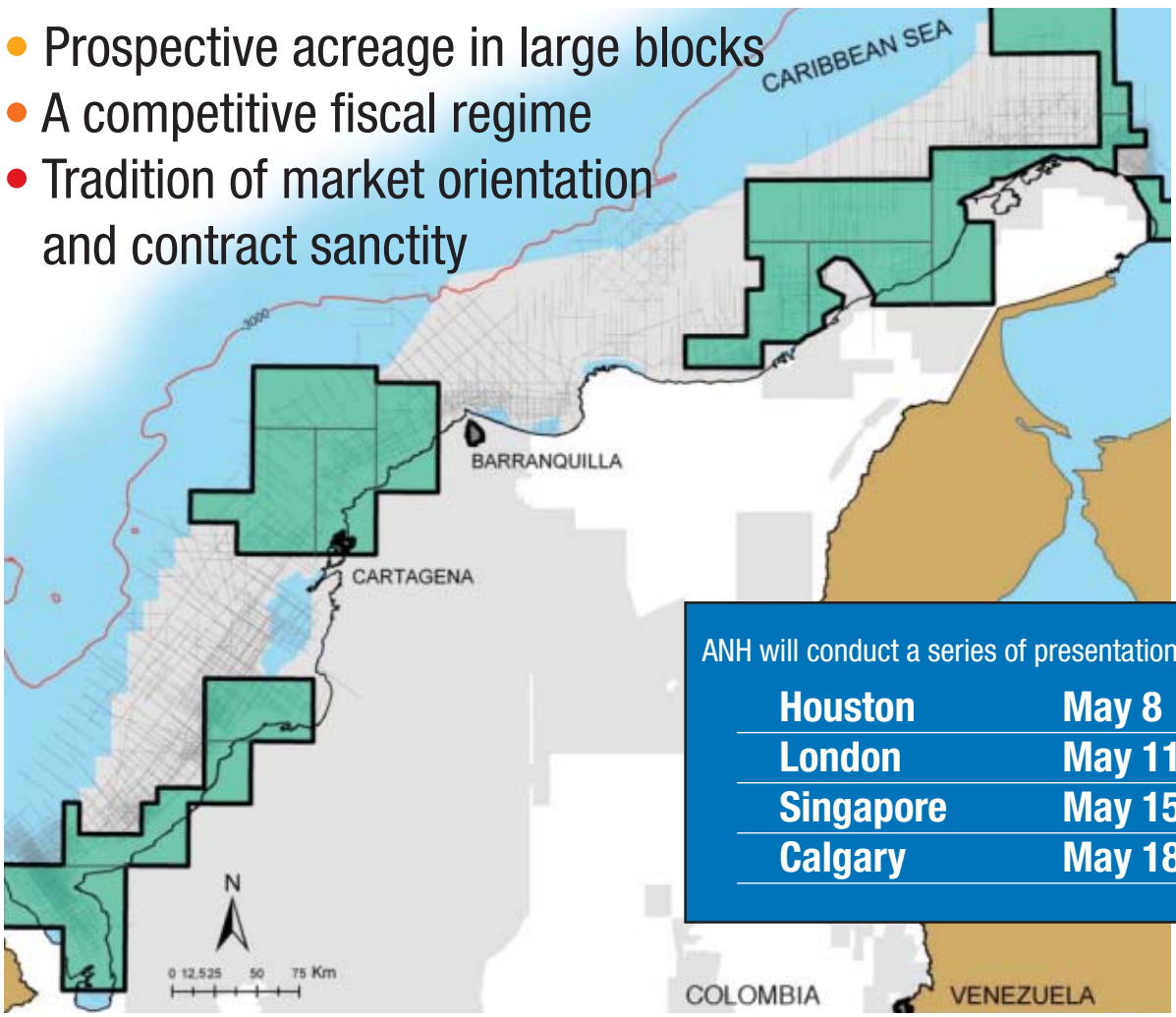

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London	May 11
Singapore	May 15
Calgary	May 18

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Apr. 16, 2007
Volume 105.15

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COVER

Modules are transported for Woodside's Train 5 in Western Australia. The 4.4-million tpy train will be completed in fourth-quarter 2008 at a cost of $2.4 billion. Details of other projects are in Oil & Gas Journal's Worldwide Construction Update starting on p. 18 and in the survey tables at www.ogjonline.com. Photo from Foster Wheeler/Woodside.

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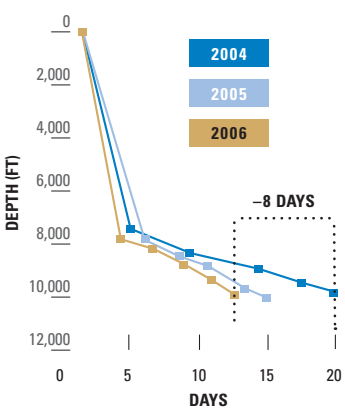

New ZX technology beats the best 2004 drilling time by over 8 days in this highly abrasive East Texas formation.

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General Interest — Quick Takes

Japan offers loan to rebuild Iraq's infrastructure

The Japanese government has agreed to lend Iraq some ¥102.8 billion ($862 million), with just over half of it earmarked for reconstruction of Iraq's oil pipelines, refineries, and export terminal facilities.

Japan's Ministry of Foreign Affairs said ¥50 billion would be used to upgrade Iraq's oil export facilities, while another ¥2 billion will enable refurbishment of a refinery in Basra on the Persian Gulf.

The ministry released a statement that Iraq boasts the world's third-largest crude oil reserves and that it is important for Japan to build a long-term strategic partnership with Iraq.

In February, Japan imported 290,973 kl of crude oil from Iraq out of total worldwide imports of 18.7 million kl.

The ministry said another ¥32.6 billion in loans will go toward rebuilding Iraq's power sector, and some ¥18 billion, for the repair and redevelopment of a fertilizer plant.

The loans are repayable over a 40-year term, with a 10-year grace period.

DOE rejects bids to supply oil to SPR

The US Department of Energy rejected initial bids to supply the Strategic Petroleum Reserve with as much as 4 million additional bbl of oil. DOE's fossil energy office said the bids were too high. A second solicitation will occur in mid-April, it indicated on Apr. 4.

The solicitation was the first of a series to replace 11 million bbl sold from the reserve in fall 2005 after Hurricane Katrina damaged supply lines. The purchases would be the first for the SPR since 1994 and will be financed with the $584 million of proceeds from the emergency sale, DOE said.

It said the SPR, which has a 727 million bbl capacity, currently has 689 million bbl of inventory. DOE said it plans to stagger solicitations over several months to minimize market impacts and hopes to achieve a moderate fill rate of 100,000 b/d.

MMS makes proposal to resolve pipeline disputes

The US Minerals Management Service proposed regulations Apr. 6 to establish processes for resolving offshore oil and gas pipeline access disputes.

The proposed regulations are designed to establish a way for shippers of oil and gas from federal leases on the Outer Continental Shelf to notify MMS if they believe they have been denied open and nondiscriminatory access to pipelines on the OCS, the agency said in a notice published in the Federal Register.

The rules also would provide MMS with tools to assure that pipeline companies provide open and nondiscriminatory access to their systems, it added.

MMS noted that the OCS Lands Act mandates that pipelines provide such access to both owner and nonowner shippers. It said the proposed rules would implement complaint procedures and alternative measures for shippers who allege they have been denied such access. It said it would accept comments on the proposal through June 5 and on its reporting burden by May 7.

UK gasoline sales up in '06 after long slide

Gasoline sales in the UK reversed a 10-year slide last year, reports the Energy Institute, London.

In line with a well-established European pattern, diesel sales increased by much more than gasoline.

UK gasoline sales climbed in 2006 by 572,000 tonnes, or 3.1%, the Energy Institute reported in its UK Retail Marketing survey. Gasoline sales had fallen each year since 1997. Diesel sales last year grew by 1.6 million tonnes, or 8.4%.

Total motor-fuel sales increased by 5.8% to a record 40.5 million tonnes in 2006 as registered UK vehicles grew by 0.6% to an all-time high of 33.1 million.

While product sales grew, the number of retail outlets in the UK and Northern Ireland fell to 9,382, the lowest since the 1920s. That number was 382 below the end-2005 total.

The Energy Institute study reported increases in the numbers of retail sites owned by supermarkets and small retailers and decreases in oil-company, main-retailer, and other unbranded sites.

Here are last year's changes in retail outlets by the leading UK oil-company marketers: BP down 20 to 1,212, Texaco down 13 to 1,041, Esso down 46 to 910, Total down 1 to 909, and Shell down 34 to 872. ✦

Exploration & Development — Quick Takes

Marathon makes oil discovery in deepwater GOM

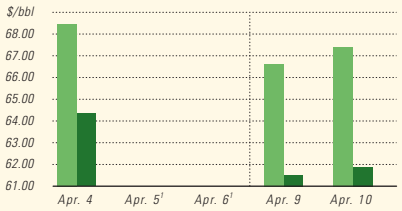
Marathon Oil Corp. has made a deepwater discovery on Green Canyon Block 244 (OCS-G 11043) in 2,900 ft of water in the Gulf of Mexico about 137 miles south-southwest of Venice, La.

The Droshky-1 well (previously named Troika Deep) was drilled to a TD of 21,190 ft and encountered high-quality oil-bearing reservoirs. The well logged about 250 ft of net oil pay, with thickness similar to that encountered by the 1994 Troika discovery well at the same location, according to an analyst note. Troika has estimated recoverable reserves of 220 million boe, the analyst said, adding that conservative estimates of recoverable reserves at Droshky are placed at 100-150 million boe.

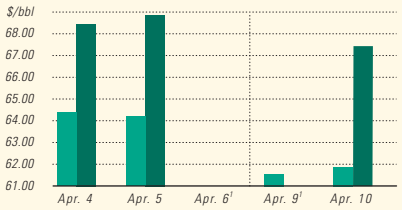
Development of the discovery is possible through the Troika Unit infrastructure about 2 miles from the Droshky well.

Industry Scoreboard

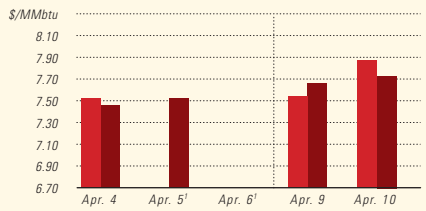
IPE BRENT / NYMEX LIGHT SWEET CRUDE



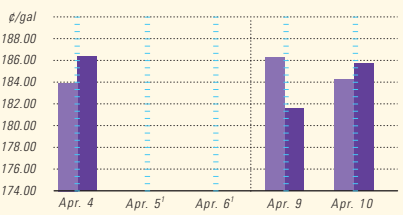
WTI CUSHING / BRENT SPOT



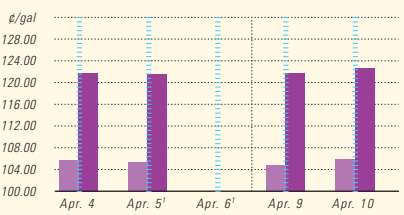
NYMEX NATURAL GAS / SPOT GAS - HENRY HUB



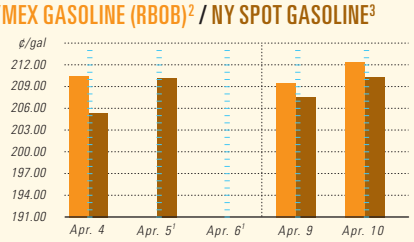
IPE GAS OIL / NYMEX HEATING OIL



PROPANE - MT. BELVIEU / BUTANE - MT. BELVIEU



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



[1]Not available
[2]Reformulated gasoline blendstock for oxygen blending

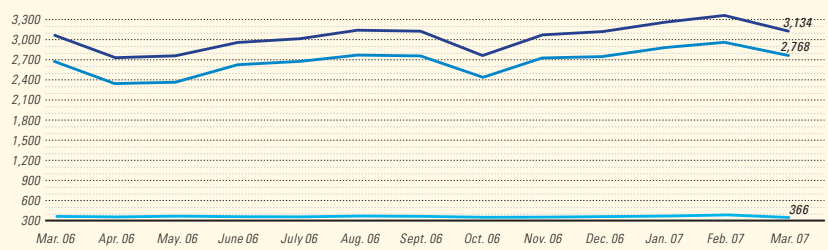
US INDUSTRY SCOREBOARD — 4/16

Latest week 4/6	4 wk. average	4 wk. avg. year ago[1]	Change, %	YTD average[1]	YTD avg. year ago[1]	Change, %
Demand, 1,000 b/d						
Motor gasoline	8,997	9,132	–1.5	9,108	8,958	1.7
Distillate	4,546	4,393	3.5	4,424	4,257	3.9
Jet fuel	1,628	1,585	2.8	1,614	1,571	2.8
Residual	885	798	10.9	756	786	–3.8
Other products	5,006	4,678	7.0	5,003	4,754	5.2
TOTAL DEMAND	21,062	20,585	2.3	20,905	20,326	2.8
Supply, 1,000 b/d						
Crude production	5,218	5,027	3.8	5,287	5,045	4.8
NGL production	2,461	1,697	45.1	2,423	1,695	43.0
Crude imports	9,947	9,822	1.3	9,661	9,804	–1.5
Product imports	3,173	3,159	0.4	3,129	3,469	–9.8
Other supply[2]	810	866	–6.5	925	1,192	–22.4
TOTAL SUPPLY	21,609	20,571	5.0	21,425	21,204	1.0
Refining, 1,000 b/d						
Crude runs to stills	14,503	14,656	–1.0	14,612	14.727	–0.8
Input to crude stills	14,993	14,996	—	15,049	15,076	–0.2
% utilization	86.5	86.2	—	86.8	86.8	—

Latest week 4/6	Latest week	Previous week[1]	Change	Same week year ago[1]	Change	Change, %
Stocks, 1,000 bbl						
Crude oil	337,164	335,192	1,972	345,300	–8,136	–2.4
Motor gasoline	198,829	202,031	–3,202	209,030	–10,201	–4.9
Distillate	119,251	119,694	–443	117,877	1,374	1.2
Jet fuel	40,450	39,960	580	40,834	–294	–0.7
Residual	38,720	38,256	464	41,425	–2,705	–6.5
Stock cover (days)[3] **3/30**			**Change, %**		**Change, %**	
Crude	22.5	22.2	1.4	23.5	–4.3	
Motor gasoline	22.1	22.8	–3.1	23.3	–5.2	
Distillate	26.8	26.5	1.1	29.2	–8.2	
Propane	18.5	17.5	5.7	20.9	–11.5	
Futures prices[4] **4/6**			**Change**		**Change**	**Change, %**
Light sweet crude, $/bbl	64.51	64.73	–0.22	67.07	–2.56	–3.8
Natural gas, $/MMbtu	7.54	7.53	0.01	7.02	0.52	7.4

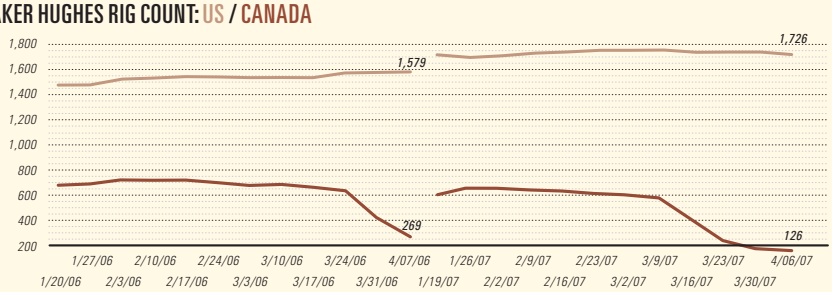
[1]Based on revised figures. [2]Includes other hydrocarbons and alcohol, refinery processing gain, and unaccounted for crude oil.
[3]Stocks divided by average daily product supplied for the prior 4 weeks. [4]Weekly average of daily closing futures prices.
Sources: Energy Information Administration, American Petroleum Institute, 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

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Preparation has begun for drilling of two sidetrack wells, which are expected to take 30 days each. Marathon has the drilling rig under contract until the end of the sidetrack program, after which engineering development studies will follow, the company said.

Marathon holds a 100% interest in the Droshky-1 well and a 50% interest in the Troika Unit.

Final flow rates given for Alapli well off Turkey

Toreador Resources Corp. and its partners reported that final test results from the Alapli-1 exploration well yielded a commingled flow rate of 7 MMcfd of gas from just outside the South Akcakos subbasin in the Black Sea off Turkey.

Toreador's joint venture partners are Turkish national oil firm TPAO and Stratic Energy Corp. (OGJ Newsletter, Mar. 19, 2007).

On final test, the Alapli-1 well's flow came from 15 m of perforations. The three zones were 1,068-1,242 m TVD in the Eocene-age Kusuri formation. The final test was a commingled flow from all three zones through a 32/64-in. choke with a flowing pressure of 1,080 psi. Dallas-basded Toreador has a 36.75% interest in the well, while TPAO has 51% interest and Stratic has the remaining 12.25%.

Southern Tanzania gas project growing

Artumas Group Inc., Calgary, expects its Msimbati-1X exploration well to become the second hydrocarbon discovery in the Mnazi Bay concession, Rovuma basin, in southern Tanzania.

The well, 2.5 km southeast of the Mnazi Bay-3 well site, went to TD 6,570 ft and penetrated the primary objective Middle Miocene sands (Msimbati Prospect) at 4,800 ft. These sands represent a high-amplitude fairway separate from Mnazi Bay gas field.

At 6,000 ft, the well encountered the classic Miocene/Oligocene sandstone formations of Mnazi Bay gas field, which the MB-2 and MB-3 wells appraised. Drillstem test results are expected in mid-April. The field was discovered in 1982 and began delivering gas in January through a 27-km pipeline to the 12-Mw Mtwara electric power station (OGJ Online, Sept. 27, 2006).

Artumas approved 60 line-km of 2D seismic surveys that will focus on highgrading a deeper exploration prospect for an Eocene/Cretaceous oil test on the Mwambo Prospect. The company expects to drill a well in the third quarter.

Dominion acquires block off Tanzania

Dominion Petroleum Ltd. has signed a production-sharing agreement with Tanzanian government agency Tanzanian Petroleum Development Corp. (TDPC) for an exploration block off eastern Tanzania.

Block 7 covers 8,500 sq km on the continental slope and lies in 100-3,000 m of water in the Indian Ocean.

Dominion plans to spend at least $8.75 million during the initial 4-year exploration period—$1 million on geological and geophysical surveys, $4 million on acquiring more than 4,000 km of 2D seismic data, and $3.75 million on acquiring more than 500 sq km of 3D seismic.

Initial data analysis previously acquired by Dominion suggests there are encouraging prospects in the shallower part of Block 7 at drillable depth. The company is required to drill a well before the second 4-year term.

Previously, Dominion entered into three PSAs with TDPC covering more than 10 million acres in the onshore Mandawa, Kisingire, Lukuliro, and Selous licenses and was scheduled to drill four wells (OGJ, July 10, 2006, Newsletter).

EnCana lets FEED contract for Deep Panuke field

EnCana Corp. let a front-end engineering and development contract to Intec Engineering and IMV Projects Atlantic for the subsea and pipeline design for EnCana's Deep Panuke dry gas development off Nova Scotia.

The FEED work will result in bid packages for the subsea and pipeline engineering, procurement, and construction contracts and will support project sanction, expected by yearend.

Deep Panuke is to recover 390-890 bcf of sales gas, with a mean estimate of 630 bcf, at the rate of 300 MMcfd. The field would produce for 8 to 17½ years.

EnCana earlier proposed two pipeline options to handle the gas: One is an offshore connection to the Sable Offshore Energy Project pipeline, operating since the end of 1999. The other is a separate 176-km subsea pipeline adjacent to the SOEP line with a linkup onshore near Goldboro, NS. Either would deliver to the Maritimes & Northeast Pipeline (OGJ Online, Nov. 17, 2006). ✦

Drilling & Production — *Quick Takes*

AWE expects production from Tui field at midyear

Australian Worldwide Exploration Ltd. Group, Sydney, is expecting the "Umuroa" floating production, storage, and offloading vessel to reach its Tui area oil development off New Zealand in mid-April. The field is on Taranaki basin permit PMP 38158 about 50 km offshore (OGJ Online, May 8, 2006).

The FPSO sailed from Singapore earlier this month.

AWE, which became project operator after acquiring New Zealand Overseas Petroleum Ltd. in early 2006, said it anticipates starting production June 30. Peak production is expected to be about 50,000 b/d.

AWE holds a 42.5% interest in Tui field. Japanese company Mitsui has 35%, New Zealand Oil & Gas subsidiary Stewart Petroleum holds 12.5%, and Pan Pacific Petroleum NL of Sydney has 10%.

Repsol YPF to use two Dalma rigs in Algeria

Repsol YPF SA has let a $23.24 million contract to Dalma Energy for two deep-drilling land rigs to be used in Algeria.

Repsol YPF operates a group that last year reported several gas discoveries in the Reggane basin of Algeria's Sahara Desert (OGJ Online, May 18, 2006).

Dalma, a wholly owned subsidiary of Aabar Petroleum Investments Co. PJSC, Abu Dhabi, owns 22 rigs, all under contract in the Middle East, North Africa, India, and Southeast Asia.

The 2,000-hp rigs under contract to Repsol YPF were built in China at a cost of $22 million each.

BPTT Cassia complex due metering system

BP Trinidad & Tobago LLC (BPTT) let a contract to Woods Hole

Group Inc., East Falmouth, Mass., to design, build, and install a meteorological and oceanographic measurement system on BPTT's Cassia oil and gas production complex off eastern Trinidad and Tobago.

Woods Hole will provide systems design, integration, installation, and real-time data display along with monthly data monitoring and archiving during the 24-month project.

Measurement of the predominant and spurious currents and waves and their impact in this environment is important for the continued safe and efficient operation of BPTT's production platforms off Trinidad and Tobago's east coast, Woods Hole said.

The BPTT Cassia Metocean system will consist of two Nortek AWAC acoustic Doppler current profilers—arranged to generate a continuous profile of currents through the 90 m water column and measure wave height and direction at the installed location—and several wind, barometric pressure, and temperature-relative humidity sensors.

The systems will be integrated into the Woods Hole integrated real-time system, which will acquire and store all raw data and display the processed data on the Cassia production complex for operational use in real time through a web-based data server application. It will enable BPTT and BP's affiliate offices in Houston to view the real-time processed data through any BP web-enabled access port. ✦

Deck lift record set in Gulf of Mexico

Saipem SPA's 7000 semisubmersible crane and pipelaying dynamically positioned vessel set a deck lift record of 10,473 tons in the Gulf of Mexico when it installed on Mar. 9 the Petróleos Mexicanos PB-KU-A2 production platform integrated deck in Ka-Maloob-Zaap field. The deck was installed on the jacket in less than 3 hr with rig-up performed offshore due to no feasibility of any prerigging in yard. The Saipem 7000 held the previous lift record in the gulf of 9,927 tons after installing the PB-KU-S deck on Dec. 14, 2006. Photo from Saipem.

Processing — *Quick Takes*

China refinery due delayed coker heaters

CNOOC Oil & Petrochemicals Co. Ltd. (COPC) has let a thermal design, engineering, procurement, and material supply contract to Foster Wheeler USA Corp. for two delayed coker heaters for a four-drum delayed coking unit to be installed at COPC's newly constructed 250,000 b/d refinery in Huizhou, Guangdong Province, China.

The delayed coker heaters will use Foster Wheeler's Terrace-Wall design.

Foster Wheeler previously was awarded the process design package contract for the delayed coking unit, which will be based on the company's Selective Yield Delayed Coking (SYDEC) process. Foster Wheeler said the delayed coker heaters are an integral component of the SYDEC process technology.

The new $2.64 billion refinery will process crude oil from CNOOC's Penglai field in Bohai Bay (OGJ Online, Sept. 8, 2005).

China plans three petrochemical plants at Daqing

Authorities in Daqing, China, near the projected terminus of Russia's East Siberia Pacific Ocean oil pipeline, are planning several large-scale petrochemicals developments.

According to China's National Development and Reform Commission, projects being designed include a 1.2 million-tonne/year ethylene plant, a 450,000-tpy propylene facility, and a 1 million-tpy fertilizer plant.

The plans were announced even as oil output from Daqing field, operated by a PetroChina Co. unit, has been declining in the past several years, dropping by 3.4% in 2006 to 43.41 million tonnes.

Despite the downturn, Chinese authorities expect the pipeline to make up the domestic production shortfall by delivering as much as 30,000 tpy of crude from Russia's East Siberian fields.

According to Russian state media, quoting Chinese official sources, preparations by China National Petroleum Corp. (CNPC) for the construction of a branch of the ESPO line are well under way.

"We're confident that the branch will be built, and we're conducting active preparations for this," a CNPC management source told Interfax-China, adding that CNPC has begun cooperation with Russia's Transneft for construction of the line.

JV to provide management at Suncor plant

Suncor Energy Inc. has let a 5-year, $1 billion (Can.) contract to Flint Transfield Services Ltd. for asset management services at its oil sands operations in Fort McMurray, Alta., and its 70,000 b/cd refinery in Sarnia, Ont.

The contract scope includes maintenance shutdown and turnaround services for Suncor's Fort McMurray oil sands and Firebag in situ facilities and the Sarnia refinery; contract maintenance services to the oil sands extraction, upgrading, and Firebag facilities and the Sarnia refinery; and overall site maintenance services at the oil sands operations.

The long-term contract also covers additional services such as engineering and construction for "select sustaining capital projects," Flint said.

FT Services has begun mobilizing resources and will continue to ramp up service delivery capacity over the next 6 months. The company is expected to assume delivery of maintenance services in

Fort McMurray in the third quarter and in Sarnia late in the fourth quarter or early first quarter 2008.

FT Services is a 50-50 joint venture of Flint Energy Services Ltd. and Transfield Services of Australia. Other companies participating with FT Services in providing services under the contract are Calgary-based Colt Engineering Corp. and ThyssenKrupp Safway Inc.

Brazil to import palm oil to meet mandate

Brazil plans to step up its purchase of palm oil from Malaysia in order to meet a government mandate for a 2% biodiesel (B2) content in diesel starting Jan. 1, 2008.

To comply with the mandate, Brazilian refiners must blend some 800,000 tonnes of biodiesel into 38 million tonnes of diesel fuel by yearend. But Brazil currently is producing less than 300,000 tonnes/year of soyaoil-based biodiesel, a shortfall of 500,000 tonnes, said Eduardo Pessoa de Carvalho, chief executive officer of Brazil's Meridian Trading Ltd.

Because Malaysian palm oil's price is lower, Brazil likely will buy more of it as feedstock to blend with its soyaoil-based biodiesel, Carvalho said.

In 2006, Brazil bought 33,222 tonnes of Malaysian palm oil, more than twice the 14,620 tonnes purchased in 2005. ✦

Transportation — *Quick Takes*

Arrow to supply gas for Queensland LNG plant

Coal seam methane company Arrow Energy NL, Brisbane, has signed an agreement to supply gas from its Daandine CSM field in southeast Queensland to use as feedstock for a proposed mini-LNG plant. The plant will be built on land Arrow owns at Daandine.

The agreement, signed with Liquegas Energy, a part of the Norwegian oil technology services company AGR Group, is for the supply of an initial 1.86 bcf/year of gas for 15 years beginning in first half 2009.

Both companies want to finalize a gas sales agreement within the next month.

The LNG produced will be marketed in southern Queensland and northern New South Wales, mostly for LPG replacement fuel and as diesel for long-haul trucking.

Crosstex starts up north Louisiana gas line

Crosstex Energy LP, Dallas, started up its $90 million natural gas pipeline expansion across three parishes in northern Louisiana Apr. 1.

The 72-mile line—63 miles of 24-in. and 9 miles of 16-in. pipeline—will add initial capacity of 200 MMcfd of gas to Crosstex's 2,000-mile Louisiana Intrastate Gas pipeline system. That capacity is fully subscribed, the company said, but Crosstex has an option to increase capacity to 240 MMcfd.

The pipeline will provide an outlet for the region's higher production, for which takeaway capacity had become insufficient, Crosstex said.

Oneok JV plans another NGL pipeline

Overland Pass Pipeline Co. LLC, a Tulsa-based joint venture of Oneok Partners LP and Williams Cos., plans to build a 150-mile NGL pipeline lateral to connect with the previously announced 750-mile Overland Pass Pipeline in a move to handle growing volumes in the Piceance basin in northwestern Colorado.

The $120 million lateral will have a capacity to transport as much as 100,000 b/d of raw NGLs from the Piceance basin to the 110,000 b/d Overland Pass Pipeline, which will extend from Opal, Wyo., to the Midcontinent NGL hub in Conway, Kan. Additional pump facilities would increase Overland Pass Pipeline capacity to 150,000 b/d (OGJ Online, May 5, 2006).

Under long-term NGL transportation and fractionation agreements that are being finalized, Williams will dedicate its NGL production from an existing plant and its newly announced Willow Creek, Colo., natural gas processing plant to the Overland Pass Pipeline via the proposed 150-mile pipeline extension.

Construction on the 14-in. lateral pipeline is expected to begin around mid-2008 with start-up scheduled for early 2009. Upon completion, the lateral will transport volumes from an existing Williams' plant. Volumes from Williams' recently announced Willow Creek plant are expected to be transported in third quarter 2009.

Along with construction expenditures of $433 million for the Overland Pass Pipeline, Oneok Partners is spending an additional $216 million to expand and upgrade its existing NGL fractionation capabilities and the capacity of its NGL distribution pipelines.

Oneok Partners is managing the construction of the Overland Pass project and will be operator of the pipeline. Construction of the Overland Pass Pipeline is expected to begin this fall with start-up expected in early 2008.

Williams, under a previously announced long-term shipping agreement will dedicate its NGL production, currently estimated at about 60,000 b/d, from two Wyoming gas processing plants to Overland Pass Pipeline. Both projects require various state and federal regulatory approvals prior to construction.

West-east gas line build to start late 2008

China National Petroleum Corp. (CNPC) will begin construction of a 6,500-km west-east natural gas pipeline from Xinjiang to Guangdong in August or September 2008, according to Xue Zhenkui, director of the China Petroleum Pipeline Scientific Research Institute in the official Shanghai Securities News. The pipeline, to carry 30 billion cu m/year of gas, is scheduled to complete in 2010.

Pipelaying will begin in Xinjiang where it will parallel China's first West-East gas pipeline to Gansu. The original 4,000 km line—from Xinjiang's Tarim basin to Shanghai—went commercial in 2004. Officials said branch lines eventually would be built to connect the two west-east pipelines and gas fields, forming a gas network to cover the country. They said the network also would link to a gas line from Kazakhstan to China.

First phase of the 10 billion cu m/year China-Kazakhstan cross-border project will be completed in 2009, officials said, while the balance of the project will be finished in 2012, increasing capacity to 40 billion cu m. ✦

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International Pipeline Conference & Exhibition, Moscow, +43 1 402 89 54 12, +43 1 402 89 54 54 (fax), e-mail: pipeline@msi-fairs.com, website: www.msi-fairs.com. 16-17.

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ERTC Coking and Gasification Conference, Paris, 44 1737 365100, +44 1737 365101 (fax), e-mail: events@gtforum.com, website: www.gtforum.com. 16-18.

API Spring Refining and Equipment Standards Meeting, Seattle, (202) 682-8000, (202) 682-8222 (fax), website: www.api.org. 16-18.

SPE Rocky Mountain Oil & Gas Technology Symposium, Denver, (972) 952-9393, (972) 952-9435 (fax), e-mail: spedal@spe.org, website: www.spe.org. 16-18.

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American Institute of Chemical Engineers Spring National Meeting, Houston, (212) 591-8100, (212) 591-8888 (fax), website: www.aiche.org. 22-26.

EnviroArabia Environmental Progress in Oil & Petrochemical Conference, Bahrain, +973 17 729819, +973 17 729819 (fax), e-mail: bseng@batelco.com.bh, website: www.mohandis.org. 23-25.

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Offshore Technology Conference (OTC), Houston, (972) 952-9494, (972) 952-9435 (fax), e-mail: service@otcnet.org, website: www.otcnet.org. Apr. 30-May 3.

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PIRA Canadian Energy Conference, Calgary, 212-686-6808, 212-686-6628 (fax), e-mail: sales@pira.com, website: www.pira.com. 2.

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IOGCC Midyear Meeting, Point Clear, Ala., (405) 525-3556, (405) 525-3592 (fax), e-mail: iogcc@iogcc.state.ok.us, website: www.iogcc.state.ok.us. 6-8.

Middle East Influence on Global Energy and Petrochemical Markets Conference, Manama, (281) 531-9966 (fax), website: www.cmaiglobal.com/EvConferences.aspx?eventid=Q6UJ9A008E3S. 7-9.

GPA Permian Basin Annual Meeting, Midland, Tex., (918) 493-3872, (918) 493-3875 (fax), website: www.gasprocessors.com. 8.

Annual Oil and Gas Pipelines in the Middle East Conference, Abu Dhabi, +44 (0) 1242 529 090, +44 (0) 1242 060 (fax), e-mail: wra@theenergyexchange.co.uk, website: www.theenergyexchange.co.uk. 14-15.

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OIL&GAS JOURNAL

Don't Miss Our Latest LNG Webcast - *A European Perspective*

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LNG WEBCAST OVERVIEW

On April 19, 2007, LNG Observer's Editor, Warren True, will lead a webcast panel discussion on European LNG issues.

The program will reflect the editorial core of Oil & Gas Journal's LNG Observer April-June 2007 issue. Topics will range from an analysis of and forecast for Atlantic Basin LNG trade, an overview of European LNG and natural gas regulation, what will comprise successful LNG terminal projects on the continent, and the European slant on issues of gas quality and interchangeability.

Presenters will be the principal authors of the articles that appear in the most recent LNG Observer.

The International Panel of Industry Experts Includes:

Daniel Rogers (Houston)

Ranked as one of the leading energy and natural resources attorneys in Texas, Daniel Rogers is a partner in King & Spalding's global transactions group. His practice centers on energy-related infrastructure projects and marine transportation projects, representing sponsors, lenders, suppliers, transporters, processors, operators, and marketers. Before joining King & Spalding, Dan was general counsel of the global LNG and Middle East business units of Enron Corp.

Jean-Paul Pinon (Brussels)

Jean-Paul Pinon is a technical adviser to the Belgian Commission for the Regulation of Electricity and Gas. He previously served on the commission since its creation in January 2000, in charge of the operation of the natural gas market. In this behalf he formulated and updated the 10-year plans for gas supply in Belgium and the code of conduct related to gas transmission, storage, and LNG. As chair of the gas working group of the Council of European Energy Regulators, Pinon helped draft the European regulation for gas transmission and the guidelines for good TPA practice for storage system operators. For 6 years, he was managing director of Amasco, a consultancy specializing in energy.

Terry Williams (London)

Terry Williams is business leader for Advantica, Loughborough, UK, and Houston. He has also served as project manager, Foseco International Heat Treatment. He holds a bachelor of science degree in chemical engineering from Aston University and a master's in control engineering from Coventry University. Williams is a UK chartered engineer, a member of the Institution of Gas Engineers & Managers, and a member of the Institute of Measurement & Control.

Thomas Warren (Atlanta)

Thomas Warren is a partner at Sutherland Asbill & Brennan LLP and a member of the firm's LNG group. His practice has focused on complex commercial transactions in the US and internationally, including LNG sale and purchase agreements, terminal-use agreements, terminal-sharing agreements, and other LNG contracts.

April 19, 2007

8:00 am CDT / 9:00 am EDT / 1:00 pm GMT

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EIA offers state profiles

Leena Koottungal
Survey Editor

The US Energy Information Administration has created an entryway to detailed state data on its web site. Called State Energy Profiles, the new feature provides specific energy statistics on each state and allows comparison on different segments of the industry. Energy maps, with symbols and a key, accompany the statistics.

Analysts will find the summarized material an organized source for making observations, drawing conclusions, and keeping up with industry knowledge. The state profile segments provide facts and figures all in one place, enabling efficient research.

US overview

The state energy feature is available at http://tonto.eia.doe.gov/state/. A map of the US on the main page allows industry professionals to view energy distribution (see map below), renewable energy potential, refineries, power plants, and coal mines. A list of states appears under the map. A comprehensive energy profile is linked to each state.

In addition, the US overview contains links to such related reports as regional energy profiles, a state compendium of nuclear power plants, state electricity profiles, and natural gas residential choice programs.

The notes and sources for the state energy profiles are accessible in the reference section of the main page and present the criteria used to select the elements shown on the map. Sources for statistics in the data tables are also available.

At the bottom of the main page are states that lead in production and consumption. This offers researchers an informative national summary.

The web page also has a sign-up area for e-mail updates.

Key facts

Quick energy facts appear as an introduction to each state profile. A state data map displays a closer look at refineries, coal mines, power plants, and renewable energy potential.

Economic statistics in reference to population and per-capita income are in tabular format. This information extends to petroleum and natural gas prices, reserves and supply data, distribution and marketing, consumption, and environment. Links to more energy statistics appear with each section of the table. The information is updated weekly.

Data to grow

The state energy data will soon grow to include written overviews on the effects of fossil fuels, renewables, and alternative energy sources on each state's energy markets. Furthermore, the energy maps will expand to provide a detailed view of the industry. ✦

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For more information please review our product offerings at www.mapsearch.com or contact us directly at 800-823-6277.

Editorial

Price-gouging politics

Decisions about energy policy, important as they are to consumers and taxpayers, should evolve from honest, level-headed discourse. The US instead gets this: "As gas prices rise, so do Big Oil's efforts to deceive the American public."

The statement came Apr. 10 from Rep. Bart Stupak (D-Mich.), sponsor of legislation to make "price-gouging" illegal (OGJ Online, Feb. 28, 2007). Stupak was responding to a study by W. David Montgomery of CRA International for the American Council for Capital Formation (ACCF). The study likens price-gouging laws to price controls, which it estimates would increase the economic losses of a supply disruption as large as those following Hurricanes Katrina and Rita in 2005 by $1.9 billion (see p. 26). It says past price controls have aggravated shortage and worsened conditions for consumers. And it asserts that making price increases that occur during energy disruptions criminal offenses would discourage delivery of the costly replacement supplies consumers need.

Dislikes implications

Stupak naturally dislikes the implication that his price-gouging bill would hurt consumers. Here's the rest of his reasoning from the Apr. 10 statement: "It is not surprising that an organization that receives hundreds of thousands of dollars of funding from Big Oil would produce a study arguing against new price-gouging laws. The fact of the matter is that last May the Federal Trade Commission examined the actions of petroleum producers and refiners following Hurricane Katrina and found that they were gouging consumers. However, even when the federal government found gas price-gouging, they were unable to act because the current law does not adequately address price-gouging."

Even by the low standards of politics, Stupak's argument is flimsy.

ACCF receives financial support from many companies and industries. If its opinions on price-gouging should be discounted on the basis of contributions it receives from oil and gas companies, so should Stupak's. Since 1992, according to the Center for Responsive Politics, he has received $59,550 for his political campaigns from the oil and gas industry. By this logic, Stupak's opinions on labor, health, and construction are even more suspect. He has received $376,250 from industrial unions, $323,207 from health professionals, and $318,350 from building trade unions.

What Stupak calls "the fact of the matter" about the FTC investigation is incorrect. FTC did not find that "petroleum producers and refiners" were gouging consumers. It didn't investigate producers and had no reason to do so; producers don't sell anything to consumers. And while the FTC found a handful of instances in which actions by refiners seemed to meet a technical definition of "gouging," it pointed out that emergency conditions mitigated the apparent offenses. "Our investigation uncovered no evidence indicating that refiners make product decisions to affect the market price of gasoline," the commission said in a summary of its report. "Instead, the evidence indicates that refiners responded to market prices by trying to produce as much higher-valued products as possible, taking into account crude oil costs and other physical characteristics."

The only technical "gouging" the FTC investigation uncovered was by a small number of individual retailers—not producers and refiners—and was limited in extent. "Local or regional market trends, however, seemed to explain the price increases in all but one case," it said.

More problems

Contrary to the implication of Stupak's statement, FTC made no claim about limits to its enforcement powers due to the inadequacy of law. An FTC statement accompanying the study in fact described the report as concluding "that federal gasoline price-gouging legislation, in addition to being difficult to enforce, could cause more problems for consumers than it solves and that competitive market forces should be allowed to determine the price of gasoline drivers pay at the pump."

Stupak's statement is wrong on all counts. Maybe he's unconscionably ignorant about fuel markets and a poor reader. Or maybe he's as deceitful as he unfairly accuses "Big Oil" of being. Either way, his pronouncements and his legislation amount to thorough disservice to American gasoline consumers. They merit no serious attention except as examples of how energy deliberations should not proceed. ✦

Sulfur rules shaping global construction

Leena Koottungal
Survey Editor

Tightening specifications for the sulfur content of gasoline and diesel fuel are shaping global construction in the oil and gas industry.

Oil & Gas Journal's semiannual Worldwide Construction Update shows strong activity for sulfur recovery plants and refinery hydrodesulfurization units.

The update is based on a survey of refining, petrochemical, LNG, gas processing, gas-to-liquids, sulfur recovery, and pipeline projects. Respondents include operators, engineering firms, and construction companies.

Compared with the previous edition of the update, the current survey shows a slight increase in sulfur recovery projects in engineering stages as well as a large number of plans for new and revamped hydrodesulfurization units in several locations (OGJ, Nov. 20, 2006, p. 20).

Following are examples of key projects in each category from a much larger list, details of which appear in tables available online (see box).

Refining

In January, Air Products & Chemicals Inc. brought on stream a second hydrogen production facility in Port Arthur, Tex. The facility supplies high-purity hydrogen to Valero Energy Corp.'s 250,000-b/d refinery and other Gulf Coast refiners. Air Products also plans a second hydrogen facility at Edmonton, Alta., to be completed in 2008. This will be the first commercial plant in Canada to provide hydrogen for upgrading Canadian oil sands, says the company.

Petroperu SA plans to expand its 62,000-b/cd refinery in Talara, Peru, with the addition of a 28,000-b/d distillation unit. The project also will add a 29,000-b/d vacuum unit, 20,000-b/d fluid coking unit, 11,000-b/d catalytic reformer, and 20,000-b/d mild hydrocracker. The project is to be completed in January 2012.

In Brazil, Petrobras is building a 140,000-b/d delayed coker at its 241,500-b/cd Sao Jose dos Campos refinery. Toyo Engineering is contractor for the project. Completion is due in March 2009.

Shell plans a 150,000-250,000-b/d refinery in Sarnia, Ont. Completion is scheduled for 2013.

Petrochemical

China dominates petrochemical construction with its plans for new and expansion projects.

Jilin Chemical (JiHua) Group Corp., a subsidiary of China National Petroleum Corp., let a contract to KBR for basic design engineering for a 200,000-tonne/year (tpy) propylene plant to be built at an existing industrial site in Jilin City, China (OGJ Online, Feb. 13, 2007). JiHua will own and operate the production facility.

The plant will use KBR's Superflex technology, a fluidized catalytic cracking process that converts low-value refinery and ethylene plant streams selectively to propylene, ethylene, and high-octane gasoline.

The unit will be the second of its kind in the world and the first commercial Superflex unit in the Asia-Pacific region, says KBR. The first commercial unit is in start-up phase for Sasol Ltd. in South Africa.

Construction of the tanks for Italy's Adriatic LNG terminal progresses in Algeciras, Spain. Capable of storing 250,000 cu m of LNG, the tanks were floated out in November 2006 to the terminal's site in the Adriatic Sea about 15 km off the Levante Po River. Photo from Adriatic LNG.

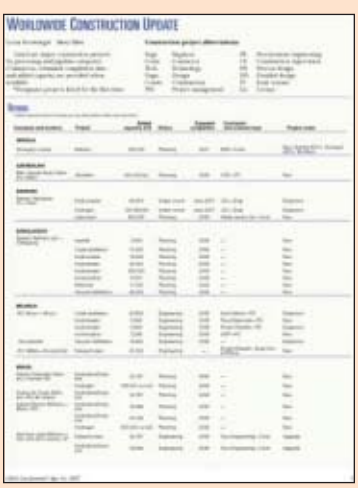
Meanwhile, subsidiaries of China Chemical & Petroleum Corp. (Sinopec), ExxonMobil Corp., and Saudi Aramco jointly signed two separate contracts for a related project to triple capacity at a Fujian Province refinery (OGJ Online, Feb. 27, 2007).

The projects seek to meet China's rapidly growing demand for oil products and petrochemicals.

One contract is for the Fujian Refining & Ethylene Joint-Venture Project, which will increase capacity to 240,000 b/d from 80,000 b/d at the refinery in Quanzhou City. The expanded refinery primarily will refine and process sour Saudi Arabian crude. The project also includes construction of an 800,000-tpy ethylene steam cracker, an 800,000-tpy polyethylene unit, a 400,000-tpy polypropylene unit, and an aromatics complex to produce 700,000 tpy of paraxylene.

Elsewhere, plastics company Borouge signed a $1.3 billion lump-sum, turnkey contract with Germany's Linde Group and Consolidated Contractors Co. for the construction of an ethylene cracker, part of a major expansion project in Ruwais, Abu Dhabi. The 1.5 million-tpy cracker will undergird a tripling of production capacity at the facility to 2 million tpy of polyolefins. The project also includes a 752,000-tpy olefins conversion unit, two 800,000-tpy polypropylene plants, and a 540,000-tpy polyethylene plant. Completion is scheduled for 2010.

OGJ subscribers can download free of charge the 2007 Worldwide Construction Update tables at www.ogjonline.com: Click on OGJ Online Research Center, OGJ Subscriber Surveys, then Worldwide Construction. This link also includes previous editions of the update. To purchase spreadsheets of the survey data, please go to www.ogj.com/resourcecenter/orc_survey.cfm or email orcinfo@pennwell.com.



Planned construction of Petroperu's Talara refinery includes several new processing units as well as expanded crude and vacuum distillation units. Project completion is due in January 2012. Photo from Petroperu.

LNG

Shanghai LNG Co. Ltd. began construction at the end of January on the first phase of its terminal on Zhong Ximentang Island in China's Zhejiang Province. The project will cost $900 million and be operational in 2009, receiving 1.1 million tpy of LNG in the first 3 years (OGJ Online, Nov. 27, 2006). Imports will rise to 3 million tpy about 2012.

In March, Qatar Petroleum and ExxonMobil Corp. announced completion of RasGas LNG Train 5 in Ras Laffan, Qatar (OGJ Online, Mar. 19, 2007). The project was completed in 29 months with a design capacity of 4.7 million tpy of LNG. It will supply gas to northern Europe. Trains 6 and 7 are under construction. These two trains, each with capacity of 7.8 million tpy of LNG, will start up in 2008 and 2009, respectively.

Peru LNG, a consortium of Hunt Oil Co., SK Corp. of South Korea, and Repsol YPF, let a $1.5 billion contract to CB&I for the engineering, procurement, and construction of a 4.45 million-tpy natural gas liquefaction plant in Pampa Malchorita. The contract represents the largest portion of the total $3.8 billion project cost. Hunt estimates that the project will take 4 years to complete.

Gas processing

The South African power company Globeleq let an engineering and project management consultancy contract to Foster Wheeler South Africa (Pty.) Ltd. for expansion of the Songo Songo Island gas processing facility in Tanzania (OGJ Online, Jan. 29, 2007). The project will double capacity to 140 MMcfd.

CDM MAX LLC is building the Grand Chenier gas processing plant in Cameron Parish, La., where several plants were damaged or destroyed by Hurricane Rita in September 2005. CDM is also the owner of the Patterson II Plant in St. Mary Parish.

The project's first phase consists of a 300-MMcfd refrigeration facility. A 300-MMcfd cryogenic gas plant is planned for the second phase. The plant offers the same three recovery modes (dewpoint control, ethane rejection, and deep ethane plus recovery mode) as the Patterson II Plant but has a wider recovery range. The project is scheduled for completion in May and costs $15 million.

In Reynosa, Mexico, Petroleos Mexicanos (Pemex) is building LPG Plants 5 and 6, each with capacity of 200 MMcfd. To be completed in 2008, the plants use Ortloff Engineers technology. The contractors for the project are Linde BOC and ICA Fluor. Plants 3 and 4 were completed in 2006 and also have capacities of 200 MMcfd.

GTL, other gas

Syntroleum Corp. signed a joint development agreement with Kuwait Foreign Petroleum Exploration Co. to join in the development of a 50,000-b/d gas-to-liquids facility in Papua New Guinea. The plant will yield diesel and other products. It will anchor the new Konebada Petroleum Park near the capital city of Port Moresby.

In Qatar, construction began in the third quarter of 2006 on the Pearl GTL complex, which will have two 70,000-b/d trains and associated facilities. Production from the first train is to begin in 2009-10, with start-up of the second train due a year later (OGJ, Aug. 7, 2006, Newsletter). Contracts worth a total of $10 billion have been awarded.

Sulfur

In the US, Fluor is working with several sulfur projects in engineering stages. A project for BP in Cherry Point,

Wash., will process 125 tonnes/day of sulfur from refinery acid gas. The project is to be completed in 2009. A similar project is being completed in Carson, Calif.

Other sulfur projects in the engineering stage are in China, Columbia, India, and other locations.

Pipeline

Falcon Gas Storage Co. Inc. plans to build a 63-mile, 24-in. gas pipeline to serve its expanded 16-bcf capacity Worsham-Steed gas storage facility in the western Barnett shale gas play near Fort Worth, Tex. The 450-MMcfd pipeline is to begin operating Sept. 1.

The pipeline will carry gas southward from the Worsham-Steed facility through Jack, Parker, and Hood counties in Texas. It will connect with two existing 36-in. gas transmission pipelines: the North Texas Pipeline, jointly owned by Enterprise Products Partners and Energy Transfer Partners, and the Atmos Energy Corp. Line X pipeline. In addition to an existing interconnection with Energy Transfer's Old Ocean pipeline at Worsham-Steed, the new pipeline will connect to Devon Energy Corp.'s Acacia pipeline, Atmos's Line WA, and Enterprise's recently announced Sherman extension pipeline, which will move gas from the Barnett shale northeast to Boardwalk Pipeline Partners' Gulf Crossing pipeline system.

Also in the US, Minnesota Pipe Line Co. received approval to construct its $300 million MinnCan pipeline, including a 304-mile, 24-in. oil pipeline from Clearbrook, in northwestern Minnesota, to refineries in Minneapolis and St. Paul. Construction will begin this summer and is expected to take 8 months. The pipeline will be fully operational in 2008 with a capacity of 60,000-165,000 b/d. Two pump stations are planned, one at the Clearbrook station and another at a midpoint pump station in Morrison County near Upsala.

Lukoil-Nizhnevolzhskneft LLC let a subsea pipeline installation contract to J. Ray McDermott SA for the Yuri Korchagin oil field pipeline project, 180 km off Russia in the Caspian Sea (OGJ, Feb. 5, 2007, Newsletter). The project consists of 36 miles of 12-in. pipe connecting the ice-resistant fixed platform No. 1 (LSP-1) to a single point mooring buoy south of Yuri Korchagin field. J. Ray will also provide design engineering, procurement, and testing of the line. ✦

FTC opposes Western Refining's merger with Giant

Nick Snow
Washington Correspondent

The US Federal Trade Commission said it will oppose Western Refining Inc.'s planned $1.4 billion acquisition of Giant Industries Inc. because it would significantly reduce competition in northern New Mexico's light products market.

The commission unanimously approved a complaint challenging the transaction on Apr. 10 and cleared the way for its staff to seek a temporary restraining order and preliminary injunction in federal district court to halt the deal while an administrative trial is held.

Western Refining and Giant Industries immediately issued a statement saying that the federal agency's decision is without basis in law and would be vigorously challenged in court. A hearing schedule on the matter was to be determined in the next few days, they said.

The two independent refiner-marketers compete as bulk suppliers of gasoline, diesel fuel, and other light petroleum products in Albuquerque, Santa Fe, and elsewhere in northern New Mexico, according to Jeffrey Schmidt, director of FTC's Bureau of Competition. "Western's acquisition of Giant would eliminate this competition, leading to higher prices of these important energy products," he said.

The federal agency noted that Giant owns and operates two refineries and adjacent terminals in northern New Mexico at Bloomfield and Ciniza from which it supplies bulk gasoline and diesel to New Mexico, Arizona, Utah, and Colorado. The Scottsdale, Ariz., company also supplies light products to northern New Mexico from its Albuquerque terminal, FTC said.

FTC said Western operates a single refinery in El Paso that supplies gasoline, diesel, jet fuel, and other light products to Albuquerque, El Paso, Phoenix, Tucson, and Juarez, Mexico. The company also is one of two refiners using the Plains Pipeline to ship light products from El Paso to northern New Mexico, it added.

Already concentrated

FTC contends that if Giant is not acquired by Western, it would soon increase the supply of gasoline to northern New Mexico by bringing up to capacity production at its two area refineries and that the merger would prevent this. The combination would substantially increase concentration in an already concentrated market and substantially reduce competition in the bulk supply of gasoline to northern New Mexico, it added.

It also contends that Western "has both the incentive and the means" to limit gasoline supplies to northern New Mexico once the acquisition is complete by diverting some of Giant's planned additional supplies for Albuquerque and Santa Fe to other markets. Western also could reduce supplies into the area by shifting some of its current bulk supply on the Plains Pipeline, FTC said.

Officials of the two companies expressed surprise at the agency's action. "This merger will result in more product being provided to the combined companies' customers and is, therefore,

procompetitive. The FTC's decision demonstrates a fundamental and troubling lack of understanding about the areas in which Western Refining and Giant operate, the competitors in those areas, and the competitive nature of those areas," said Paul L. Foster, Western's president and chief executive officer.

Fred L. Hollinger, Giant's chairman and chief executive officer, noted that the two companies represent less than 1.5% of the nation's total refining capacity, and that FTC has approved mergers and acquisitions in the past several years that have created much larger refining companies. "The employees of both companies have spent countless hours preparing documents in response to the FTC's information requests, and we and our advisors haven't seen anything that we believe would serve as a basis for the FTC to oppose this merger," he said.

The companies said FTC has never suggested the need for divestitures or other potential remedies, and that numerous state and trade association officials submitted letters supporting the merger. They note that the companies are small, independent refiners; that the areas in which they operate are highly competitive and have numerous fuel supply options; that Western has one of the industry's best operations and its expertise would help ensure more reliable gasoline and diesel supplies by improving utilization rates and reducing the risk of unplanned refinery shutdowns; and that the combination would create a more stable organization.

FTC said the proposed merger, which was announced on Nov. 13, 2006, violates Section 5 of the FTC Act and Section 7 of the Clayton Act, as amended. It said it plans to appoint a New Mexico assistant attorney general as a special deputy to the commission to participate in the court action. ✦

US EPA establishes RFS program requirements

Nick Snow
Washington Correspondent

The US government announced a requirement for refiners, blenders, and importers to increasingly use renewable fuels from 2007 through 2012. Officials portrayed the renewable fuels standard (RFS), which was authorized under the 2005 Energy Policy Act (EPACT), as an important step toward meeting US President George W. Bush's goal of reducing domestic gasoline use by 20% within 10 years.

US Environmental Protection Agency Administrator Stephen L. Johnson, US Department of Energy Sec. Samuel W. Bodman, and National Highway Traffic Safety Administration Chief Nicole R. Nason told reporters that the RFS would help domestic renewable and alternative transportation fuel use climb to 35 billion gal/year by 2017.

For 2007, the RFS establishes a renewable fuel share of 4.02%, or roughly 4.7 billion gal, of the total motor fuel consumed in the US. By 2012, the equivalent of at least 7.5 billion gal will be required as part of the US motor fuel mix.

Officials said that the program will promote the use of ethanol, biodiesel, and other petroleum alternatives, as it establishes special incentives to produce and use motor fuels produced from switch grass, wood chips, and other cellulosic biomass. It also will use a trading system to give fuel producers flexibility in using the most economical alternatives, they added.

An RFS standard is only the first step, according to Nason. "We must also continue to improve the efficiency of our passenger cars and light trucks. As a part of the president's '20-in-10' energy security plan, we need Congress to give the secretary of transportation authority to reform the current passenger car fuel economy standard," she said.

Charles T. Drevna, vice-president of the National Petrochemical & Refiners Association, said EPA has issued a reasonable framework to implement EPACT's renewable fuel provisions. "NPRA believes that the RFS credit program—the core of the program—must be understandable, allow unambiguous enforcement, and promote adequate flexibility for refiners and gasoline importers," he said. ✦

IOGCC issues guidebook of produced water data, research

Nick Snow
Washington Correspondent

The Interstate Oil & Gas Compact Commission has issued a guidebook cataloguing produced water data and water processing techniques used by oil and gas operators across the US.

The guidebook contains results of research funded by the US Department of Energy's National Energy Technology Laboratory and conducted by IOGCC and ALL Consulting. Researchers visited more than 80 production facilities in 25 states with regulators and operators as part of the study.

"What has historically been viewed as a waste that was efficiently disposed of in a cost-efficient and environmentally sound manner can now be efficiently managed and used as a valuable resource," said Dan Arthur, a partner in the Tulsa consulting firm.

IOGCC noted that US oil fields

WATCHING GOVERNMENT

Nick Snow, Washington Correspondent

Price-gouging salvos begin

The US summer driving season is 6 weeks away, and the first gasoline price-gouging salvos of 2007 have been exchanged.

At a US Federal Trade Commission conference on energy markets and competition, Cambridge Energy Research Associates Inc. Chairman Daniel Yergin attempted to put concern about gouging in the context of lessons from the energy crises of the 1970s.

One such lesson, he said, is that tight supplies and elevated prices are most effectively relieved when markets work without government interference.

"The question the FTC will have to confront is what this word 'gouging' means and whether it's necessary to intervene," Yergin said. "It could look politically attractive. But to intervene quickly would simply interfere with the market's ability to respond."

Meanwhile, the American Council on Capital Formation released its own study concluding that price-gouging legislation would do more harm than good. Former US House members Bill Archer (R-Tex.) and Charles Stenholm (D-Tex.), who are on ACCF's board, suggested that a price-gouging bill simply is an indirect effort to control prices.

Likely impacts

The study concluded that price controls, if they had been implemented as current legislation recommends during supply disruptions following Hurricanes Katrina and Rita in 2005, would have cost consumers an additional $1.9 billion.

Controls also would have prolonged the disruption by discouraging refiners and marketers from securing higher-price supplies from other sources, it said.

"The fact that the US continues to import a significant amount of gasoline from foreign producers should give great pause to legislators seeking to impose price-gouging legislation," Archer said. "In the event of a disaster and potential price caps, foreign producers simply will sell their products in other countries at higher prices—ultimately harming the very consumers the controls were meant to protect."

AACF said price-gouging bills, such as the one recently introduced by Rep. Bart Stupak (D-Mich.), have vague criteria for determining when a violation occurs and ambiguous definitions of price-gouging, which would lead to market disruptions (OGJ Online, Feb. 28, 2007).

Not surprised

In a response to reporters, Stupak said he was not surprised that AACF, which he called "an organization that receives hundreds of thousands of dollars in funding from Big Oil," would produce a study critical of price-gouging legislation. "Last May, the FTC examined the actions of petroleum producers and refiners following Hurricane Katrina and found that they were gouging customers."

In its May 22, 2006, report on gasoline price increases following the 2005 hurricanes, the FTC said it found 15 instances that fit the definition of "gouging" in legislation at the time, but added, "Other factors, such as regional or local market trends, appeared to explain these firms' prices in nearly all cases." ✦

produced 20-50 times more water than crude, which traditionally has been a problem for the industry. Currently, each of the oil and gas producing states making up IOGCC's membership are responsible for regulating produced water in accordance with its specific geology and geography.

US oil and gas operations produce 14 billion bbl/year of water, according to IOGCC. It pointed out that the Permian basin of Texas and New Mexico produces huge volumes, with only a small percentage suitable for irrigation. The Powder River basin in Wyoming and Montana produces only modest volumes, but most of this can be used for irrigation, it said.

Guidebook's features

Arthur said the guidebook will help state and federal authorities develop produced water regulations, which will encourage beneficial uses while protecting each region's environment. Oil and gas producers also can use it to plan produced water stewardship as they move into new areas, IOGCC said.

Technology transfer recommendations in the guidebook also may prove useful as operators try to maintain economic production from older fields that have progressed to higher water-to-oil ratios, it added. IOGCC said the guidebook also will provide operators a valuable reference as they pursue unconventional resource plays such as the Barnett shale or coalbed methane, which can involve unusually high initial water production rates.

The guidebook assembles operational parameters of produced water management strategies, leading edge water treatment technologies, and water reduction techniques into a catalogue of currently available practices. Many of these already are being used while others require more field trials, according to IOGCC.

Water quality data from many important US onshore oil and gas basins also are listed, with case studies providing examples of water stewardship successes and specific lessons to be learned.

The guidebook also organizes water quality data in a geo-spatial framework "alongside average rainfall, evapo-transpiration, and population density" to identify US areas where water stewardship is important and beneficial use of produced water is vital.

Lastly, the guidebook can help educate landowners near oil and gas fields, concerned consumers, and environmental groups about the issue, IOGCC said. ✦

Shell to pay $353 million in reserves settlement

Royal Dutch Shell PLC agreed to pay $352.6 million, plus administrative costs, to investors outside the US in a settlement related to a series of reserves writedowns. Shell admitted no wrongdoing in the settlement. Investors had said the oil and gas major was involved in improper accounting for oil and gas reserves during 1997-2003.

The company reclassified reserves five times in a little over a year (OGJ Online, Feb. 4, 2005).

In an Apr. 11 news release, Shell said it agreed to settle with a group of European and other investors outside the US. Parties to the settlement involve institutional investors including Dutch pension funds led by Stichting Pensioenfonds ABP. Others are organizations representing individual shareholders in the Netherlands and the Shell Reserves Compensation Foundation, a settlement foundation.

The agreement depends on the Amsterdam Court of Appeals declaring the settlement binding for all of the shareholders that it covers and is subject to agreed opt-out provisions. Regarding US investors, Shell intends to offer a proportional settlement to them, pending approval from the US court overseeing the case.

A legal director for Shell told reporters at a news conference in London that the firm plans to offer US investors an $80 million settlement.

In addition, Shell is asking the US Securities and Exchange Commission to distribute to shareholders the $120 million that Shell paid in 2004 under a consent agreement resolving the SEC's investigation into Shell's reserves recategorization.

Grant & Eisenhofer PA attorney Jay Eisenhofer said it was an unprecedented settlement of a large-scale European shareholder dispute. His law firm represented the investor group and the special purpose foundation. Grant & Eisenhofer is based in Wilmington, Del., and New York

"The scale of recovery and the sheer collective unity of the investor group are both unique in a European context," Eisenhofer said, noting that the shareholder class involved a broad swath of public pension funds. ✦

SPE industry groups approve new reserves definitions

Society of Petroleum Engineers (SPE) board members approved a new Petroleum Resources Management System, ending 2 years of collaboration by SPE, the World Petroleum Council (WPC), the American Association of Petroleum Geologists (AAPG), and the Society of Petroleum Evaluation Engineers (SPEE).

The boards of the other societies also approved the system following industry review and comment. Coordinated by the SPE Oil and Gas Reserves Committee (OGRC), the new system consolidates and replaces guidance contained in the 1997 SPE-WPC Petroleum Reserves Definitions, the 2000 SPE-WPC-AAPG Petroleum Resources Classification and Definitions publications, and the 2001 SPE-WPC-SPEE Guidelines for the Evaluation of Petroleum Reserves and Resources. The new system also includes the 2005 SPE-WPC-AAPG Glossary.

ORGC Chairman John Ritter, senior director, worldwide reserves and reservoir engineering, Occidental Petroleum, said previous guidelines were "not sufficiently rigorous or encompassing to meet the requirements of industry stakeholders due to advancements in technology, the international expansion of the industry, and the increasing role of unconventional resources." The 2007 system builds on industry efforts to achieve consistency in estimating reserves (OGJ, Oct. 23, 2006, Newsletter).

The old and new resource classification remains basically the same. The new system explains the classification in 30 pages, plus a glossary, compared with a 4-page explanation for the 2000 classification. The new explanation emphasizes project-based resources and makes recommendations on various topics, including aggregating methods and economic criteria.

The primary updates are:

- Categorization is based on quantities recovered by applying a defined project to a reservoir base case that uses the evaluator's forecast of future conditions (including prices and costs, technology available, environmental standards, fiscal terms, and regulatory constraints) but permits an option to use constant conditions.
- Recognition of the growing importance of unconventional resources (including bitumen, oil shale, coalbed methane, and gas hydrates).
- A way to enable low, middle, and high categories of contingent resources.
- An introduction of classification modifiers. ✦

COMPANY NEWS

IOC, OIL move for Congo assets suffers setback

A move last month by India's Indian Oil Corp. (IOC) and its partner Oil India Ltd. (OIL) to acquire French energy firm Maurel & Prom's (M&P) assets in the Republic of Congo (Brazzaville) has hit a stumbling block.

The state-owned combine had offered $1.5 billion, which was $66 million more than an existing offer from Italy's Eni SPA, for the assets in the producing M'Boundi and Kouakouala oil fields and a few other exploration areas in the Congo.

In other recent company news:

• Offshore drilling contractor Hercules Offshore Inc. agreed to acquire its larger peer Todco in a $2.3 billion stock and cash transaction.

• KazMunaiGaz Exploration & Production JSC (KMG EP) is carrying out due diligence toward purchase of a 33% stake of PetroKazakhstan and also is assessing whether to acquire a 50% stake in Nations Energy, said KMG EP Chief Executive Askar Balzhanov in an interview.

• Elixir Petroleum Ltd., London, and Gawler Resources Ltd., Perth, last month agreed to merge their oil and gas E&P businesses in a stock deal.

• Gaz de France's UK subsidiary GDF Britain Ltd. has acquired interest in 10 offshore licenses from CGC Veritas. Seven are in the North Sea area and three are west of the Shetland Islands on the UK continental shelf.

• DONG Energy has agreed to acquire ConocoPhillips Petroleum International Corp. Denmark for $300 million from Phillips Petroleum International Corp.

• Japan's Itochu Corp. said it has obtained concessions in 15 natural gas fields in the Gulf of Mexico by acquiring properties belonging to Range Resources Corp.

• Veneco Inc. recently signed two separate agreements with two undisclosed companies to acquire properties in California and Texas for a combined net cost of $106 million.

• Five Perth-based companies have formed an alliance to collectively acquire oil and gas projects worldwide, and the group said it initially plans to focus on Africa.

• Kinder Morgan Energy Partners LP agreed to buy and operate Vancouver Wharves, a bulk marine terminal, from British Columbia Railway Co.

IOC, OIL setback

M&P owns 48.6% interest in M'Boundi oil field and 66% interest in Kouakouala A field. It was looking to sell these rights to Eni, along with 50% equity in Kouakouala B, C, and D blocks, and a 50% exploration interest in Kouilou.

IOC-OIL's bid was placed through UK-based Burren Energy, which is M&P's minority partner in the Congo assets and holds pre-emptive rights.

The Eni transaction fell through after Burren refused to waive its right of preemption to the stake. Burren has 31.5% equity in M'Boundi and a 25% interest in Kouakouala. It has been reported that the company wants to operate the Congo fields.

The tentative plan was that, by exercising its preemption right, Burren would acquire M&P's interest in the fields and then resell most of it to IOC-OIL combine through a back-to-back agreement.

As per the proposal, Burren was expected to block the old agreement between M&P and Eni, which would have seen the stake transferred for a total consideration of $1.43 billion. However, Burren has now withdrawn from negotiations with IOC and OIL, and the Indian duo believe that the "chapter is closed."

The oil fields have 1.4 billion bbl of OOIP and produce high-quality crude. Had the sale gone through, IOC-OIL would have added 17,000 b/d of oil production from the M'Boundi field in 2007. That figure was slated to increase to 28,000 b/d by 2010.

Hercules-Todco deal

The Hercules-Todco combined company will operate 33 jack up rigs, 27 barge rigs, 64 liftboats, 3 submersible rigs, 9 land rigs, and 1 platform rig. It will operate in 10 countries on five continents.

The boards of Todco and Hercules, both based in Houston, unanimously approved the transaction. Closing, expected in midyear, is subject to regulatory approvals and shareholders approval.

Upon completion, Todco shareholders will own 64% of the resulting company and Hercules will own 36%.

Terms call for Todco shareholders to receive 0.979 share of Hercules Offshore and $16/share in cash for each share of Todco stock.

KMG EP-PetroKazakhstan deal

KMG EP's Balzhanov told OGJ last month these propositions are attractive because they have good fields and excellent internal efficiency. Acquiring additional assets would help KMG EP achieve significant growth and position itself as a national champion, he added. "We want to be the second biggest oil producer in Kazakhstan." At present, it is third.

KMG EP wants to increase oil production by 50% and boost its reserves by 35-40%. In 2006, it produced 192,000 b/d of oil from assets in western Kazakhstan and holds 1.5 billion bbl of proved and probable reserves.

PetroKazakhstan, purchased by China National Petroleum Corp. in 2005 for

WATCHING THE WORLD

Eric Watkins, Senior Correspondent

No cigar in Tokyo

Oil and gas were on the agenda when Japanese Prime Minister Shinzo Abe and Chinese Premier Wen Jiabao met in Tokyo last week seeking to build "mutually beneficial strategic ties and a steady improvement in relations."

Ahead of their talks, Abe praised Wen's visit as "a big step forward" toward nurturing the strategic relationship, while Wen said his trip "will lead to significant achievements and reflects both sides' desires."

Afterward, the two nations issued separate joint statements on boosting environmental and energy cooperation. Abe and Wen were also expected to issue a joint document confirming collaboration in areas of common interest.

A joint statement signed by the two countries' foreign ministers featured a commitment of "political will" to fight global warming in a new climate change framework beginning in 2013.

Nuclear agreement

Japan and China also agreed in a statement by their ministers in charge of industry and state development to boost tie-ups in promoting energy saving in China utilizing Japanese technology. They even reaffirmed cooperation in construction of nuclear power plants.

Along the way, the two sides actually signed an accord to lift China's four-year ban on imports of Japanese rice, with the first 25-ton shipment aimed at high-end Chinese consumers due to arrive in Beijing and Shanghai in July.

But the two sides did not say much about oil or gas, certainly not the Russian oil they both are squabbling over, or the disputed gas they both want at the bottom of the East China Sea.

The Russian oil—and the East Siberia Pacific Ocean pipeline that will transport it—must be a sensitive topic between the two Asian nations. After all, it was China that first broached the subject of such a pipeline with Russia several years ago.

Sounds of silence

But memory is short and desire is long, especially in Russia where a crafty old Kremlin saw—and has since exploited—competition between Japan and China over supplies of oil and gas.

Even now, with the ESPO system under construction, Russia continues to play the two sides against each other in an effort to extract more concessions from them—and we don't mean oil concessions. No, plainly and simply, the Russians want more cash.

As for the gas beneath the East China Sea, well, the Russians have no part in that disagreement. Intransigence there is strictly between the Japanese and Chinese, and both sides seem pretty determined in their own views.

Put simply, the Chinese are drilling in waters they consider their own, while the Japanese see those waters—and the gas—as belonging to both sides. Up to now, there has been no agreement on anything to do with the area.

Make no mistake: oil and gas were on the agenda of both countries. Very clearly, though, they were on the unspoken agenda. ✦

$4.2 billion, produces 110,000 b/d of oil. Nations Energy, recently bought by China's Citic Group for $1.9 billion, produces 45,000 b/d of oil. Karazhanbas oil field is the main asset of Nations Energy in Kazakhstan.

Balzhanov expects to submit an internal report to KMG EP's board within the next couple of months about these possible acquisitions, he said.

In addition, KMG EP has offered its parent company, JSC National Co. KazMunaiGas, $1.07 billion for a 50% stake in National Kazgermunai LLP. KMG EP's shareholders are to vote on that offer Apr. 12. Balzhanov said it was pursuing the deal because the company produces 60,000 b/d of oil from young fields and has a favorable tax regime. KMG EP will meet investors in Boston and New York to discuss the acquisition.

KMG EP also is in early talks with western majors about asset swaps so the company can diversity its portfolio, he added, but he declined to give details.

"With oil price increases and greater competition in the sector, we don't want to be lost in the process," Balzhanov said. "We want to integrate with the international oil industry and recognize that we must play the rules of the game. We have adopted standards and procedures used by western majors and adopted a code of corporate governance to be more transparent."

Elixir-Gawler merge

Elixier will be the continuing company, and its headquarters will be in Perth with an office in London, the companies said in a news release. The value of the overall transaction was not finalized.

Elixir shareholders will represent 52% of the resulting company, and Gawler shareholders, the remaining 48%.

The merged group will combine Gawler's Gulf of Mexico production with Elixir's North Sea exploration.

The combined company will include Gawler's 30% working interest in the High Island A268 oil and gas development project in shallow water off Texas.

The project is scheduled to come on stream in September at gross rates of 20 MMcfd.

Elixir's exploration assets are interests in nine UK North Sea exploration licenses comprising nine blocks or partial blocks.

GDF Britain buys blocks

GDF Britain's transferred licenses include a 15% stake in an appraisal well operated by Maersk Oil that is planned for the second quarter on the Ockley discovery on Block 30/01d and a 30% stake in an appraisal well operated by Venture Production Co. on the Milburn discovery on Block 22/22c, to be drilled later this year.

The other assets include a 10% stake in the Handcross prospect on Block 204/19c, which lies west of the Shetlands, plus 10% in each of 204/14c and 204/15 in the same area.

Three other assets were 100% acquired in the 23rd Round: Blocks 20/05b, 22/05c, and 20/04f. In the 24th Round, 100% of 29/04g also was acquired.

DONG Energy's Danish assets

With the acquisition, DONG Energy will assume control of ConocoPhillips's equity in three Danish licenses—Hejre, Hejre Extension, and Svane, all of which ConocoPhillips Denmark currently operates.

Following the acquisition, DONG Energy will operate all three licenses and will own 50% of the Hejre license. ConocoPhillips currently holds a 30% share of Hejre, and DONG Energy, 20%.

DONG Energy estimates the ConocoPhillips Denmark 30% share in the Hejre license represents 35-40 million boe, of which 2.5-3 billion cu m is gas.

Equity amounts and reserves estimates were not identified for the Hejre Extension and Svane licenses, which DONG Energy said include "discoveries and further exploration potential."

Range divests GOM fields

Separately from Itochu's purchase of the GOM fields, Range Resources said it had sold its Gulf of Mexico properties, which includes its interests in 37 platforms in 11-240 ft of water, for $155 million.

At yearend 2006, Range estimated that the properties contained proved reserves of 40 bcf of gas equivalent. It characterized the division's wells as having "high initial rates and relatively short reserve lives."

Veneco buys fields

In one agreement, Veneco will acquire West Montalvo field in Ventura County, Calif. The field, discovered in 1951, has 243 million bbl of oil in place, with only 10% recovered. It is within 5 miles of Veneco's Hastings field.

PERSONNEL MOVES AND PROMOTIONS

ExxonMobil makes executive appointments

ExxonMobil Corp. has made several executive appointments.

The major has elected **M.W. Albers** senior vice-president. He will become a member of the company's management committee and assume certain responsibilities for its upstream businesses.

Prior to his appointment, Albers held various managerial positions in development, operations, production, and engineering. Most recently, he served as president of ExxonMobil Development Co. following his role as EMDC vice-president, Africa, Chad/Nigeria.

Albers also served as executive assistant to ExxonMobil's chairman and president at the company's Irving, Tex., headquarters. Prior to that, he served as Alaska interests manager and production manager for the Western US.

After several assignments in Texas and New Jersey, in 1991 Albers transferred to Esso Australia in Melbourne as technical manager and later became operations manager. He has been with the company since 1979.

Separately, **N.W. Duffin**, executive vice-president of EMDC, was appointed president of EMDC, succeeding Albers.

Duffin joined Mobil Oil Co. in the UK in 1979 and has held various managerial positions in production, operations, and development.

In 1992, he served as producing advisor for Europe and Africa based in Fairfax, Va. In 1995, he transferred to Aberdeen as operations and northern North Sea manager and in 1998 was named senior vice-president, Mobil Oil Indonesia. After the Exxon-Mobil merger, Duffin became vice-president, EMDC, with responsibility for projects in Russia-Caspian Sea and the Middle East. He later served as vice-president, Africa, for ExxonMobil Production Co.

Other moves

Toreador Resources Corp. has made several appointments within its E&P division.

The company has appointed **Michael J. Fitzgerald** executive vice-president, E&P.

Previously Fitzgerald served as Toreador's senior vice-president, E&P. He joined the company in late 2001 as part of the acquisition of Madison Oil Co., which he cofounded, and served as vice-president, exploration, since 1992. Before that, he worked for Triton Energy Corp., Dallas, for more than 10 years. He began his career as an exploration geologist for Texaco Inc. in New Orleans in 1972.

Edward Ramirez, Toreador's vice-president, technical, was promoted to senior vice-president, E&P, succeeding Fitzgerald. Ramirez joined Toreador in 2001, also as part of the acquisition of Madison, which he joined in 1993. He began his career as an interpretation geophysicist with Mobil Oil Corp. in 1974, working primarily on evaluation of seismic data in East Asia and the Gulf of Mexico. He joined Triton Energy Corp. in 1980 and served as a geophysicist and geophysical manager through 1989. After that, he served as an international marketing manager and international coordinator at Schlumberger-Geco-Prakla in Houston.

Senior International Geophysicist **William J. Moulton** was appointed vice-president, technical, succeeding Ramirez. Prior to joining Toreador earlier this year, he was a consultant to Toreador on the South Akcakoca Subbasin project in the Turkish Black Sea since mid-2004. He has been working as a geophysical consultant since 2000. Prior to that, he served as manager of advanced imaging services for Geotrace Technologies. He has previously worked for Snyder Oil Corp. (now Devon Energy Corp.) and Enserch Exploration Co. (now Newfield Exploration Co.) as an exploration geophysicist.

Bill Barrett Corp., Denver, has appointed **R. Scot Woodall** senior vice-president, operations.

Woodall has more than 20 years of operational experience, including drilling, completions, production, and facilities. He most recently served as senior vice-president, Western US, at Forest Oil Corp.

Previously he worked for Amoco Production Co. as senior petroleum engineer and operations engineer and for Santa Fe-Synder Corp. as senior operations engineer and, later, as operations and engineering manager.

Veneco Pres. Bill Schneider said the field has seen limited capital in the last decade. In addition to the fee leasehold, the field includes a largely undeveloped offshore portion under lease from the State of California that is easily reachable from onshore locations.

The other agreement covers the acquisition of several Texas Gulf Coast fields, including Manvel field in Brazoria County, which is similar to Veneco's Hastings field.

Since acquiring Hastings last year, Schneider said, Veneco has completed over 100 workovers in the field, increased production by more than 35%, and added 3 MMboe to proved reserves.

"We see the same type of potential in the Manvel field," he added, "particularly since both produce from Frio sands and are very similar geologically."

Veneco initially plans to return idle wells to production, enhance the lift systems, and upgrade the facilities. This work is expected to yield results similar to that in Hastings field of increased

daily production and proved reserves.

Schneider said studies may prove Manvel to be a good candidate for CO_2 flooding.

The properties being acquired have an estimated combined total proved reserves of 9.7 million boe and proved plus unproved conventional reserves of 14.7 MMboe as of Dec. 31, 2006. Conventional reserves do not include reserves from tertiary recovery methods. There are 75 wells on the properties, and the two acquisitions should add over 500 boe/d to Veneco's average net production this year.

Perth alliance formed

Conceived by Baraka Petroleum Ltd., the Perth-based alliance of companies also includes Beach Petroleum Ltd. of Adelaide, Arc Energy Ltd., Adelphi Energy Ltd., and Advanced Well Technologies Pty. Ltd., all of Perth.

They signed a memorandum of understanding to pool resources in seeking, evaluating, and acquiring projects.

A spokesman from Baraka said the alliance's creation will allow member companies to jointly acquire projects of a magnitude that probably would not be possible for any of them acting alone. They will be looking at projects in the $20-100 million range.

Baraka's general manager, Mark Fenton, who originated the idea, says it will "allow the companies concerned to punch well above their weight."

He said it also reduces the overall risk and pools complementary resources to ensure the most-efficient use of each company's financial and human resources.

The companies have signed confidentiality and noncompete agreement as well as a joint evaluation agreement.

Unlike a joint venture, no company is obligated to take part in all or any of the opportunities that are brought to the table. The alliance will be flexible, enabling a sharing of costs through the various stages of a project, and companies can elect to discontinue participation at various agreed-on points in a project.

Projects to be contemplated include production, rejuvenation, development, near-field exploration, and frontier exploration.

The alliance will start immediately, initially evaluating prospects in Africa where Baraka already is a key player in Mauritania and Mali.

KMEP to buy terminal

Terms and value of KMEP's transaction were withheld pending closing, which is expected in the second quarter, a KMEP spokesman said.

Vancouver Wharves involves five vessel berths on a 139-acre site. Terminal assets include rail infrastructure, dry bulk and liquid storage, and material handling systems. ✦

East Texas Deep Bossier gas deliveries expanding

The East Texas Deep Bossier gas play is growing fast with some of the country's highest-delivering wells and a lot of room to grow.

Dry gas production from the Amoruso area alone topped 200 MMcfd in early April 2007, having doubled since February 2007 due to the hookup of several high-rate wells. The Robertson County area's production rate could double again before the end of 2007, one participant said.

Amoruso is considered one of the five largest US onshore discoveries in the past decade.

While drilling to the Bossier at 14,000-18,000 ft, operators have seen good potential in shallower pay zones that have yielded good recoveries throughout the East Texas basin. These include the Upper Cretaceous Austin chalk and Woodbine, Lower Cretaceous Georgetown, Rodessa, James, Pettit, and Travis Peak, and Upper Jurassic Cotton Valley.

Operators expect to ultimately recover several trillion cubic feet of gas from the area, but it is too early to be precise about the total.

Amoruso prospect

EnCana Oil & Gas (USA) Inc. has operated all but one of the wells drilled so far at Amoruso, namesake of geologist John J. Amoruso, under its 50-50 agreement with Leor Energy LP, private Houston independent (OGJ, Oct. 23, 2006, p. 20).

An application has been filed for official designation as Amoruso field.

Leor Energy operated the discovery well, McCullough-1, completed and placed on production in late 2005. The companies had 19 wells producing in early April, several more were to go on line through mid-June, and eight rigs were running.

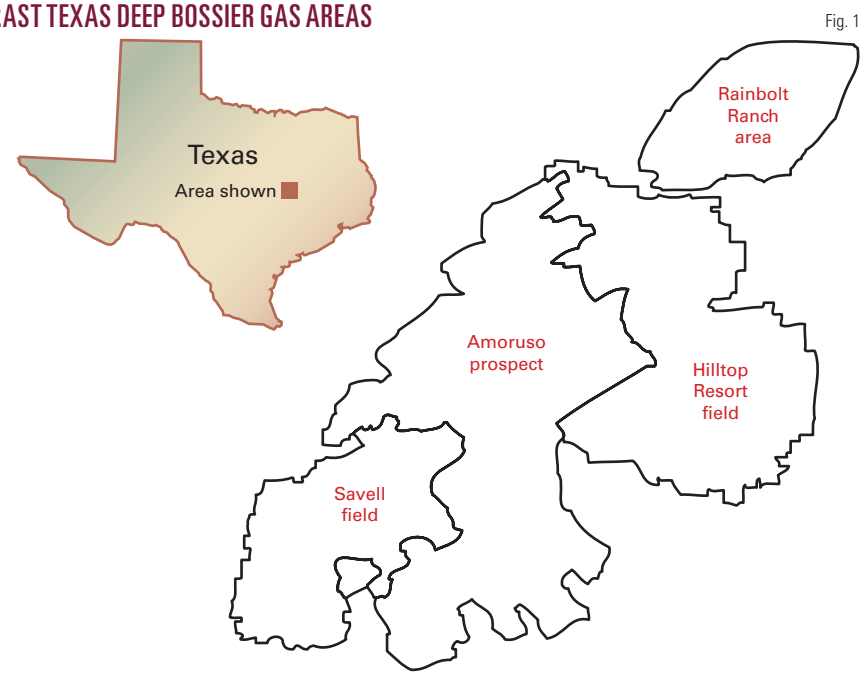
A well to 16,000 ft takes 75-80 days at an average $8 million to drill and complete. Crews face hard drilling in complex geology and pressures of 15,000 psi in the Deep Bossier, said Guma Aguiar, vice-chairman and chief executive officer, Leor Energy.

Initial production rates probably average 10-15 MMcfd, but several of the wells have started out at 45-55 MMcfd, Aguiar said.

In the last 10 years, he said, only 26 US wells have made 1 bcf of gas or more in their first 30 days on produc-

EAST TEXAS DEEP BOSSIER GAS AREAS

Fig. 1



tion, and three of the top 10 wells are in the Amoruso area. Initial production rate averaged 17 MMcfd at the last 13 wells and 22 MMcfd at the last six wells, Aguiar said.

He expects many wells to yield 80% of their estimated ultimate recovery in 3-5 years and have producing lives of 15-20 years. Leor projects EUR of 2-3 tcf net to its Amoruso area interest excluding development upside.

Initial data are to be delivered in the third quarter from a large 3D seismic survey in Robertson County supported by Deep Bossier operators EnCana, Leor, ConocoPhillips, Gastar Exploration Ltd., and Chesapeake Energy Corp.

The program for the rest of 2007 calls for offsetting some of Amoruso's best wells, working on 640-acre units. Aguiar estimates that EnCana has drilled only 1-2% of Amoruso's 55,000 acres.

Other fields

Several other fields are under development in the Deep Bossier and shallower formations.

Chesapeake Energy Corp., Oklahoma City, acquired 16.5% of Gastar and a 33% working interest in Gastar's 26,000 net acres in Hilltop Resort field, Leon and Robertson counties (OGJ Online, Nov. 15, 2005).

Gastar said its 2006 Deep Bossier reserves increased 86% to 21 bcfe after production of 2.9 bcfe, but the numbers don't reflect late-2006 successful wells, and gross East Texas gas sales nearly doubled as of Mar. 31 from the end of 2006.

Log analysis showed that Gastar's Lone Oak Ranch-2 well, TD 18,100 ft in Leon County, cut 36 ft of apparent net pay in two Bossier sands and was being cased at the end of March.

Gastar was drilling the Wagner-1 and Donelson-3 offset wells. Other recent completions were John Parker-2, Williams-1, and Wildman Trust-2. LOR-2 was in completion, and further production growth was expected in the second quarter from 22 MMcfd in mid-March, Gastar said.

ConocoPhillips is working to the north in the Rainbolt Ranch area.

Expanding play

EnCana and Leor are in early drilling stages of another project farther east.

Project Houston, aimed at Deep Bossier gas and the same bailout zones as in Robertson County, takes in 100,000 gross acres in Angelina, Houston, Nacogdoches, and Trinity counties.

The first well there was disappointing, but the second well has raised high expectations, Aguiar said. ✦

Petrobras set to invest $1 billion in Ecuador

Peter Howard Wertheim
OGJ Correspondent

Brazil's state-owned Petroleo Brasileiro SA (Petrobras) and Ecuador's state oil firm Petroecuador signed a memorandum of understanding Apr. 5 to develop Ecuador's Ishpingo-Tiputini-Tambococha oil fields in the Amazon region.

This area of fields already has five discoveries with a potential output of 190,000 b/d of oil that could double after 4 years of exploration.

The fields are in the remote easternmost Oriente Province in Ecuador's Yasuni National Park, a UNESCO Biosphere Reserve (see map, OGJ, July 10, 1995, p. 32). They hold nearly 1 billion bbl of crude reserves, said Ecuador's President Rafael Correa in Brazil during a visit to Brazil's President Luiz Inácio Lula da Silva. With the MOU, Petrobras joins a consortium of Chile's state-owned oil company Empresa Nacional del Petróleo (ENAP) and a unit of China's state-owned Sinopec.

They signed the MOU committing to present an exploration program to Ecuador in the next few months with concrete proposals for protecting the region's highly vulnerable ecosystem.

Ishpingo has 16° gravity oil in Cretaceous Hollin. Tiputini is a 1970 discovery that contains 18° gravity oil. Tambococha also dates to the early 1970s, as does Petrobras's interest in operating in the area.

Lula said Brazil will invest $1 billion in oil and gas exploration and biofuels projects in Ecuador until 2010. The two countries also signed agreements to jointly produce biofuels and ethanol in Ecuador using Brazilian technology.

Brazil is the world's number one sugar producer and exporter, and the leading exporter of ethanol made from sugarcane. It also is the world's second-largest ethanol producer after the US and is ramping up production of soybean-based biodiesel.

Correa said Ecuador will return as a member of OPEC, although he didn't say when. Ecuador was a member until the 1990s, when it failed to meet its export quotas. ✦

Barbados

Barbados plans to launch an offshore oil and gas licensing round with promotional meetings June 1 in Bridgetown and June 8 in Houston.

Barbados National Oil Co. produces more than 1,000 b/d of oil from fields on the island, which is refined in Trinidad and Tobago, but the country has no offshore E&P activity.

The energy and environment ministry intends to publish bidding procedures in September and will invite bid submissions to be made in October or November.

Iraq

A group led by Petoil of Turkey reached TD of 11,007 ft at the Bina-Bawi-1 exploratory well in northern

Iraq's Kurdistan region and awaits material and testing equipment.

The group plans to test at least three zones, said partner Calibre Energy Inc., Washington, DC. It also plans to drill the Bina-Bawi-2 appraisal well to test prospective intervals in the Upper Cretaceous. Bina-Bawi-1 recovered oil from Upper Cretaceous at 1,800-2,460 ft during a fishing job earlier this year.

The well is on the 30 by 10 km Bana-Bavu structure on an exploration and production sharing contract area of the same name in the northern Zagros fold belt 45 miles north of supergiant Kirkuk oil field. Objectives on the structure are in formations of Triassic, Jurassic, and Lower Cretaceous age.

Mali

Mali's Authority for the Promotion of Oil Research in Mali (AUREP) formally approved transfer of operatorship of blocks 1, 2, 3, 4, and 9 in the Taoudeni basin to Eni SpA from Baraka Petroleum Ltd., Perth.

The proposed work program calls for magnetics and gravity interpretation studies, seismic feasibility studies, and the start of a 4,000 line-km 2D seismic survey in late 2007. The five blocks total 193,200 sq km.

Interests are Eni 50% and Sonatrach International Petroleum Exploration & Production BVI 25%. Baraka retains 18.75% participating interest, will recoup past costs, and is carried for up to $10 million starting Apr. 28, 2007.

Niger

CNPC International Tenere Ltd. spudded the Fachi West-1 exploration well on the 17.3 million acre Tenere Block in Niger.

The drill site is 27 km north of Saha-1, where one formation tested noncommercial oil and a second interval was tight.

The well established the existence of a working hydrocarbon system on the block, said 20% interest holder TG World Energy Corp., Calgary. It found reservoir sandstones in the primary objective Sokor and Madama formations and sandstones in the Donga formation.

Once Saha-1 is drilled, the operator plans to rerisk the existing prospect inventory and choose a third exploration drillsite.

Meanwhile, CNPCIT is acquiring a seismic survey on the adjacent Bilma concession, where TG World does not hold an interest. Afterward, the crew will acquire 700 line-km of 2D seismic surveys on Tenere.

Saskatchewan

Petrobank Energy & Resources Ltd., Calgary, expanded its holding in the Southeast Saskatchewan Bakken oil play to 116,163 net acres in the Williston basin.

The company's first four 100%-interest Bakken wells went on production at 200-250 b/d and on average have produced more than 12,000 bbl in the first 3 months, and the next four wells had similar results.

The company drilled in early 2007 but did not place on production for competitive reasons a series of exploration wells to determine the play's boundaries prior to a provincial land sale.

Two rigs are drilling, and two are to be added in the third quarter to pursue a goal of drilling 60 wells by the end of 2007.

North Dakota

A dual lateral well in Mountrail County 18 miles north of EOG Resources Inc.'s Parshall area flowed 443 b/d of oil, 300 Mcfd of gas, and 187 b/d of load water from Bakken.

Drilled and completed by ConocoPhillips, the Nelson farms 11-19H well in 19-156n-91w is now operated by Prima Exploration Inc.

Cordillera Energy Partners, Prima, and partners hold 72% working interest in the well and control 56,000 net acres.

Oklahoma

Verden field in the Anadarko basin is averaging 57.8 MMcfd of gas from wells operated by Apache Corp., Houston.

The company's most recent completion, West 8-14 in Caddo County, cut 380 ft of gas pay and gauged 5.3 MMcfd of gas and 5 b/d of condensate from the Middle Wamsley member of Pennsylvanian Springer perforated at 16,391-521 ft.

Verden field, discovered in 1976, has produced 593 bcf of gas and 5.1 million bbl of oil. Apache has drilled 88 wells there since 1993.

West 8-14 is the eighth well drilled in this 640-acre unit. The ninth well is drilling. Apache operates the unit with a 56% working interest. It is indicative of the downspacing opportunities afforded by reservoir compartmentalization in Verden field, where Apache has four rigs running.

Texas

Gulf Coast

ECA Holdings LP, private Denver independent, plans continuous horizontal development of Brazos Belle field in Fort Bend County, Tex., where a recent completion set depth and temperature records for the field.

IP at the Foster Farms Deep-1 was 7.49 MMcfd of gas and 199 b/d of condensate on a $^{15}/_{64}$-in. choke with 8,590 psi FTP from Eocene Lower Wilcox Meek sand.

The well went to a field-record true vertical depth of 15,800 ft before ECA drilled the lateral. Measured total depth is 18,474 ft, and the lateral was drilled at what ECA believes is a record temperature of 350° F. The frac job carried 1 million lb. of bauxite proppant.

ECA has built location for another well to spud May 1 and plans to drill two further offsets in 2007. The company owns 100% interest in the first well and 12,000 net acres on the Brazos Belle structure.

Portable VSDs, load cells aid rod pumping at Duri

Mursalim
Didi Ruchyadi
Nibukat Zaradan
Budi Julianto
PT Chevron Pacific Indonesia
Duri-Riau, Indonesia

Emir Syahrir
PT Catur Khita Persada-eProduction Solutions
Jakarta

A pilot project on a portable variable-speed-drive and load cell for obtaining counterbalance effect (CBE) data in the Duri steamflood improved the sucker-rod pumping efficiency from wells that had low lift efficiency caused by incomplete pump fill.

The Duri steamflood on the Island of Sumatra in Indonesia is the largest in the world and currently produces about 200,000 bo/d.

In the field, incomplete or low pump fill is the most common operational problem experienced especially on ramp-down wells. The low fill results from having a pump capacity that exceeds the formation's ability to flow fluid into the well or from having excessive gas or steam at the pump intake.[1]

Excess pumping capacity creates shock loading from fluid pound (Fig. 1) that can cause rod buckling, excessive pump and tubing wear, unnecessary friction, and stress fluctuations throughout the entire pumping system.

Shock loading transmitted to the surface pumping unit may cause vibrations greater than the unit can tolerate. These vibrations may reduce equipment run life and magnify the effects of an unbalance pumping unit and gearbox overload.

Pumping problems

A major operating cost associated with sucker-rod pumping is the pulling and repair of the rods, pump, and tubing, as well as the replacement or repair of the surface pumping unit. Frequent repairs may make wells marginally economic. Repairs also decrease production because of well downtime.[2]

The solution to the over-pumping problem is to control the producing parameters, such as pump size, speed, frequency, and stroke length.

A reduced pump size is least effective because of its high cost.

A shorter stroke length has minimal effect on the problem and is limited because of the fixed number of crank holes, worn-out holes, and the fact that many pumping units in Duri have been set-up for a maximum stroke length.

A combination of a reduced stroke length with reduced speed, however, can deliver good results.

Pumping intermittently by placing the unit on a timer or installing a pump-off controller (POC) are the usual methods for reducing pumping frequency. Both methods have at least four drawbacks:

1. Intermittent pumping changes the frequency, but not the pumping speed. When the unit comes back on, the loads associated with motion and fluid pound reoccur.
2. During the downtime, liquid flows from the reservoir into the wellbore. This flow builds a liquid level in the casing that creates backpressure on the producing formation. Maximum flow occurs with minimum backpressure; therefore, the liquid column height should be kept as low as possible.
3. Starting the unit from a dead stop requires more power. The start phase also induces a shock on the pumping unit, rods, and pump.
4. If the well produces solids, the downtime allows the solids to settle. These solids may cause the plunger to stick more frequently.

Timers and POCs, therefore, cannot eliminate all the shocks, unnecessary pump cycles, and unnecessary power use, nor can they minimize the backpressure on the reservoir.

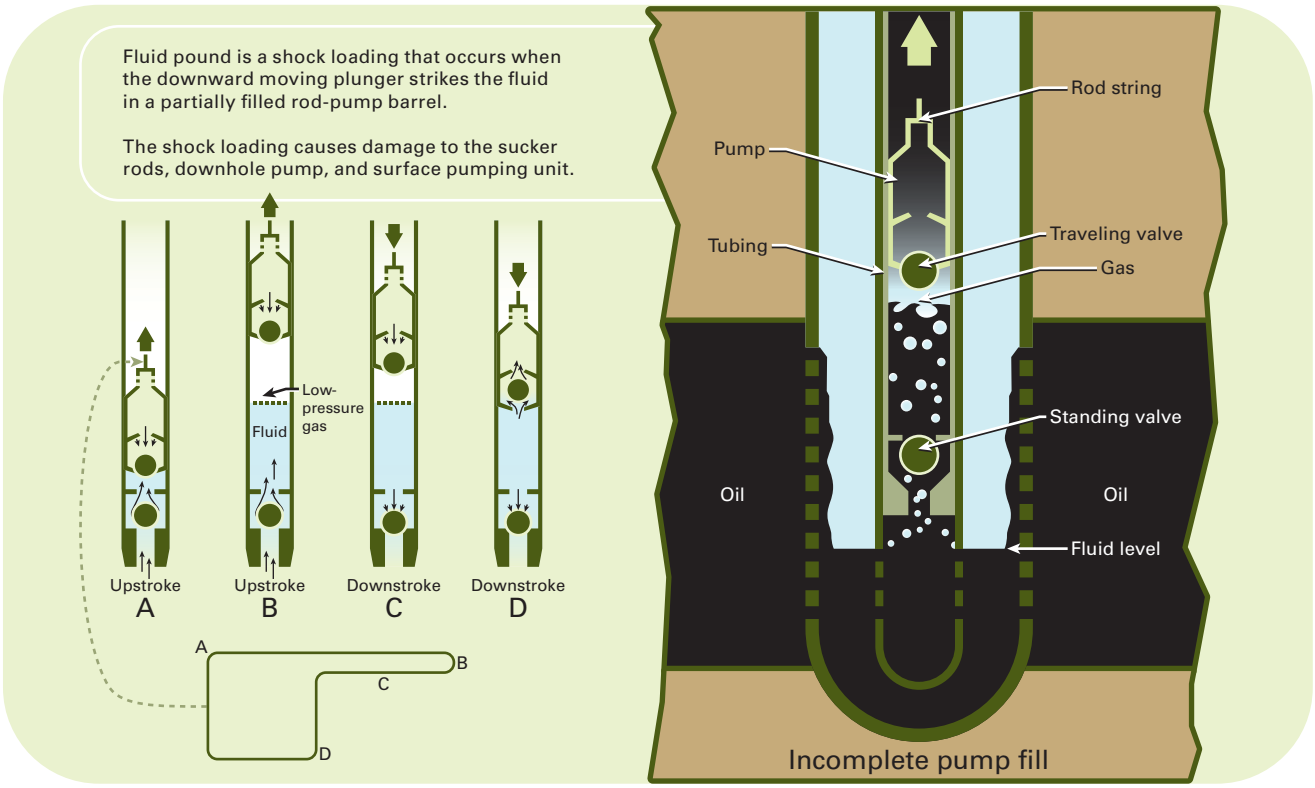
The faster a unit pumps, the larger the number of cycles, and the sooner the rods reach a fatigue limit. The effect is similar to flexing a wire until it breaks.

To minimize the number of pumping cycles and the stresses caused by motion, one can set the unit to pump at

Based on a presentation to the Simposium Nasional & Kongres IX Ikatan Ahli Teknik Perminyakan Indonesia (IATMI), Jakarta, Nov. 15-17, 2006.

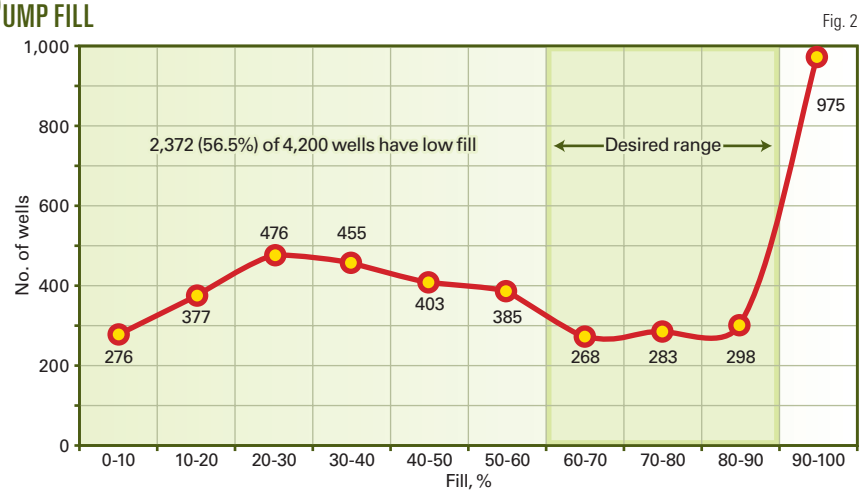
FLUID POUND

Fig. 1



PUMP FILL

Fig. 2



Note: Pump fill is from dyno data of normal pump fill, as of Aug. 14, 2006.

the slowest speed and with the longest stroke possible.

Long run times are normal with slow and steady pump strokes, making marginal wells economic for a longer time.

Duri steamflood

The Duri field uses only sucker-rod pumps for lifting fluids because these pumps can handle high fluid temperatures and sand production.[3]

In 1995, Duri reached a peak production of 350,000 bo/d and currently produces about 200,000 bo/d with an average steam injection of 1.017 million bbl of cold-water equivalent/day.

Most of production comes from Pertama and Kedua sands, with some areas also developed in the Rindu formation.

Fig. 2 shows that 2,372 out of a total of 4,200 producing wells or 56.5% of the wells in the field had low pump fill. This is because pumping parameters were not adequately downsized as oil production declined.

Steam breakthrough is one problem. In this case, the average wellhead temperature increases rapidly from 200° to 250° F. and is usually accompanied by a decline in oil production. Also the average reservoir pressure rises to 150–200 psi. High pressure makes lifting of fluid difficult. This condition requires close monitoring of producing wells and numerous changes to maintain normal or even pump-off conditions.

A pump-off condition means that the pump lifts all fluid supplied by the reservoir. This ideal condition occurs

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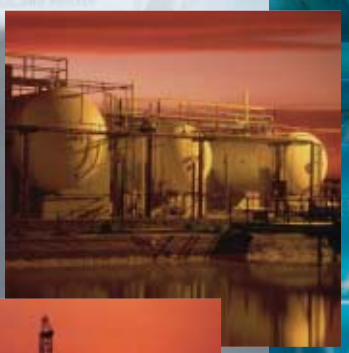

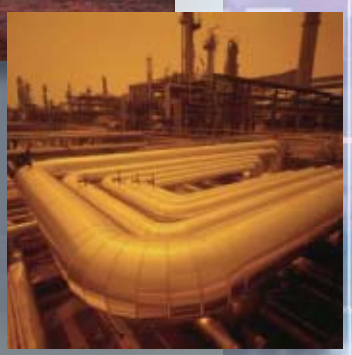

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Petrochemical	E1341 $395.00 US	E1341C $1,495.00 US
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U.S. Pipeline Study — There are 14 categories of operating and financial data on the liquids pipeline worksheet and 13 on the natural gas pipeline worksheet.
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PUMPING UNIT CONTROLS

Fig. 3

when the producing parameters are aligned with producing rate and at the lowest operating fluid level near the downhole pump intake.

A dynamometer survey can determine the pump-off condition. At Duri, these surveys are taken once on each well every 2 months.

The dynamometer survey also measures the pumping system efficiency, pump fill, and loading of its components. A petroleum engineer can use these data as a source for optimizing the pumping system.

There are two kinds of dynamometer surveys: simple dyno and full dyno analysis.

A simple dyno survey identifies the mechanical condition of wells and operating fluid level above the pump (Fig. 3). Full analysis measures the pumping-unit balance, structural and gear reducer loads, rod stress, power consumption, and component mechanical efficiency.

Speed optimization

Each area in the steamflood experiences production phases with rapid increase within the first few years followed by a slow decline with steam maturity. To accommodate the declining phase, the field requires aggressive optimization efforts; otherwise, the field will incur multiple failure costs related to overpumping conditions, repairs, and downtime oil lost.

Three key points in this optimization effort are: dynamometer data for analysis and candidate selection, application of VSD (variable-speed drive) for obtaining optimum pump speed at the production rate, and drive-sheave size change.

Well candidate selection starts by grouping wells according to pump fill that include plots of:

- Very low pump fill wells that are candidates for pump downsizing but are outside the scope of this project.
- Medium fill wells that are candidates for a combination of reducing pump speed and stroke length. These are in the scope of this project.
- High fill wells that are closely monitored until reaching fluid over the pump or pump fill greater or equal to 100%. At that stage, the units need an increased stroke length or speed so as not to have an excess fluid level over the pump.

One can obtain the optimum speed for producing a well at its highest rate with software simulation, but this method is not popular at Duri because of inaccuracies caused by the many assumptions made.

Variable-speed drive is the most popular method for adjusting speed to an optimum level. For the best result, these drives are installed permanently on individual wells (Fig. 4). That is ideal for accommodating rod load changes to the most suitable speed at anytime. At Duri, the plans call for installing the drives on new wells that are still in the ramp-up phase with high production rate.

For mature wells in the ramp-down phase, the drives are marginally economic. In these cases, the program is to use only a limited number of VSDs on target wells. This involves installing a VSD unit at one well for 2 days only to obtain the optimum speed. This is followed by a change in drive-sheave size.

The portable VSD combined with a dynamometer survey and sheave change costs much less then the installation of individual fixed VSDs.

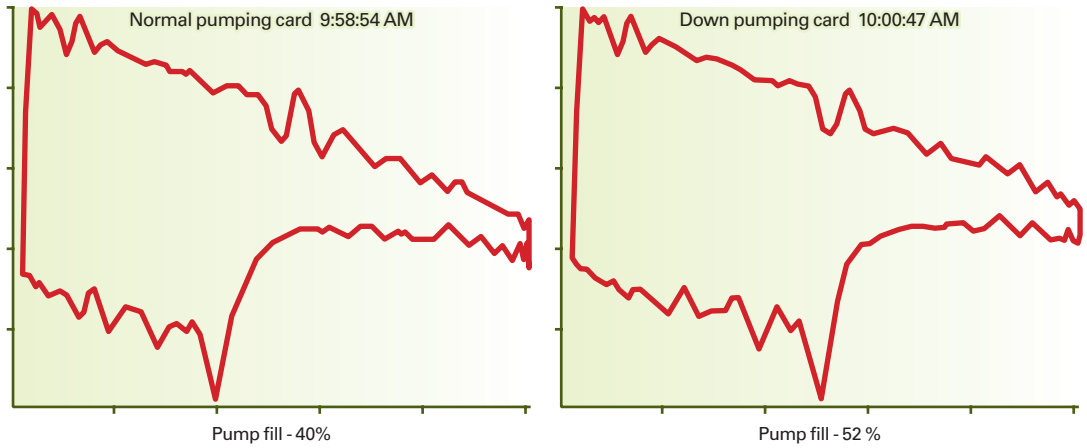
Well performance before and after speed change can be compared through pre and post dynamometer analysis and well test data. For continual improvement, our petroleum engineers and technical assistants monitor and analyze all related data provided by the dynamometer survey, well test, and operator checklist.

To accommodate dynamic changes of formation fluid level, the program includes scheduled reviews of the pump speed once a year for stable wells and twice a year for ramp-down wells. Also adjustments are made if the operator notices significant changes and if the dynamometer data indicate a need.

This initiative incorporates a new pumping-unit balancing method using a load cell and load indicator. Unbalance pumping units remain a large challenge at Duri and the unbalanced units affect downtime, repair man-hours, and equipment damage, such as broken gearboxes, bearings, wrist pins, and belts, as well as motor burnouts.

Dynamometer survey

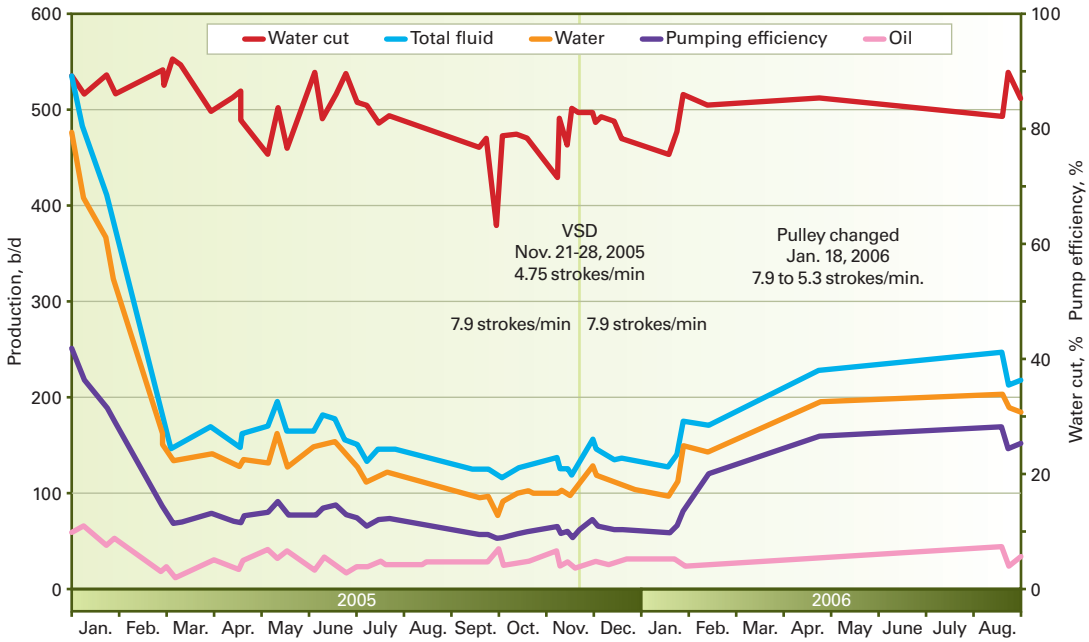
Fig. 4



A simple dyno card indicating fluid pound or incomplete pump fill. On left is normal pumping card and on the right is down card of the same well after 2-min shut down.

Production trend

Fig. 5



Balancing a unit

At Duri, ammeters are used for balancing pumping units. The amp probe connects to the electric motor leads and measures amperage drawn by the electric motor during the pumping cycle.

The balancing procedure involves moving the counterweights until the mean amp reading on both the upstroke and downstroke are the same. This method, however, can be time consuming and often is inaccurate because it requires moving the weights an indefinite distance then securing the bolts, running the unit, and remeasure

the amperage. The process often needs repeating until the technician obtains a satisfactory ampere reading.

This method can be effective if the unit already is nearly balanced. It may, however, result in a grossly unbalanced condition. Because the ammeter cannot detect whether the alternating current is leading or lagging the voltage, the motor current will indicate a positive value, regardless of whether the motor is regenerating or motoring. One may mistake regenerative currents for motoring currents, thereby, severely unbalanced the pumping unit.[4]

Repeatedly moving heavy weights also increases the safety hazard to technicians for the trial-and-error process.

An important consideration is that the downhole fluid level increases while the pump is down for this balancing work. A longer downtown requires longer times to normalize the load. This can lead to wrong amp readings if the load is not stabilized.

Simplified balancing calculations with a computer program is another way for balancing a unit. Output of this simulation includes the distance and direction that the weights should move and the needed pounds added or reduced. The software also contains information of crank and counterweight data for most common pumping unit brands.

But at Duri, this software has the problem that some of the pumping unit brands and models are not included in the software, making the software unusable. The software, furthermore, requires much downhole and surface data that may be unavailable.

The best alternative solution at Duri has been to use a load cell and load indicator. The load cell installed above the carrier bar records load changes to obtain counterbalance effect (CBE) data.

The CBE data is sufficient to move the counterweights the right distance during the first adjustment. This is a much faster balancing process and uses the CBE data provided in the dyno full analysis. Compared to the amp probe, the load cell method is much easier, faster, more accurate, and safer.

Results

The 10-well pilot project provided the following results:

- 40% pump speed reduction, averaging from 9.1 to 5.5 strokes/min, equaled 1.9 million stroke/unit/year less without reducing production.
- 50% vibration reduction, averaging from 0.68 to 0.32 in./sec to the safe range below 0.5 in./sec.
- Reduced and balanced gearbox loading.
- More than 20% reduction in ampere reading, which leads to energy savings and a smaller motor size from Size 3 to 2 on all 10 wells.
- 70% increase in pump fill and 79% increase in fill ratio.
- Reduction in steam interference.

By improving pump fill with a slower speed, the field reduced fluid pound and shock loading and friction wear, resulting in reduced failures and well downtime. In other words, production did not increase directly by slowing (optimizing) the speed, but rather indirectly through reduced well downtime.

After speed reduction the production trend followed the long-term decline (Fig. 5).

Acknowledgment

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SINOPEC MPD—Conclusion

Air drilling successful in Puguang field

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Last year, Sinopec improved drilling rates in the Puguang field using percussion (air) drilling and plans to increase its use in the 2007 drilling program.

The first part of this article, published last week, described drilling in the Puguang field, drilling-failure analysis, risk assessment, and the project management road map.

This concluding part discusses the optimized well design, Sinopec's experiences with percussion drilling using compressed air and foam, MPD system design, and plans for near-balanced operations in the sour-gas reservoir.

Optimized well design

According to the original scope of the feasibility study, the initial recommendation was to apply air and air-hammer drilling to the 17½-in. and 12⅜-in. sections of the Puguang field, from surface conductor at 50 m to about 3,600 m. Sinopec and Weatherford are currently developing a program to apply MPD in the reservoir section.

This recommendation was made because air drilling in hard-rock formations provides a rate of penetration (ROP) up to five times faster than drilling with conventional fluids. The increased speed not only reduces cost but brings wells online faster. Air drilling produces a straighter hole and, with lower bit weights, results in fewer deviation issues while maintaining good ROP.

A stepwise or staircase approach to applying MPD through all sections of a Puguang well has proven cost effective and satisfactory to the operator (Fig. 1).

The primary objective is to significantly increase the drilling rate to at least double that of previous conventionally drilled wells, from the conductor casing shoe to the setting depth of the 10¾-in. intermediate casing shoe at around 3,600 m (Table 1).

Well design specifications

The wells in the Puguang field are conventional in design:

- 26-in. *hole section.* This section is drilled conventionally, with a water-based mud system, from the surface to 33 m. The conductor is cemented at a depth of 33-40 m.
- 17½-in. *hole section.* Air and air hammer were planned for drilling this section from 33-700 m. On both Puguang 2-2 and 5-2, water flows were encountered between 30-40 m. The ground surface-water level must be identified before setting the conductor, and any water flows should be isolated by setting the conductor below this depth. Water flows in the section have significantly affected ROP during percussion drilling.

The section was drilled with air and mist in both Puguang 2-2 and 4-2. In the Puguang 5-2 well, the upper hole section was drilled with air, then with mud when the water flow became too great. On Puguang PD-3, the section was drilled with mud, as Sinopec was concerned about hole collapse after high water production was observed as soon as the conductor was drilled out. This section was cased and cemented with a 13⅜-in. casing string.

- 12⅜-in. *hole section.* This section is drilled with air down to the top of the Xujiahe formation, which contains a number of high-pressure, low-permeability gas zones. A nonrecyclable, stiff foam system is planned for drilling this zone to the top of the Leikuopo formation at 3,600 m. It is cased and cemented with 10¾-in. casing.

The stiff foam system uses an intentionally viscosified liquid phase (base fluid). The increased viscosity of the liquid phase provides a more stable structure by slowing gravity drainage and rupture of the cell walls. Thus, foam with a higher-quality (lower liquid volume fraction) can be created than

would be possible without the viscosifiers.

The principal benefit of stiff foam over conventional stable foam is improved wellbore stability in unconsolidated formations through reduced water content of the foam and consequentially avoiding hole collapse.

The stiff foam system is also better able to handle gas production. Should H_2S be encountered or gas production be significant (in excess of 1 MMscfd), the well would be killed with mud and returned to the operator for conventional drilling.

Engineers recommended that high-quality foam (more than 90% in the annulus) be used to drill the water-sensitive lower claystone formations in the Puguang field. With a stiff foam system, the foam quality in the annulus can be raised as high as 99.5% before breaking the foam. This level of foam quality would minimize the amount of water in contact with the formations as well and avert water-wetting and associated hole collapse.

• *9½-in. hole section.* This section is drilled from the shoe of the 10¾-in. casing to the kickoff point (KOP) at about 4,400 m. Air drilling is planned for this section. There is no further nuisance gas production expected from these depths; therefore, the section is programmed to be drilled with air hammers.

At the KOP at 4,400 m, the well is already 200 m above the sour-gas Feixinguan reservoir. Any underbalanced drilling (UBD) will be halted and the rest of the well will be drilled overbalanced to TD.

At the time of this article, the hole stability of the 9½-in. section had not yet been confirmed and it remains to be determined whether MPD can be used in this section.

Currently conventional mud systems are being used but they provide low ROP. This section currently takes an average of 150-200 days to drill and case to the bottom of the reservoir.

In the reservoir, found between about 4,500-6,000 m, the hole is kicked off with a build rate of 15°/100 m and will be drilled at an angle of 47° to 5,519 m MD. This section is currently drilled by Sinopec using a conventional, overbalanced mud system.

MPD systems

Drilling these wells with managed pressure and air-drilling techniques requires that equipment selection take into account drilling objectives.

• *Circulation system.* The criteria that drive the design include hole cleaning; managing corrosion; improving shale stability; and maximizing ROP.

With foam playing a large part of the technical solution, the team modeled the flow to determine the best ratios of air, liquids, and chemicals to achieve stable foam at different operating parameters. At these depths, the best parameters were determined to be 2,500 scfm of air, with 10 gpm of liquid.

At these rates there is enough annular velocity to lift cuttings to surface, even with high-quality foam in the annulus. The foam quality is maintained above 90% to minimize the water contact with the formations. The base fluid of the foam is also treated with shale inhibitors to try to improve the shale stability of the system.

• *Compressed-air system.* This system provides air as the base gas for the compressible drilling fluid. The main components of the system include six air compressors, two pressure boosters, and two mist pumps. The system can provide 7,000 scfm of air and 60 gpm of liquid at 1,500 psi. A nitrogen membrane system is now being considered in the nuisance-gas zones to alleviate the risk of downhole fires.

• *Separation.* A 48-in. diameter, skid-mounted atmospheric mud/gas separator with a capacity of 24 MMscfd is used in the lower sections of the well.

Mud and solids return to the rig's mud system from the 10-in. outlet at the bottom of the mud/gas separator to the mud return line. To increase efficiency, a 2-in. line is rigged up from the rig's mud system to a butterfly valve under the vessel. This configuration will allow for sparging of solids should accumulation occur and for fill-up should the mud seal be evacuated. Also, a mud catch system is used to drain the separator to check for solids.

Gas exits from the top of the separator through 8-in. piping and through an 8-in. flow-check valve installed at ground level. The 200-ft flare line will be routed to the flare pit.

• *Choke manifold.* The choke manifold rated to 5,000 psi has dual inlet valves for redundancy. The piping and valves are 4⅛ in. with a 6-in. gut line. The 6-in. gut line allows for a straight-through 6-in. run from the rotating control device (RCD) to a pit or other peripheral. One choke is manual; the other is hydraulic.

• *Rotating control device.* A 500-psi RCD is placed on top of the well during drilling of all sections above the reservoir. The bottom flange of the RCD is 21¼-in. × 2,000 psi; the outlet flange of the RCD is 11-in. × 3,000 psi.

A high-pressure, passive RCD, with operating pressures of 2,500 psi and dual packer elements, is planned for MPD operations.

• *Percussion hammers.* The gouging action of roller cone bits is reduced in ultra-hard rock and hammer bits offer a distinct advantage. By imparting high-frequency impacts, coupled with rotation, the natural tendency of the

DRILLING PROGRAM Table 1

Depth, m	Hole size, in.	Casing size, in.	Fluid system
50 to 1,000	17½ (444.5 m)	20	
1,000 to 1,500			Air and mist
1,500 to 2,500	12¼ or 12⅜ (311-314 mm)	10¾	
2,500 to 3,600			Stable foam
3,600 to 5,500	9½ (241.3 m)	7	MPD

rock to propagate fractures is used to maximize cuttings size while drillstring rotation indexes the bit inserts on fresh rock surfaces during each beat of the air hammer.

Sinopec used 8-in. and 11-in. air hammers in the Puguang wells. Rotations in the 20-30-rpm range and a WOB of less than 2 tons usually provided maximum air-hammer ROP.

• *Bits.* Air drilling normally uses mining bits. Because the tolerance specifications on mining bits are not as strict as the API oilfield standards, drift diameter of the casing becomes more important. Initially standard mining bits of the following sizes were used to drill the first four wells:

- 444.5 mm (17½ in.).
- 314.0 mm (12⅜ in.).
- 241.3 mm (9½ in.).

Special impact hammer bits have been designed to drill future wells in hopes of increasing performance and minimizing the number of bits. These bits will be fully diamond-enhanced with protected gauge and face. The diameters of the 314-mm bits are also equipped with enhanced diamond inserts to enhance gauge protection.

Current results, operations

Following a stepped approach to using MPD at Puguang, the objectives for the first two wells were to increase the drilling rate to at least double of previous conventionally drilled wells in sections down to 3,000 m.

Sinopec's initial four wells took an average of 1 year to drill, with ROPs at 1-2 m/hr. The results of the first two air-drilled wells handily exceeded the objectives. The wells listed in Table 2 also exceeded expectations.

For the footage drilled in the 17½-in. and 12⅜-in. sections (70-3,000 m), the original conventional wells took 90 days. Current wells using percussion drilling are taking an average of 40 days, which represents a 50% overall reduction (Fig. 2).

PG 2-2

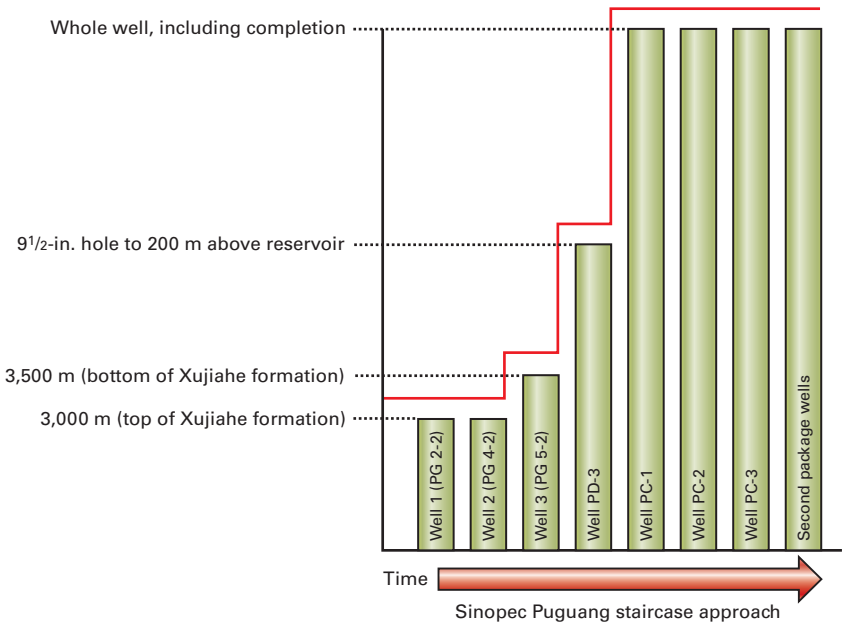
The increase in drilling rate was achieved as the well was drilled from 32 to 2,907 m in 37 days, whereas the initial well drilled in the field, Puguang 2-1, took 78 days to reach the same depth. The secondary objective, to air drill to 3,600 m, was not achieved because of suspected high gas production in the Xijuahe formation. Air drilling stopped at 2,907 m.

Previous conventionally drilled wells had average ROP of 2-3 m/hr. In the first air-drilled well of the field, the average ROP for the 17½-in. section was 9.77 m/hr. The average ROP for the 12¼-in. section, with air, was 12.55 m/hr; with air hammers, the average ROP was only 18.06 m/hr. Overall ROP did decrease in that section, as the BHA was changed to a tricone assembly from 2,492 m for well-control purposes in response to increasing gas production.

Two major incidents contributed to downtime in the operation. The first incident occurred when the rig unintentionally pulled an 8-in. collar into the RCD, which damaged the RCD bearing. The second incident occurred when parted pipe damaged the air hammer. Both equipment items were subsequently classified as unusable junk.

STAIRCASE APPROACH TO MPD

Fig. 1



PG 4-2

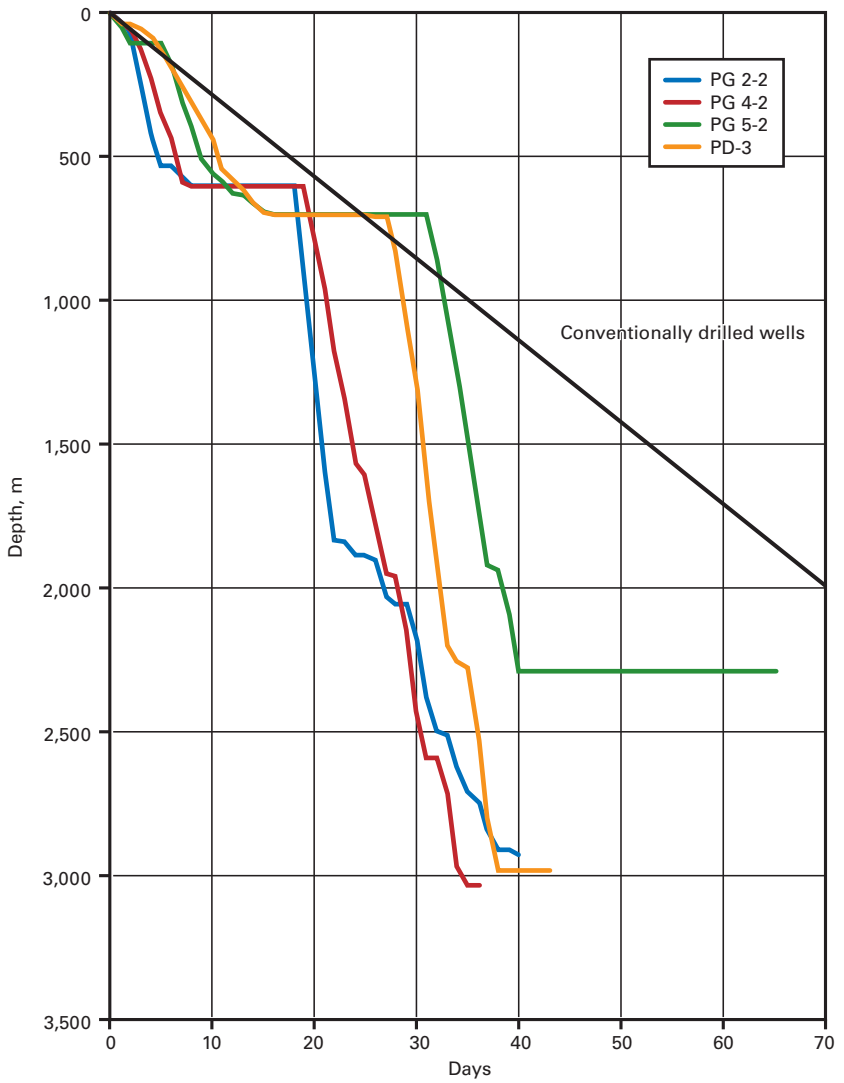
The next test was to determine whether the initial success on the first well was repeatable. The second well was drilled from 32 to 3,032 m in 33 days, besting the first air-drilled well, Puguang 2-2, which was drilled from 32 to 2,907 m in 37 days. As before, however, Sinopec decided to stop air drilling at 3,032 m because of concerns about gas presence below this depth.

Other highlights from drilling Puguang 4-2:

- Deepest hole drilled with air to date. A total of 2,997 m was drilled from 33-3,032 m.
- Fewer bits used compared to Puguang 2-2. Only three hammer bits were used to drill the 2,997 m.
- Good hole stability. Montmorillonite and mudstone formations were encountered during air drilling. The hole would have easily collapsed and enlarged had mud been used. Air drilling eliminated this possibility.
- Low deviation. At most 1 ton was put on the hammer bit; therefore, the hole was quite straight. According to the survey, hole deviation was only 0.8° at 2,505 m.

PUGUANG DRILLING PERFORMANCE

Fig. 2



The average ROP for the 17½-in. section was 7.71 m/hr. The average ROP for the 12⅜-in. section was 13.93 m/hr. Average ROP for the whole performance drilling section, from 32 m to 3,032 m, was 12.10 m/hr.

PG 5-2

Unfortunately, this well proved to be less successful primarily because of poor decision-making and miscommunication. Although drilling performance was better than performance of conventional drilling, water influx resulting from high casing setting depths and the inability to drill with foam made this well the worst performer.

Overall, for the section drilled, an increase in drilling rate was achieved. The well was drilled from 40.5 to 2,290 m in 41 rig-days; the actual performance drilling time is 17 days for 40-561 m and 702-2,290 m.

The drilling program was changed, however. Sinopec decided to switch to foam in the air-drilled sections because of safety concerns about drilling with air through a potential gas zone below 2,330 m. Sinopec decided to change from air drilling to foam drilling at 2,290 m without prior warning.

As a result of this unplanned change, there were no experienced fluids personnel on location and the foam was not correctly formulated. As a direct consequence of this foam failure, the hole collapsed completely and the drillstring became stuck. Sinopec commenced the fishing operation and retrieved the BHA 22 days later.

The average air-drilling ROP for the 17½-in. section was 7.52 m/hr. Before the stuck pipe incident, the average ROP for the 12⅜-in. section, while with air hammers, was 11.98 m/hr. Average ROP for the whole performance drilling section, from 40.5 to 2,290 m, was 10.45 m/hr.

PD-3

Another time record in the Puguang field was set when the 12⅜-in. hole section of the fourth air-drilled well this year was completed. The section from 700 to 3,000 m was drilled with only two bits and an average ROP of 9.36 m/hr, sustaining the learning curve from the previous wells and resulting in a 94% improvement in ROP over the first air-drilled well in the field.

Sweet gas was encountered at 2,321 m in the Qianfoya formation. The gas was circulated out and flared for about 3 min before air drilling was resumed.

Another sweet-gas zone was encountered at 2,666 m in the Ziliujing formation. The gas flared for about 11 min before air-hammer drilling continued.

Drilling continued, without further gas shows, down to 2,980 m. At this point an attempt was made to drill the deeper, high-pressure nuisance gas in the Xujiahe formation with a foam-based drilling system and the step approach. The foam was mixed with a half life in excess of 15 min and was pumped with a quality of 92 to 99%. Only 10 bbl of water was used to achieve foam circulation to surface and in total, only 35 bbl of water were circulated in the well during the foam operation.

The well was displaced with foam and circulated for 2 hr. A wiper trip was made back to the shoe to ensure hole stability. As the string was run back into the hole, fill was encountered 212 m off bottom. Foam was circulated and

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the well was reamed, but at that point large amounts of cuttings were being lifted from the well. The kelly was drilled down but there was some rotary table stalling and the well was producing large amounts of cavings. It was obvious that the hole was collapsing and the decision was made to mud up the well.

The foam was blown out of the hole with air and the well was circulated with air for another 30 min. Sinopec decided to pull out of the hole to change the BHA to prepare for mud-up. After 60 m of drillstring was pulled, a tight spot was encountered and air was put back on the hole. After working the string, an additional 40 m was back-reamed out of the hole before the string was pulled out.

This exercise, together with the failure on Puguang 5-2, proved that the formations below 2,500 m are extremely water sensitive and that the subsequent hole collapse could probably not have been avoided. Once the well was mudded up, a total of 4 days was needed to redrill the lower 300 m of the well. Sinopec is now more positive in attempting to air-drill the Xujiahe formation, including the nuisance gas formations.

Other highlights from drilling PD-3 are:

- The hammer bit used from 703 to 2,252 m is currently the longest bit run in the field.
- This well was the fastest to reach 2,980 m from start of drilling the intermediate section in the field (10 days).
- Minimal bit use. Only two hammer bits were used to drill the section, including a bit used in the previous well.
- Up until the introduction of foam, hole stability was not an issue.
- Vertical hole was achieved with deviations less than 0.5° recorded. At 2,900 m, deviation was only 0.25°.

ROP PERFORMANCE Table 2

Well	ROP, m/hr
PG 2-2	4.81
PG 4-2	5.33
PG 5-2	7.39
PG D-3	9.36

Lessons

There were several key operations lessons and a few significant changes from the planned objectives as implemented.

The operator, Sinopec, has successfully employed air drilling on four wells. The individual well times were reduced by 20% and air-drilled sections reduced by 41 days, or 50%.

Using a team-based project approach, the program has maintained an admirable safety record, given the environment. To date, there have been only two minor medical cases and no lost-time incidents.

The application of water-based foam in the zones above the main reservoir (mudstones, siltstones) was not successful. Even with foam quality at 98%, the sensitivity of the formations to water is extreme. The main issue is that the formation below 2,600 m consists of kaolonite, which is 100% soluble, and was identified in the core sample studies.

The only other possible option to using pure air or N_2 would be to drill these formations with an oil or diesel-based foam system.

Nonproductive drilling time in the Pugaung field is significant. Unusual drilling practices and philosophies caused numerous delays. Adopting API standards and establishing a best practices culture are essential to achieving better drilling performance in China. As much as both parties would like to adopt a technical limit methodology, there are more significant issues to be addressed, which are primarily culture and role related.

As the team addresses these issues, however, several opportunities for further reducing the drilling curve have been identified:

- Batch drilling sections down to the reservoir.
- Drilling 26-in. conductor below the aquifer to 70 m.
- Inspecting drillstring to maintain API standards.
- Adopting cementing best practices.

There are many other areas that, if addressed, could result in additional savings. The team believes drilling and completing these wells in fewer than 120 days, as opposed to 200, is achievable.

Future of MPD

The sour-gas Feixinguan reservoir is located between 4,700 and 6,000 m below surface. The geology encountered consists primarily of mudstone, siltstone, and shale sequences above the productive reef. This oolitic dolomite reservoir has a porosity of about 3.65 to 8.71% and permeability that varies from 0.1 to 126 md. The average initial formation pressure approximates 7,977 to 8,267 psi (55 to 57 MPa), with a formation pressure gradient of about 1.09 to 1.18 sg. The reservoir formation temperature is estimated at 120° to 133° C., with an initial gas saturation of 90%. The reservoir has gas productivity from its original vertical wells between 10 and 20 MMscfd.

This reservoir is deep, high pressured, and extremely sour. From a risk-analysis perspective, these wells would have the highest risk classification in the world if UBD were applied. Using in-house risk assessments and reservoir screening tools, the Feixinguan reservoir scored poorly as a UBD candidate.

The mean score of +18 from the reservoir screening tool indicates that the reservoir is an average candidate for underbalanced reservoir drilling (in terms of average horizontal candidacy and APT_i), but the low susceptibility to damage and low clay content of the reservoir, in combination with the sour and high -pressure characteristics, made it a poor UBD candidate.

In addition, the operations risk-assessment score of 8.3 is extremely high and there is no record in the world of a well with such high levels of H_2S at this depth ever having been drilled underbalanced. There are also political factors

to consider, as China has currently banned UBD operations in sour-gas reservoirs.

Consequently, MPD methods will be applied at close-to-balanced conditions to achieve the main objective of improving ROP in the reservoir. At the same time, increasing the angle through the reservoir to about 80° should also provide further reservoir exposure and potentially increase productivity.

Drilling ROP drops significantly to less then 1 m/hr with borehole pressures reaching 10,000 psi. Drilling the reservoir section currently takes 70 to 90 days. At this moment in the project, MPD packages are not designed to drill large productive horizons. Air-drilling operations are suspended if any potential gas or oil zones outside of the design parameters are penetrated.

The proposal is to drill the reservoir with minimal overbalance or at balance, with a fluid designed to minimize reservoir damage. Optimizing drilling performance through the use of motors, advanced rock-bit technology, improved drilling hydraulics and solids control systems in combination with MPD well-control equipment, should allow significantly improved drilling rates and, at the same time, reduce reservoir damage.

The surface equipment deployed for MPD operations will ensure that any H_2S produced to surface can be safely handled with the gas busters and flare systems. Further improvements in rig hydraulics and solids control equipment will also help to reduce drilling times.

Optimizing well cleanup, combined with optimizing the running of the completion tubulars, will allow further overall time savings.

Recommendations

Since the initial Puguang wells were drilled and completed in years per well, conventional drilling was deemed uneconomical. Thus, Sinopec decided to test air drilling and MPD techniques in an initial two-well trial.

After the trial was successful, extensive air drilling was used in subsequent wells, and more than 15 rigs are scheduled for drilling this year. The additional use of MPD in the non-reservoir sections would result in:

- Increased ROPs and shortened drilling curves.
- Reduced bit use.
- Enhanced overall drilling performance through reduction of vibration, drillstring-related problems, and sticking potential.

The most attractive reason to use MPD systems in the field is to achieve and support the goal of drilling three wells/rig/year. The field has a tight delivery schedule, and initial performance (long drilling times) was creating doubt that production targets would be reached.

The initial use of percussion drilling in the Puguang field produced excellent results, so far demonstrating that:

- Air drilling is highly successful in the surface formations.
- Formations down to 3,000 m are extremely water sensitive.
- The project management road map works effectively in addressing engineering and operational design.
- The project team approach works and can be implemented in China with cooperation of the operator.

Acknowledgment

The authors thank Sinopec and Weatherford for permission to publish this article. ✦

Generalized equation predicts hydrocarbon acentric factors

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A new acentric factor correlation, based on Pitzer's[1] definition of the acentric factor and a correlation of Antoine's equation,[2] accurately predicts the acentric factor of hydrocarbons and other components.

This equation can be used in vapor pressure correlations and cubic equations of state to improve the prediction of physical properties of light and heavy hydrocarbons as well as other components.

The new general correlation predicts the acentric factor of hydrocarbons more accurately than other equations reported in the literature. The generalized equation presented here accurately estimates the acentric factor of hydrocarbon and other fluids using critical pressure, critical temperature, and normal boiling temperature, and it is independent of vapor pressure.

This article reports the application of the developed acentric factor equation in predicting vapor pressure and phase behavior of hydrocarbons.

Acentric factor correlations

The acentric factor is widely used to estimate the physical properties of hydrocarbons. Equations of state in general and, particularly, commonly used cubic equations of state are often used for heavy petroleum fractions because proper characterization of this fraction is very difficult. When an equation of state is applied to defined components or pseudopetroleum fractions, the value of acentric factor is needed to predict phase behavior.

In addition, one of the important areas of application of the acentric factor is the prediction of vapor pressure from the generalized vapor-pressure correlations. The Edalat (OGJ, Feb. 1, 1993, p. 39) and Lee-Kesler[3] correlations, which predict the vapor pressure of hydrocarbons, are functions of the acentric factor.

Although many data in the literature include values of the acentric factor, ω, the value of ω for petroleum fractions is not readily available. Even for defined compounds, there are instances where experimentally determined acentric factor values are not available.

Vapor pressures, for example, may not have been measured at a reduced temperature, T_r, of 0.7 or the critical constants may simply be unavailable. Under these circumstances, the acentric factor cannot be calculated. One would therefore have to use estimation methods for the acentric factor or apply a general correlation of the acentric factor.

Although many estimation methods have been proposed, there are two practical ways to estimate ω from a single vapor-pressure point. One is to solve an acentric-dependent cubic equation of state and the other is to use a generalized vapor pressure equation. Both methods are lengthy and tedious procedures.

There are several equations that predict the acentric factor. Equation 1 (see attached equation box) shows Pitzer's definition of the acentric factor, which represents the acentricity or nonsphericity of a molecule.[1] He measured the deviation from simple molecules.

Equation 1 is in terms of the vapor pressure at a reduced temperature of 0.7 and the critical pressure. $P_r^s = P_s/P_c$, and is known as the reduced vapor pressure.

One must use the vapor pressure at a reduced temperature of 0.7 with Equation 1. Pitzer's acentric factor is therefore inadequate for calculations performed in the critical region and for liquids at low temperatures.

Edmister (1986) proposed the following relation for the acentric factor based on two parameters of the Clausius-Clapeyron equation (Equation 2), where $\theta = T_b/T_c$.[4]

Lee-Kesler developed a vapor pressure relation (Equation 3) for the acen-

tric factor. Watanasiri, et al., also derived a very lengthy relation for acentric factor.[5]

We have developed an acentric factor correlation (Equation 4) that can be used in vapor-pressure correlations and cubic equations of state to improve the prediction of physical properties of light and heavy hydrocarbons. Our general correlation predicts the acentric factor more accurately than the other equations.

Our equation accurately estimates the acentric factor of hydrocarbon and other fluids using the properties of critical pressure, P_c, critical temperature, T_c, and normal boiling temperature, T_b. Contrary to Pitzer's equation, our equation is independent of vapor pressure.

Equations

$$\omega = -\log(p_r^s)_{T_r=0.7} - 1.0 \quad (1)$$

$$\omega = \frac{3}{7}\left(\frac{\theta}{1-\theta}\right)\log P_c - 1 \quad (2)$$

$$\omega = \frac{1nP_c - 5.92714 = 6.09648/\theta - 1.288621n\theta - 0.1693470^6}{15.2518 - 15.6875/\theta - 13.4721\ln\theta + 0.435770\theta^6} \quad (3)$$

$$\omega = \frac{(1-T_r)(-0.901420 - 0.06833/\theta + 0.63372)}{(1-\theta)(T_r)0.637 - 0.901480 - 0.0683/\theta}\log P_c - 1 \quad (4)$$

Nomenclature

MW = Molecular weight
P_c = Critical pressure
P_r^s = Reduced saturated pressure
T_b = Boiling temperature, K.
T_c = Critical temperature, K.
T_r = Reduced temperature
ω = Acentric factor
θ = T_b/T_c

Equation accuracy

Table 1

Data points	Average error, %	Input data	Model
277	6.0	T_b, T_c, P_c	Edmister, 1986
133	20.5	T_b, T_c, P_c	Lee-Kesler, 1979
133	805	MW, SG, T_b	Lin-Chao, 1984
Alkane only	2.2	Molecular structure	Hoshino, 1982
94	11.8	MW, SG, T_b	Watanasiri, 1985
304	1.366	T_b, T_c, P_c	Equation 4

Generalized equation

Because the conventional characterization parameters of normal boiling point (NBP) and specific gravity are used in the refining industry, we used NBPs in our equation to estimate the acentric factor of petroleum fractions. Using the right correlation for calculating the critical temperature and pressure to determine T_r and P_c, one can then determine the acentric factor from the NBP.

Equation 4 shows the new generalized accurate correlation for acentric factor.

Equation comparability

We compared the acentric factors predicted from Equation 4 with those of Edmister (Equation 2) and Lee and Kesler (Equation 3). The results of calculated acentric factor from Equation 4 indicate that this equation can predict the acentric factor more accurately than the other acentric factor equations available in the literature.

Table 1 shows the comparison between acentric factor of hydrocarbons using Edmister, Lee-Kesler, Lin-Chao,[6] Hoshino,[7] and Watanasiri correlations, and the proposed correlation of this article.

The new equation predicts the acentric factor accurately compared with other correlations in the literature. In addition, Table 1 shows the average percentage of errors of the new equation and other equations.

Acknowledgment

The authors thank the Faculty of Engineering of the University of Tehran. ✦

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LNG TRADE—1

US gas supply security requires source diversity

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David Wood & Associates
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COMMENT

The necessary expansion and diversification of US natural gas supply sources brings with it increased exposure to political and economic risks that could cause this supply to be interrupted.

Part 1 of this article, presented here, examines the nature of US demand, the growing role of LNG in meeting this demand, and how insufficient diversification of supply sources would expose the country to particularly acute supply risk. Part 2 will address other issues complicating natural gas supply to the US as well as examine Europe's dependence on Russian gas.

The US imported 16.81 billion cu m (594 bcf) of LNG in 2006, some 2.72% of the 619 billion cu m (21.86 tcf) of natural gas it consumed (Table 1). This compared with 2005 US imports of 17.92 billion cu m (633 bcf) of LNG, some 2.85% of the 630 billion cu m (22.24 tcf) of gas it consumed.

High US gas prices, slightly higher domestic gas production, and higher LNG prices in Europe, which led to some LNG cargoes being diverted from the US, caused the slight contraction in LNG imports and drop in US gas consumption. Imported LNG, however, continues to provide a pivotal incremental source of natural gas supply in tight winter market conditions, moderating the magnitude of any potential price spikes.

Global LNG industry construction in 2007 and 2008 will lead to 50 million tonnes/year of new liquefaction capacity, 14 million cu m of new LNG shipping capacity (some 90 vessels), and nearly 90 million tonnes/year of regasification capacity. The US, however, continues to lag in its efforts to add new LNG import capacity.

Lack of infrastructure to land sufficient LNG through 2007 and 2008, due to slow permitting (2003 and 2005) and persistent obstructive regional governments in the areas where supply is most needed (New England and California) is likely to cause gas-supply shortages, particularly if winter weather is severe and demand growth is sustained. The natural gas industry (both North American and international companies) has proposed more than 50 projects to build North American LNG import and regasification terminals.

The US produced 50.66 bcfd of natural gas in 2006, up from 49.59 bcfd in 2005. Russia produced 57.9 bcfd of gas in 2005.

US LNG IMPORTS, NATURAL GAS CONSUMPTION

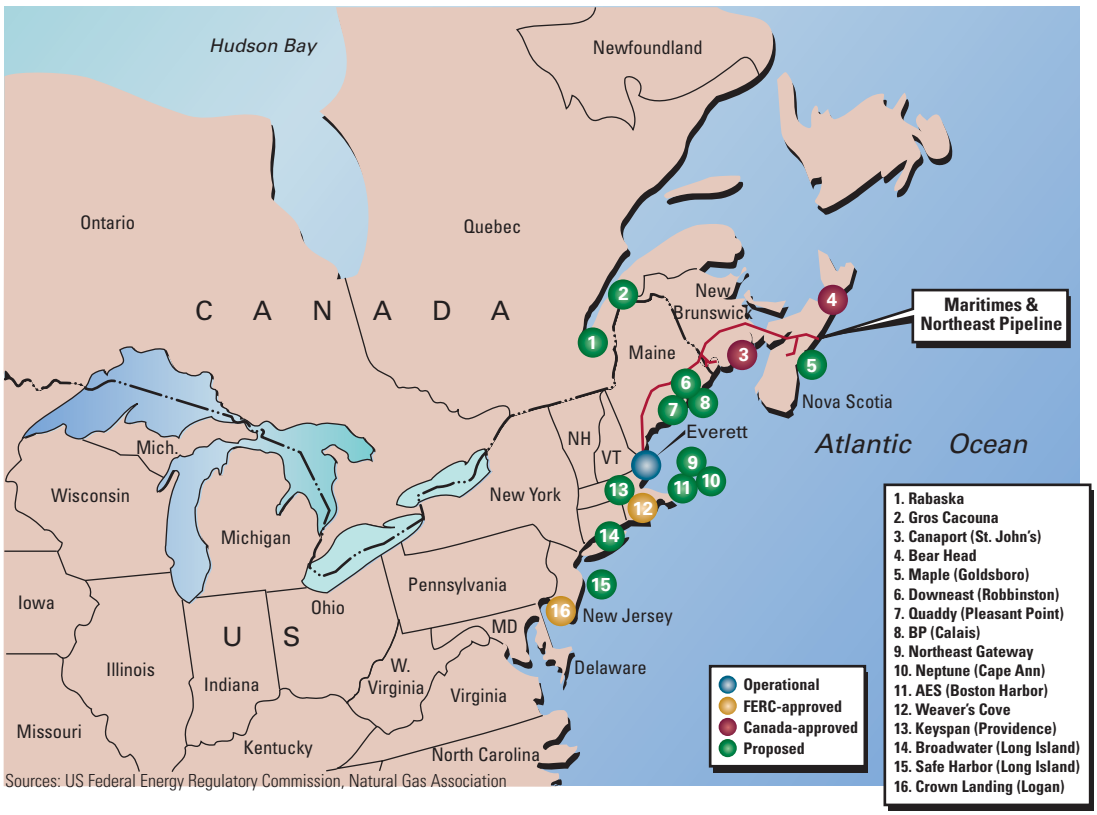
Table 1

Month	2006 LNG imports (bcf)	2006 Total US natural gas consumed (bcf)	2006 LNG portion of US consumption, %	2005 LNG imports (bcf)	2005 Total US natural gas consumed (bcf)	2005 LNG portion of US consumption, %
January	39.37	2,173.5	1.81	60.28	2,585.4	2.33
February	38.64	2,151.6	1.80	52.70	2,264.5	2.33
March	33.16	2,140.5	1.55	46.22	2,228.1	2.07
April	58.69	1,692.5	3.47	47.43	1,744.6	2.72
May	67.14	1,548.9	4.33	56.36	1,539.8	3.66
June	61.57	1,572.5	3.92	56.07	1,550.5	3.62
July	57.40	1,781.0	3.22	50.48	1,704.0	2.96
August	51.98	1,779.8	2.92	43.10	1,712.3	2.52
September	41.46	1,478.5	2.80	51.57	1,438.0	3.59
October	36.16	1,656.7	2.18	59.47	1,444.7	4.12
November	47.24	1,771.2	2.67	58.09	1,681.4	3.45
December	60.87	2,112.8	2.88	51.10	2,347.9	2.18
Full year	593.68	21,859.5	2.72	632.87	22,241.1	2.85

Sources: LNG Observer, January-March 2007; EIA Statistics, February 2007.

PROPOSED LNG IMPORT TERMINALS; CANADA, NORTHEAST US

Fig. 1



Sources: US Federal Energy Regulatory Commission, Natural Gas Association

Reserves-production ratios, however, show that US natural gas production represented 9.6% of its proven reserves and 81.4% of its annual gas consumption in 2005, requiring substantial imports to fill the gap. By contrast, Russian production represented 1.25% of its proven reserves and 147.7% of its annual gas consumption in 2005, leaving substantial volumes available for export.

The long-term implications of this imbalance for the US (and several other OECD countries) require prompt action. Delays in building new LNG receiving terminals and failure to further diversify gas procurement, in terms of both geographic sources of supply and the corporations operating the LNG supply chains, are likely to lead to serious natural gas supply interruptions and price hikes for gas consumers before 2020 and will be even more difficult to remedy then than now.

NORTH AMERICAN ONSHORE LNG, UNDER CONSTRUCTION DECEMBER 2006

Table 2

Terminal	Location	Developer	Peak throughput capacity, bcfd	Peak throughput capacity, tcf/year	Average throughput capacity, 60% load factor, tcf/year
US					
Cameron	Hackberry, La.	Sempra	1.5	0.55	0.33
Freeport	Freeport, Tex.	Cheniere	1.5	0.55	0.33
Sabine Pass	Sabine, La.	Cheniere	2.6	0.95	0.57
Corpus Christi	Corpus Christi, Tex.	Cheniere	2.6	0.95	0.57
Golden Pass	Sabine, La.	ExxonMobil	2.0	0.73	0.44
Total, US			**10.2**	**3.72**	**2.23**
Canada					
Canaport	St. John's, NB	Irving Oil, Repsol	1.0	0.37	0.22
Bear Head	Point Tupper, NS	Venture Energy	1.0	0.37	0.22
Total, Canada			**2.0**	**0.74**	**0.44**
Mexico					
Altamira (operational, Sept. 30, 2006)	Tamulipas	Shell, Total, Mitsui	0.7	0.26	0.15
Energia Costa Azul	Baja California	Sempra	1.0	0.37	0.22
Total, Mexico			**1.7**	**0.63**	**0.37**
Total, North America			**13.9**	**5.1**	**3.0**

Sources: FERC, company sources

Permitting, opposition

The US government has slowly but progressively acted to streamline the permitting process for LNG terminals since 2002, primarily through the Federal Energy Regulatory Commission and the US Coast Guard.

FERC eliminated open-season requirements in 2002, giving developers clearer incentive to invest in LNG terminals, and progressively asserted its authority in determining facility siting. FERC ruled in December 2002 that the proposed Hackberry (La.) LNG import terminal could be built without complying with the open-access requirements that had been strictly applied to all parts of the gas transmission chain previously as part of ensuring open competition in the deregulated gas market.

The Hackberry decision has encouraged proposals to build new receiving terminals by removing the risk that potential developers might lose some of their built capacity by having to offer it to third-parties at market rates.

Moves in September 2004 sought to make FERC a one-stop LNG facilities

regulator, eliminating conflicts with other agencies (e.g., military and state authorities) that had previously caused delays.

The Energy Policy Act of 2005 and new FERC regulations to implement both the act and maritime safety and security processes recommended by the Coast Guard, cleared away many potential obstacles and delays impeding approval of, and investment in, LNG terminals. But they also require project developers to engage in a minimum 6-month prefiling process and conduct more detailed waterway safety and security assessments earlier in project development than was previously the case.

Navigation and Vessel Inspection Circular (NVIC) 05-05, also issued in 2005, further affects the approval process for new terminals. Together with FERC's filing process, NVIC requirements extend the full approval process to between 18 months and 2 years. In some locations, even once all federal hurdles have been crossed, state legal challenges can still delay a project's progress into the construction phase.

Under construction

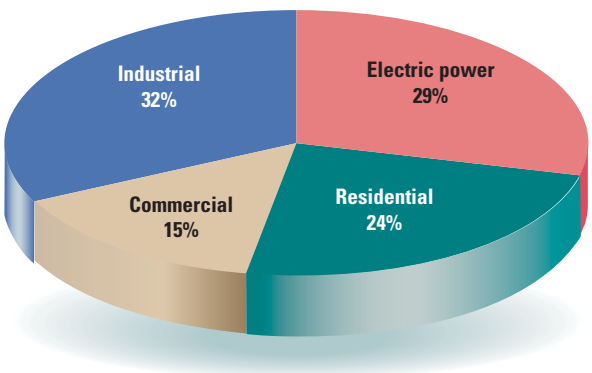
In late 2006 only nine new onshore terminal projects were under construction in North America, including two projects each in Canada and Mexico (Table 2). Several other projects have been permitted. The five under construction in the US are along the Gulf Coast.

Total peak sendout gas capacity of the nine projects is 14 bcfd (5 tcf/year). But such plants usually average throughput of less than 60% of maximum capacity, limiting their likely contribution to 3 tcf/year when they become fully operational in 2008-09.

These projects will help the US diversify its fuel supply by tapping global LNG markets. Expanding LNG import capacity is a necessary and, by many, an accepted step for the US to take.

Utilities contracting their gas supply from remote foreign LNG suppliers, however, face a range of new risks to manage and, where possible, mitigate. These geopolitical risks make the US gas and power utilities and their end users more vulnerable to potential supply interruptions and price spikes, in a future dependent on long-distance LNG supply chains from several continents.

US NATURAL GAS CONSUMPTION BY END USER, 2005 Fig. 2



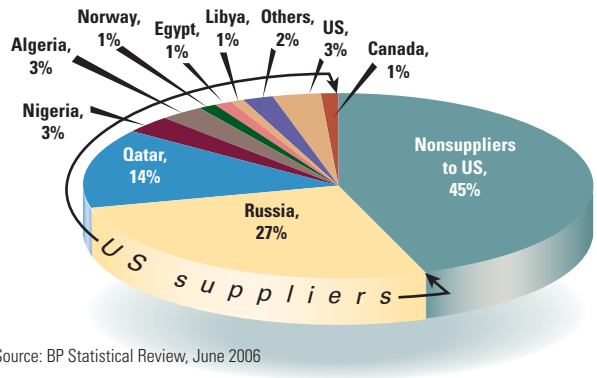
The new Altamira LNG receiving terminal in northeast Mexico (Shell 50%, Total 25%, Mitsui 25%) became fully operational in late 2006, with an initial gas sendout capacity of 500 MMcfd, and potential to expand that to 700 MMcfd. The plant consists of two 150,000-cu m full-containment LNG storage tanks that can handle marine tankers with cargoes up to 200,000 cu m.

The LNG imported, however, is contracted to Mexican utility Comisión Federal de Electricidad (CFE) at 185 bcf/year, and no plans exist to import additional LNG for re-export to US.

Although this, and some of the Mexican terminals planned for the country's west coast, will improve North America's overall natural gas balances by serving growing natural gas demand in Mexico and filling its supply gap, it will not solve the US gas shortfall. It is clear that the most vulnerable regions of the

PROVED GLOBAL NATURAL GAS RESERVES, YEAREND 2005

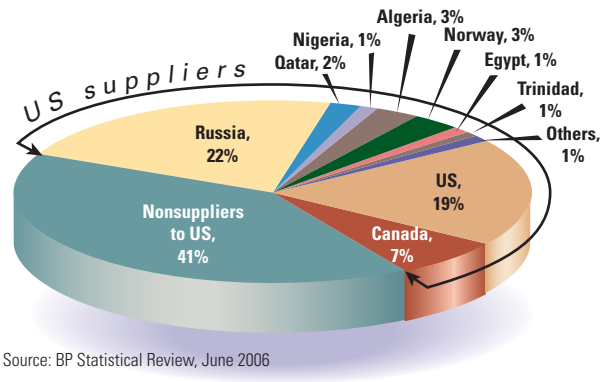
Fig. 3



Source: BP Statistical Review, June 2006

GLOBAL NATURAL GAS PRODUCTION, 2005

Fig. 4



Source: BP Statistical Review, June 2006

US gas market, namely California and New England, need to build their own infrastructure. Imported LNG can help balance North American gas supply, but for the US to improve its own security of supply it must commit to build LNG receiving terminals in strategic areas within the US.

New England

Gas-fired generation accounted for about 16% of New England's total electric consumption in 1999; this has since risen to closer to 40%, according to ISO New England (the entity responsible for managing the region's gas transmission system), and could reach 50% by 2010.

Consumption of natural gas in the New England market has grown at one of the fastest rates in the US over the past 10 years. Natural gas is now the leading source of fuel for electric generation in New England. New England's monthly load factor for gas pipelines approached 90% over the 3 mid-winter months this year, indicating little redundant capacity on gas pipelines during peak periods. If New England's economy is to grow at the 1%/year forecast by the Energy Information Administration, much of that growth will be driven by increased power and therefore gas consumption, placing more pressure on an already strained gas supply network.

New England is at the end of the pipeline systems originating in the US Gulf Coast and from northeastern and western Canada. New England is more dependent on Canadian gas imports (40% of supply) than other US regions (~15%). LNG imports through Suez Energy NA's Everett terminal in Boston make only 15% of New England's gas supply.

Because the region lacks any gas storage, however, regasified LNG makes up 25% of the gas delivered on a peak winter day. Its tight supply situation, lack of underground gas storage, and limited existing LNG infrastructure cause the New England gas market to experience significantly higher wholesale and residential natural gas prices than the rest of the US.

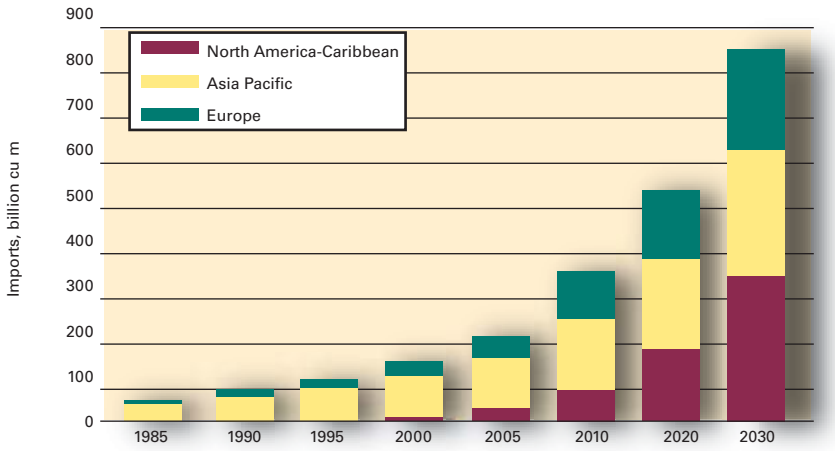
Fig. 1 shows the location of proposed LNG receiving terminals in Canada and the Northeast US. Canaport terminal is set for completion in late 2008, having started construction in May 2006. RepsolYPF has taken a 75% stake in the facility (Irving Oil, 25%) and 100% of the capacity (1-bcfd sendout capacity from two 160,000-cu m tanks).

Anadarko sold its Bear Head facility in July 2006, having started and halted construction earlier in the year when it failed to secure an LNG supply deal. Venture Energy bought Bear Head for $110 million, but still has to build the facility and find a supply deal.

MapleLNG Ltd's proposed site at Goldboro, NS, adjacent to the Maritimes and Northeast Pipeline (M&NP) intake station, received environmental approval in March 2007. 4Gas North America and Suntera Canada Ltd., joint-venture partners in MapleLNG, purchased the

LNG TRADE VOLUMES

Fig. 5



Source: Historical, BP Statistical Review, June 2006; Forecast, David Wood & Associates.

LNG portion of an integrated LNG-petrochemical complex from Keltic Petrochemicals Inc. in March 2006 but have yet to announce an LNG supply deal.

MN&P will require five new compressor stations to accommodate additional capacity, and a new 145-km pipeline is planned from the Canaport site to the US border to tie into the US part of the MN&P network.

Other plants proposed in Canada have yet to make substantial progress.

Of the projects in the Northeast US, BP's Crown Landing, NJ, and Hess-Poten & Partners Weaver's Cove Energy, Fall River, Mass., terminals have received permitting but have yet to commence construction.

Public opposition and legal challenges continue to delay these and other New England LNG receiving terminal projects.

End users

The US imports 25% of the natural gas it consumes, mainly from Canada. LNG imports will play an increasingly central role in meeting US needs as demand grows, and Canada's ability to supply declines. Natural gas provides 15% of US electricity generation; 45% of residential heating fuel; and 30% of the energy and petrochemicals consumed by agriculture and industry. Gas also supplies minor volumes of feedstock for the manufacture of hydrogen, a promising new entrant in the development of alternative fuels.

Fig. 2 shows the average consumption of natural gas by end user in the US during 2005. Industrial, electric power generation, and residential heating dominate natural gas consumption in US.

Geopolitical risks

Rapid depletion of US domestic gas reserves inexorably leads to growing dependence on foreign imports from beyond the politically safe confines of Canada. The future LNG supply mix for the US is likely to come from Algeria, Angola, Egypt, Equatorial Guinea, Libya, Nigeria, Norway, Peru, Russia, Qatar, Trinidad, and Yemen.

These countries (including the US itself and Canada) hold some 55% of global gas reserves (Fig. 3) and 59% of global production (Fig. 4). Diversity of supply from large and smaller reserve-holding countries is critical, as several of these countries have large radical minorities, which if they gained power would attempt to disrupt LNG supplies to OECD countries.

If political events interrupted the supply from just a few of these countries, the remainder might struggle to sustain global gas demand for long. A number of political scenarios could easily lead to such an outcome.

Risk exposure

Expanding US dependence on imported LNG will expose utilities and their customers to a spectrum of risks including political instability, fiscal delinquency, terrorism, war, and the prospect of market manipulation by a prospective international gas cartel. LNG undoubtedly increases US dependence on overseas energy producers, particularly in the Middle East, where much of the reserves are located. This increased dependence makes many in the US uncomfortable.

Even Trinidad & Tobago—the source of most LNG imported by the US in recent years—shows signs of a government keen to increase the power it wields over the LNG produced in its territory.

Geopolitically driven supply interruptions seem inevitable at some stage during the next decade or so. Unless LNG supplies are broadly diversified, these geopolitical risks may increase US gas and power utilities' vulnerability in the long-term to the price shocks LNG imports are striving to avert.

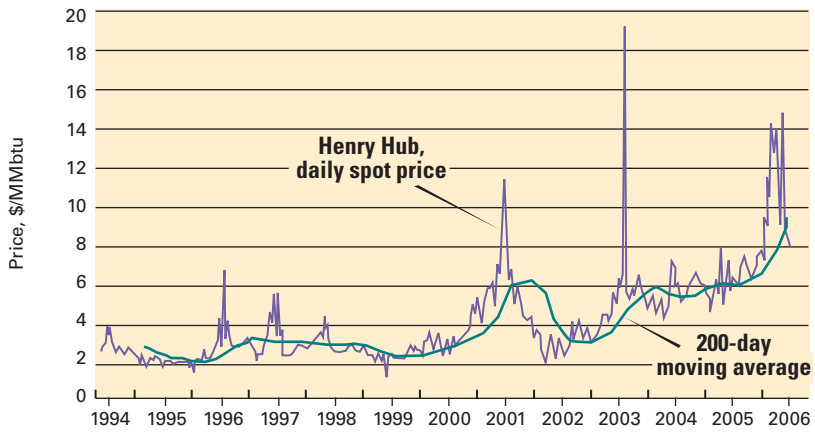
OECD countries such as Japan, Germany, France, and South Korea, however, have depended on imported gas for decades and have succeeded in establishing and managing long-term relationships with a range of suppliers. The US—and such new entrants into the LNG import sector as the UK, India, and China—can learn many lessons from such longstanding relationships.

Gas demand is set to increase substantially over the next 2 decades in all consuming regions (Fig. 5), even as geopolitical tensions impacting gas supply chains intensify.

Embracing long-term high volume LNG supply contracts linked to stable pricing formulas should provide long-term confidence that LNG sale terms are sustainable for both buyer and seller on a commercial basis. Such price formulas in the US could involve a range of competing power-generation fuel and electricity prices, as well as short-term Henry Hub gas prices, reducing the potential effect of LNG supply inter-

WHOLESALE US NATURAL GAS PRICES, 1994-2006

Fig. 6



Source: US General Accountability Office, February 2006

ruptions caused by price volatility and gas price spikes that have characterized deregulated markets such as the US in recent years (Fig. 6). ✦

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Equipment/Software/Literature

Flowmeter approved for custody transfer of LNG

Micro Motion flowmeters have been certified by the Nederlands Meetinstituut (NMi) and approved for custody transfer measurement of cryogenic fluids such as LNG.

The cryogenic measurement accuracy of better than 0.5% certified by NMi exceeds the maximum permissible error of 1.5% for cryogenic applications. This level of accuracy is achieved by patent-pending algorithms and advanced meter design that mitigate the dynamic relationships between supercold process fluids, highly sensitive measurement technologies, and carefully selected materials of construction.

Source: **Emerson Process Management**, Box 4100, St. Louis, MO 63136-8506.

New on line service provides E&P data worldwide

NeoFirma OperationsMaster, a new combination of on line services and service providers, offers up-to-date exploration and production information on a global basis.

The company says that organizations' staff, partners, and service providers can keep each other informed via their own private databases and company web sites at all times, regardless of location. The service is easy to use, economical, and features bank-level security that encrypts and protects all information, the firm notes.

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An alliance of service providers includes Crosstex Energy Services, Dallas; Banks Information Solutions Inc., Austin; Carr Environmental Group Inc., Houston; and Haas Petroleum Engineering Services Inc., Dallas. These partners all use NeoFirma's services to provide on line delivery of their services and customer support.

Source: **NeoFirma Inc.**, 8117 Preston Rd., Suite 260, Dallas, TX 75225.

Services/Suppliers

Knight

Lafayette, La., has announced the promotion of Doug Keller to vice-president of marketing and business development, with responsibilities encompassing all Knight companies.

Keller, who earned a BS degree from Louisiana Tech University, has been with Knight for 18 years.

Knight is the largest privately held rental tool business in the oil and gas industry. The company operates with four business units: Knight Oil Tools, Knight Fishing Services, Well Services, and Manufacturing.

PSL Energy Services Ltd.

Aberdeen, has announced the appointment of David Kay as country manager for Kazakhstan, and has opened a new office in Atyrau.

Kay has wide experience in well engineering disciplines, working for major operators in the North Sea, and in various roles in the former Soviet Union. During his 10 years with Baker Hughes, Kay worked in Uzbekistan, Siberia, and Moscow.

PSL Energy Services Ltd. provides oil and gas services from regional bases in Stavanger, Great Yarmouth, Houston, Singapore, Abu Dhabi, Doha, Baku, and Algeria. Its core activities are well services, process, pipeline, excavation, and inspection services, and hydraulic workovers.

Barnes & Click Inc.

Dallas, has announced that D. Loren Fuller has joined the firm as a senior consultant to the gas midstream and LNG industries.

Fuller most recently was engineering coordinator at Woodside Petroleum in Perth, and previously was with Chevron-Texaco, and Dynegy. He earned his chemical engineering degree from Oklahoma State University.

Barnes & Click Inc. is a management and engineering company serving operating companies and financial institutions active in the international hydrocarbons industry.

Continental Alloys & Services

Houston, has announced its acquisition of Alloy & Oilfield Pte Ltd., Singapore. The move enhances the company's distribution and skilled manufacturing services capabilities.

Continental Alloys & Services, formerly Continental Casing Ltd., is a leading materials management company, distributing pipe, tube, bar, and manufacturing tools for energy service companies' well completion programs around the world.

OpenSpirit Corp.

Sugar Land, Tex., has announced the appointment of Lyn Babec as vice-president of marketing.

Babec holds a BS degree in chemical engineering from the University of Saskatchewan. She joins OpenSpirit from Halliburton Drilling Evaluation & Digital Solutions/Landmark, where she held production operations and systems development roles.

OpenSpirit Corp. is an independent software company, providing integration solutions for upstream applications and data.

API IMPORTS OF CRUDE AND PRODUCTS

	Districts 1-4		District 5		Total US		
	4-6 2007	[1]3-30 2007	4-6 2007	[1]3-30 2007	4-6 2007	[1]3-30 2007	4-7 2006
	1,000 b/d						
Total motor gasoline	433	418	4	79	437	497	377
Mo. gas. blending comp.	547	415	191	76	738	491	461
Distillate[2]	176	318	14	62	190	380	188
Residual	505	320	30	90	535	410	336
Jet fuel-kerosine	152	86	163	59	315	145	107
LPG	240	288	6	4	246	292	364
Unfinished oils	505	494	5	18	510	512	642
Other	619	341	6	13	625	354	459
Total products	**3,177**	**2,680**	**419**	**401**	**3,596**	**3,081**	**2,934**
Canadian crude	1,468	1,025	191	260	1,659	1,285	1,884
Other foreign	7,025	8,010	534	1,180	7,559	9,190	6,976
Total crude	**8,493**	**9,035**	**725**	**1,440**	**9,218**	**10,475**	**8,860**
Total imports	**11,670**	**11,715**	**1,144**	**1,841**	**12,814**	**13,556**	**11,794**

[1]Revised. [2]Includes No. 4 fuel oil.
Source: American Petroleum Institute.
Data available in OGJ Online Research Center.

PURVIN & GERTZ LNG NETBACKS—APR. 6, 2007

Receiving terminal	Liquefaction plant					
	Algeria	Malaysia	Nigeria	Austr. NW Shelf	Qatar	Trinidad
	$/MMbtu					
Barcelona	6.94	5.53	6.41	5.42	5.87	6.16
Everett	6.49	5.00	6.24	5.15	5.38	6.69
Isle of Grain	2.62	1.31	2.27	1.26	1.23	2.31
Lake Charles	5.52	4.25	5.36	4.35	4.44	5.93
Sodegaura	5.07	6.77	5.32	6.36	5.94	4.03
Zeebrugge	5.53	4.23	5.30	4.32	4.66	5.31

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

API CRUDE AND PRODUCT STOCKS

	Crude oil	Motor gasoline		Jet fuel	Fuel oils		Unfinished oils
		Total	Blending comp.[1]	Kerosine	Distillate	Residual	
	1,000 bbl						
PAD I	16,144	54,767	27,682	10,330	41,313	14,801	7,193
PAD II	74,058	48,223	15,692	7,621	28,974	1,134	15,602
PAD III	178,768	64,086	27,265	13,814	32,779	16,618	45,889
PAD IV	14,379	5,929	1,804	564	3,233	367	3,156
PAD V	[1]53,815	25,814	18,730	8,211	12,952	5,800	22,544
Apr. 6, 2007	**[1]337,164**	**198,829**	**91,173**	**40,540**	**119,251**	**38,720**	**94,384**
Mar. 30, 2007[3]	**335,192**	**202,031**	**92,251**	**39,960**	**119,694**	**38,256**	**92,021**
Apr. 7, 2006	**345,300**	**209,030**	**85,906**	**40,834**	**117,877**	**41,425**	**92,616**

[1]Included in total motor gasoline. [2]Includes 6.630 million bbl of Alaskan crude in transit by water. [3]Revised.
Source: American Petroleum Institute.
Data available in OGJ Online Research Center.

API REFINERY REPORT—APR. 6, 2007

District	REFINERY OPERATIONS					REFINERY OUTPUT			
	Total refinery input	Crude runs	Input to crude stills	Operable capacity	Percent operated	Total motor gasoline	Jet fuel, kerosine	Fuel oils: Distillate	Fuel oils: Residual
	1,000 b/d					1,000 b/d			
East Coast	3,120	1,362	1,364	1,618	84.3	1,568	82	505	148
App. Dist. 1	14	7	7	95	7.4	13	0	4	0
Dist. 1 total	**3,134**	**1,369**	**1,371**	**1,713**	**80.0**	**1,581**	**82**	**509**	**148**
Ind., Ill., Ky.	2,045	2,041	2,043	2,355	86.8	1,192	137	568	33
Minn., Wis., Dak.	374	364	369	442	83.5	283	27	117	13
Okla., Kan., Mo.	698	565	571	786	72.7	403	21	192	3
Dist. 2 total	**3,117**	**2,970**	**2,983**	**3,583**	**83.3**	**1,878**	**185**	**877**	**49**
Inland Texas	960	639	644	647	99.5	452	40	193	7
Texas Gulf Coast	3,751	3,343	3,466	4,031	85.5	1,343	328	998	130
La. Gulf Coast	3,331	3,180	3,259	3,264	99.9	1,255	354	909	163
N. La. and Ark.	213	162	173	215	80.5	92	12	41	5
New Mexico	168	100	100	113	88.5	108	2	40	0
Dist. 3 total	**8,423**	**7,424**	**7,622**	**8,270**	**92.2**	**3,250**	**736**	**2,181**	**305**
Dist. 4 total	**676**	**571**	**582**	**596**	**97.7**	**258**	**31**	**160**	**15**
Dist. 5 total	**2,770**	**2,354**	**2,600**	**3,173**	**81.9**	**1,713**	**331**	**476**	**152**
Apr. 6, 2007	**18,120**	**14,688**	**15,158**	**17,335**	**87.4**	**8,680**	**1,365**	**4,203**	**669**
Mar. 30, 2007*	**18,740**	**14,564**	**15,071**	**17,335**	**86.9**	**8,934**	**1,493**	**4,164**	**682**
Apr. 7, 2006	**16,757**	**14,160**	**14,556**	**17,115**	**85.1**	**7,880**	**1,412**	**3,432**	**674**

*Revised.
Source: American Petroleum Institute.
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

	*4-6-07	*4-7-06	Change	Change, %
	$/bbl			
SPOT PRICES				
Product value	82.53	81.79	0.74	0.9
Brent crude	68.62	66.97	1.65	2.5
Crack spread	13.91	14.82	–0.91	–6.1
FUTURES MARKET PRICES				
One month				
Product value	82.96	80.17	2.79	3.5
Light sweet crude	64.99	67.07	–2.08	–3.1
Crack spread	17.97	13.09	4.88	37.3
Six month				
Product value	80.57	79.44	1.14	1.4
Light sweet crude	69.35	69.92	–0.57	–0.8
Crack spread	11.22	9.51	1.71	17.9

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

OGJ GASOLINE PRICES

	Price ex tax 4-4-07	Pump price* 4-4-07	Pump price 4-5-06
	¢/gal		
(Approx. prices for self-service unleaded gasoline)			
Atlanta	228.4	268.1	254.5
Baltimore	229.5	271.4	255.4
Boston	221.9	263.8	248.7
Buffalo	220.4	280.5	260.0
Miami	235.5	285.8	272.3
Newark	221.3	254.2	239.9
New York	212.7	272.8	259.3
Norfolk	224.2	261.8	248.4
Philadelphia	228.1	278.8	259.6
Pittsburgh	218.1	268.8	253.8
Wash., DC	239.0	277.4	266.9
PAD I avg.	225.4	271.2	256.3
Chicago	247.9	298.8	282.4
Cleveland	219.8	266.2	248.9
Des Moines	221.8	262.2	247.2
Detroit	221.3	270.5	255.3
Indianapolis	225.5	270.5	259.2
Kansas City	221.8	257.8	241.0
Louisville	233.9	270.8	260.0
Memphis	220.7	260.5	248.9
Milwaukee	226.2	277.5	259.4
Minn.-St. Paul	223.7	264.1	258.6
Oklahoma City	222.8	258.2	240.8
Omaha	222.1	268.5	253.8
St. Louis	225.9	261.9	244.6
Tulsa	223.4	258.8	244.7
Wichita	218.1	261.5	243.0
PAD II avg.	225.0	267.2	252.6
Albuquerque	230.7	267.1	260.1
Birmingham	222.8	261.5	251.4
Dallas-Fort Worth	226.7	265.1	260.2
Houston	223.4	261.8	255.3
Little Rock	220.3	260.5	246.5
New Orleans	221.8	260.2	254.6
San Antonio	212.4	250.8	243.7
PAD III avg.	222.6	261.0	253.1
Cheyenne	219.8	252.2	232.1
Denver	230.7	271.1	244.4
Salt Lake City	216.2	259.1	225.7
PAD IV avg.	222.2	260.8	234.0
Los Angeles	263.2	321.7	279.5
Phoenix	242.0	279.4	249.7
Portland	255.5	298.8	253.4
San Diego	271.8	330.3	282.4
San Francisco	288.5	347.0	281.9
Seattle	251.0	303.4	268.8
PAD V avg.	262.0	313.4	269.3
Week's avg.	**229.8**	**273.4**	**254.7**
Mar. avg.	**210.4**	**254.0**	**235.4**
Feb. avg.	**184.4**	**228.0**	**229.8**
2007 to date	**194.1**	**237.7**	—
2006 to date	**190.4**	**232.8**	—

*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

	3-30-07 ¢/gal		3-30-07 ¢/gal
Spot market product prices			
Motor gasoline (Conventional-regular)		Heating oil No. 2	
New York Harbor	204.75	New York Harbor	187.05
Gulf Coast	196.75	Gulf Coast	183.77
Los Angeles	243.75	Gas oil	
Amsterdam-Rotterdam-Antwerp (ARA)	188.95	ARA	187.77
Singapore	195.71	Singapore	189.88
Motor gasoline (Reformulated-regular)		Residual fuel oil	
New York Harbor	208.00	New York Harbor	108.64
Gulf Coast	210.75	Gulf Coast	108.33
Los Angeles	253.75	Los Angeles	130.03
		ARA	111.38
		Singapore	125.07

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

BAKER HUGHES RIG COUNT

	4-6-07	4-7-06
Alabama	3	4
Alaska	13	9
Arkansas	43	14
California	32	35
Land	31	30
Offshore	1	5
Colorado	104	84
Florida	0	0
Illinois	0	0
Indiana	2	0
Kansas	14	6
Kentucky	9	5
Louisiana	191	184
N. Land	59	56
S. Inland waters	26	18
S. Land	41	33
Offshore	65	77
Maryland	0	0
Michigan	2	1
Mississippi	18	6
Montana	20	24
Nebraska	0	0
New Mexico	74	95
New York	7	3
North Dakota	33	32
Ohio	14	7
Oklahoma	173	172
Pennsylvania	17	14
South Dakota	1	0
Texas	807	717
Offshore	9	14
Inland waters	0	3
Dist. 1	23	20
Dist. 2	33	21
Dist. 3	52	68
Dist. 4	87	77
Dist. 5	162	128
Dist. 6	127	106
Dist. 7B	45	41
Dist. 7C	61	33
Dist. 8	107	80
Dist. 8A	25	31
Dist. 9	31	29
Dist. 10	45	66
Utah	42	39
West Virginia	29	25
Wyoming	69	102
Others—ID-1; NV-2; TN-4; VA-2	9	1
Total US	**1,726**	**1,579**
Total Canada	**126**	**269**
Grand total	**1,852**	**1,848**
Oil rigs	283	264
Gas rigs	1,438	1,313
Total offshore	75	96
Total cum. avg. YTD	**1,734**	**1,526**

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	4-6-07 Rig count	4-6-07 Percent footage*	4-7-06 Rig count	4-7-06 Percent footage*
0-2,500	58	6.8	46	6.5
2,501-5,000	101	60.3	92	52.1
5,001-7,500	213	23.0	206	19.9
7,501-10,000	420	4.0	354	2.5
10,001-12,500	416	3.6	367	1.0
12,501-15,000	263	—	268	—
15,001-17,500	111	0.9	121	0.8
17,501-20,000	72	—	70	—
20,001-over	38	—	17	—
Total	**1,692**	**8.6**	**1,541**	**6.8**
INLAND	36		45	
LAND	1,597		1,434	
OFFSHORE	59		62	

*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]4-6-07	[2]4-7-06
	1,000 b/d	
(Crude oil and lease condensate)		
Alabama	18	21
Alaska	787	764
California	681	684
Colorado	53	61
Florida	7	6
Illinois	31	28
Kansas	96	90
Louisiana	1,380	1,209
Michigan	15	14
Mississippi	52	48
Montana	91	98
New Mexico	165	157
North Dakota	104	105
Oklahoma	171	172
Texas	1,343	1,293
Utah	43	46
Wyoming	142	144
All others	64	74
Total	**5,243**	**5,014**

[1]OGJ estimate. [2]Revised.

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

US CRUDE PRICES

$/bbl*	4-6-07
Alaska-North Slope 27°	50.46
South Louisiana Sweet	65.50
California-Kern River 13°	53.05
Lost Hills 30°	60.90
Southwest Wyoming Sweet	60.28
East Texas Sweet	61.68
West Texas Sour 34°	54.15
West Texas Intermediate	61.00
Oklahoma Sweet	61.00
Texas Upper Gulf Coast	57.75
Michigan Sour	54.00
Kansas Common	59.75
North Dakota Sweet	54.00

*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]	3-30-07
United Kingdom-Brent 38°	64.98
Russia-Urals 32°	61.98
Saudi Light 34°	60.26
Dubai Fateh 32°	60.42
Algeria Saharan 44°	66.74
Nigeria-Bonny Light 37°	67.31
Indonesia-Minas 34°	64.72
Venezuela-Tia Juana Light 31°	59.99
Mexico-Isthmus 33°	59.88
OPEC basket	62.76
Total OPEC[2]	61.70
Total non-OPEC[2]	61.96
Total world[2]	61.81
US imports[3]	58.08

[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]

	3-30-07	3-23-07	Change
	Bcf		
Producing region	629	597	32
Consuming region east	702	677	25
Consuming region west	238	237	1
Total US	**1,569**	**1,511**	**58**
	Jan. 07	**Jan. 06**	**Change, %**
Total US[2]	**2,379**	**2,371**	**0.3**

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

Statistics

International rig count

Region	Mar. 2007 Land	Mar. 2007 Off.	Mar. 2007 Total	Mar. 06 Total
WESTERN HEMISPHERE				
Argentina	87	0	87	69
Bolivia	4	0	4	3
Brazil	18	23	41	27
Canada	390	2	392	620
Chile	1	0	1	0
Colombia	32	0	32	21
Ecuador	11	0	11	12
Mexico	62	29	91	85
Peru	9	0	9	4
Trinidad	4	3	7	3
United States	1,667	81	1,749	1,551
Venezuela	61	19	80	81
Other	2	0	2	1
Subtotal	**2,348**	**157**	**2,505**	**2,477**
ASIA-PACIFIC				
Australia	9	8	17	19
Brunei	0	4	4	2
China-offshore	0	18	18	17
India	53	31	84	83
Indonesia	31	18	49	52
Japan	1	0	1	3
Malaysia	0	15	15	15
Myanmar	7	2	9	10
New Zealand	2	1	3	5
Papua New Guinea	3	0	3	3
Philippines	0	0	0	2
Taiwan	0	0	0	0
Thailand	3	10	13	10
Vietnam	0	7	7	9
Other	2	2	4	3
Subtotal	**111**	**116**	**227**	**233**
AFRICA				
Algeria	26	0	26	22
Angola	3	2	5	4
Congo	2	1	3	3
Gabon	1	1	2	2
Kenya	0	0	0	0
Libya	13	0	13	9
Nigeria	2	6	8	11
South Africa	0	0	0	1
Tunisia	1	1	2	1
Other	3	3	6	5
Subtotal	**51**	**14**	**65**	**58**
MIDDLE EAST				
Abu Dhabi	8	4	12	14
Dubai	1	0	1	2
Egypt	38	8	46	33
Iran	0	0	0	0
Iraq	0	0	0	0
Jordan	1	0	1	1
Kuwait	12	0	12	13
Oman	46	0	46	36
Pakistan	19	0	19	15
Qatar	3	11	14	11
Saudi Arabia	68	7	75	60
Sudan	0	0	0	0
Syria	19	0	19	22
Yemen	14	0	14	12
Other	1	0	1	2
Subtotal	**230**	**30**	**2620**	**221**
EUROPE				
Croatia	1	0	1	3
Denmark	0	3	3	4
France	1	0	1	0
Germany	5	0	5	3
Hungary	2	0	2	4
Italy	2	1	3	2
Netherlands	2	3	5	6
Norway	0	16	16	16
Poland	2	0	2	2
Romania	2	0	2	2
Turkey	5	0	5	4
UK	0	25	25	30
Other	6	1	7	2
Subtotal	**28**	**49**	**77**	**80**
Total	**2,768**	**366**	**3,134**	**3,069**

Definitions, see OGJ Sept. 18, 2006, p. 42
Source: Baker Hughes Inc.
Data available in OGJ Online Research Center.

Oil import freight costs*

Source	Discharge	Cargo	Cargo size, 1,000 bbl	Freight (Spot rate) worldscale	$/bbl
Caribbean	New York	Dist.	200	258	2.17
Caribbean	Houston	Resid.	380	182	1.71
Caribbean	Houston	Resid.	500	162	1.52
N. Europe	New York	Dist.	200	246	3.29
N. Europe	Houston	Crude	400	196	3.84
W. Africa	Houston	Crude	910	57	2.89
Persian Gulf	Houston	Crude	1,900	57	2.30
W. Africa	N. Europe	Crude	910	135	2.17
Persian Gulf	N. Europe	Crude	1,900	58	1.71
Persian Gulf	Japan	Crude	1,750	61	1.46

*January 2007 average.
Source: Drewry Shipping Consultants Ltd.
Data available in OGJ Online Research Center.

US LNG imports

Country	Jan. 2007	Dec. 2006	Jan. 2006	Change from a year ago, %
	MMcf			
Algeria	2,521	0	2,988	–15.6
Brunei	0	0	0	—
Malaysia	0	0	0	—
Nigeria	5,325	3,082	3,028	75.9
Oman	0	0	0	—
Qatar	0	0	0	—
Trinidad and Tobago	36,792	36,718	30,480	20.7
Others	8,803	11,440	2,970	196.4
Total	**53,441**	**51,240**	**39,466**	**35.4**

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

Baker oil tools workover rig count*

Region	Mar. 2007	Mar. 2006	Change, %
Gulf Coast	276	298	–7.4
Midcontinent	261	242	7.9
Northeastern	75	76	–1.3
Rocky Mountains	202	244	–17.2
Southeastern	203	213	–4.7
West Texas	334	331	0.9
Western	145	135	7.4
Total US	**1,496**	**1,539**	**–2.8**
Canada	635	488	30.1
Total N. America	**2,131**	**2,027**	**5.1**

*Wells over 1,500 ft deep and tubing out of the wellbore. Excludes rigs on rod jobs. Definitions, see OGJ Sept. 22, 1997, p. 46. Source: Baker Hughes Inc. Data available in Oil & Gas Journal Energy Database.

Propane prices

	Feb. 2007	Mar. 2007	Feb. 2006	Mar. 2006
	¢/gal			
Mont Belvieu	97.55	103.71	91.89	92.60
Conway	96.77	100.47	89.51	90.38
Northwest Europe	100.83	100.54	108.17	104.76

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

Muse, Stancil & Co. refining margins

	US Gulf Coast	US East Coast	US Mid-west	US West Coast	North-west Europe	South-east Asia
	$/bbl					
Mar. 2007						
Product revenues	81.94	75.91	79.51	91.77	71.49	69.07
Feedstock costs	–62.81	–63.53	–58.07	–55.98	–61.23	–64.46
Gross margin	19.13	12.38	21.44	35.79	10.26	4.61
Fixed costs	–2.04	–2.36	–2.30	–2.68	–2.30	–1.79
Variable costs	–2.12	–1.43	–1.88	–3.35	–2.11	–0.78
Cash operating margin	**14.97**	**8.59**	**17.26**	**29.76**	**5.85**	**2.04**
Feb. 2007	9.72	4.54	13.09	26.82	6.05	2.55
YTD avg.	10.75	4.98	12.89	25.18	5.69	2.46
2006 avg.	12.49	6.01	15.00	23.72	5.88	1.06
2005 avg.	12.53	6.98	12.31	20.55	5.51	1.52
2004 avg.	6.16	3.70	6.64	11.76	5.08	1.83

Source: Muse, Stancil & Co. See OGJ, Jan. 15, 2001, p. 46.
Data available in OGJ Online Research Center.
NOTE: The refining models that comprise the basis for the Muse refining margins have been updated to reflect changing crude slates, product specifications, and market pricing. All current and historical margin series have been revised.

Muse, Stancil & Co. gasoline marketing margins

Feb. 2007	Chicago*	Houston	Los Angeles	New York
	¢/gal			
Retail price	236.52	211.34	262.95	233.60
Taxes	52.46	38.40	56.83	48.41
Wholesale price	179.41	171.36	204.68	176.21
Spot price	166.57	166.04	205.43	167.81
Retail margin	4.77	1.58	1.44	8.98
Wholesale margin	12.84	5.32	–0.75	8.40
Gross marketing margin	**17.61**	**6.90**	**0.69**	**17.38**
Jan. 2007	35.03	30.52	28.87	45.15
YTD avg.	26.32	18.71	14.78	31.27
2006 avg.	19.74	20.34	18.03	27.90
2005 avg.	19.77	16.26	20.39	27.13
2004 avg.	22.49	17.49	23.61	30.36

*The wholesale price shown for Chicago is the RFG price utilized for the wholesale margin. The Chicago retail margin includes a weighted average of RFG and conventional wholesale purchases.
Source: Muse, Stancil & Co. See OGJ, Oct. 15, 2001, p. 46.
Data available in OGJ Online Research Center.

Muse, Stancil & Co. ethylene margins

	Ethane	Propane	Naphtha
	¢/lb ethylene		
Mar. 2007			
Product revenues	50.35	86.39	103.99
Feedstock costs	–25.72	–59.03	–100.83
Gross margin	24.63	27.36	3.16
Fixed costs	–5.38	–6.36	–7.19
Variable costs	–5.32	–6.28	–8.45
Cash operating margin	**13.93**	**14.72**	**–12.48**
Feb. 2007	13.09	14.96	–4.27
YTD avg.	14.56	15.66	–4.76
2006 avg.	19.55	22.53	1.77
2005 avg.	14.43	20.68	1.28
2004 avg.	9.00	12.03	0.51

Source: Muse, Stancil & Co. See OGJ, Sept. 16, 2002, p. 46.
Data available in OGJ Online Research Center.

Muse, Stancil & Co. US gas processing margins

Mar. 2007	Gulf Coast	Mid-continent
	$/Mcf	
Gross revenue		
Gas	6.81	5.41
Liquids	1.07	2.91
Gas purchase cost	7.58	7.26
Operating costs	0.07	0.15
Cash operating margin	**0.23**	**0.91**
Feb. 2007	0.04	0.31
YTD avg.	0.15	0.59
2006 avg.	0.26	0.97
2005 avg.	–0.06	0.25
2004 avg.	0.07	0.33
Breakeven producer payment, % of liquids	75%	67%

Source: Muse, Stancil & Co. See OGJ, May 21, 2001, p. 54.
Data available in OGJ Online Research Center.

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The Ministry of Mines now invites consultants with more than 15 years relevant experience to indicate their interest. Interested individuals must possess an appropriate degree and provide information indicating that they are qualified to perform the services

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Further information may be obtained by contacting the PMU at the address below during office hours 08.00 - 16.00 hours or by email. Expressions of interest (including CV) must be delivered to the address below or sent by email by no later than **4TH May 2007at 1600 hrs**. Reference MMI/PMU/38 must be quoted on all correspondence and the Expression of interest.

Attention: Dr David Greenbaum / Pavel Cemirtan, Ministry of Mines, Program Management Unit (PMU), Afghanistan Geological Survey Building (AGS), 2nd floor, Annex, Close to Abdul Haq roundabout, 3rd Makrorayan, Kabul, Afghanistan. Email: deegee2006@gmail.com (copied to: pcemirtan@gmail.com). Cell.Nos. +93 (0)798 254 396 or +93 (0)797 203 579

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- Identifying and distributing the workload for program planning and implementation
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Global warming melts separation of power in US

Can anyone guess which branch of the US government produced the following paragraph?

"A well-documented rise in global temperatures has coincided with a significant increase in the concentration of carbon dioxide in the atmosphere. Respected scientists believe the two trends are related. For when carbon dioxide is released into the atmosphere, it acts like the ceiling of

The Editor's Perspective

by Bob Tippee, Editor

a greenhouse, trapping solar energy and retarding the escape of reflected heat. It is therefore a species—the most important species—of a 'greenhouse gas.'"

Glosses make this statement typical of arguments for urgent responses to global warming. The paragraph thus might seem to belong to some political document, most probably issuing from Congress or, perhaps, an agency of the Executive Branch.

But no, the Judicial Branch served up the delicacy. It appears atop the Supreme Court's Apr. 2 opinion that CO_2 should be subject to regulation as a pollutant under the Clean Air Act.

Supreme Court justices are busy people. Their spacious minds brim with legal knowledge and arguments about the many complex cases awaiting their decisions. To them, it probably seems unimportant that observed warming hasn't always coincided with the Industrial Age's CO_2 build-up, that temperature averages in fact fell for many years while the gas concentration rose.

The justices also might consider it inconsequential that CO_2, a life-sustaining compound of which human activity is hardly the only source, is less important as a greenhouse gas than water vapor.

Yet pesky trivialities like these, which supporters of aggressive CO_2 regulation ignore, lie at the center of arguments over what to do about global warming.

If average temperature and CO_2 concentrations haven't changed together consistently, for example, the gas build-up can't account for all observed warming. It might therefore be impossible to influence global average temperature much with cuts in emissions of a relatively small portion of one gas among several. Controversy about this, notwithstanding senseless talk about scientific "consensus," is lively.

And their honors have taken one side in a political issue of the type that the Constitution seems at pains to reserve for other branches of government.

(Online Apr. 6, 2007; author's e-mail: bobt@ogjonline.com)

Market Journal

by Sam Fletcher, Senior Writer

US gas storage near record high

The US winter heating season ended Mar. 31 with 1.569 tcf of natural gas still in underground storage, "the second highest level ever," said Robert S. Morris, Banc of America Securities LLC, New York.

That's down 127 bcf from the same period a year ago but 337 bcf above the 5-year average. The Energy Information Administration reported the injection of 58 bcf of gas into US underground storage in the week ended Mar. 30, vs. withdrawals of 22 bcf the prior week and 10 bcf during the same period in 2006. The latest update of gas in storage "does not appear to reflect any overall change in domestic supply-demand fundamentals," Morris said. The Nov. 1-Mar. 30 heating season was 2.5% warmer than the 10-year average, he said.

In a separate monthly report, EIA said total US "organic" (excluding, or adding back, hurricane-related shut-ins) gas production declined 0.7% sequentially in January but increased 0.5% from year-ago levels. "January production was negatively impacted by well 'freeze-offs' in the Midcontinent and Rockies due to ice storms," Morris said. EIA revised its 2006 production estimate to a 3% increase from year-ago levels (1.6% organic) vs. a previous estimate of a 3.3% increase. "Our models still yield a 2.4% year-over-year increase (0.7% organic) for last year. Thus, our long-held proprietary models continue to yield slightly lower growth estimates vs. the EIA's projections but indicate similar trends," Morris said.

"Our 2007 production growth forecast is still just over 3% (1.6% organic), with nearly one third of the organic increase due to the start-up of the eastern deepwater Gulf of Mexico Independence Hub in the third quarter, which may in fact come on line sooner or ramp up quicker than we are now modeling," said Morris.

Captives released

After nearly 2 weeks of tough talk, Iran's President Mahmoud Ahmadinejad suddenly decided to release 15 captive UK naval personnel as an Easter holiday "gift" to the British people. Eight British sailors and seven marines flew to London from Tehran Apr. 5. They were seized Mar. 23 in the Persian Gulf by naval units of Iran's Revolutionary Guard after the British personnel finished inspecting a merchant ship for possibly smuggled goods just outside the Shatt al-Arab waterway dividing Iraq and Iran.

Iran claimed the inspectors trespassed into its territory and threatened to put them on trial. However, UK officials said data from a position-tracking satellite prove the British personnel were 1.7 nautical miles inside Iraqi waters when they were illegally seized.

Neither side admitted wrongdoing. Ahmadinejad announced the release after first pinning a medal on the commander of the Iranian unit who took the prisoners. Even as the captives returned home, British Prime Minister Tony Blair called for continued international pressure on Iran, blaming elements of the Iranian government for backing militants in Iraq, where four British soldiers and a translator were slain in an ambush hours before the freed crew touched down. The UK, like the US, is a permanent member of the United Nations Security Council, which is still trying through trade sanctions to force Iran to postpone its nuclear program.

Oil stocks and prices

The May contract price for benchmark US crude fell Apr. 4 in the New York market following Ahmadinejad's decision to release the captives. The loss was limited, however, by the EIA's report that US gasoline inventories fell for the eighth consecutive week, down 5 million bbl to 205.2 million bbl in the week ended Mar. 30. That draw "was larger than expected, but it includes a correction for a report mistake in [the previous] edition when the stock draw came out less than expected," said Olivier Jakob, managing director of Petromatrix GMBH, Zug, Switzerland. "The correction does not change anything to the current stock level, but we need to keep in mind that when adjusting for the correction we are drawing only at half the weekly pace suggested by [the latest] report," he said.

However, Eitan Bernstein at Friedman, Billings, Ramsey Group Inc., Arlington, Va., said: "This should serve to remind investors that the refined product supply-demand balance remains tight, and with gasoline inventories currently 3% below comparable year-ago levels and the summer driving season less than 60 days away, the outlook for refining margins remains very favorable, in our view." Commercial US crude inventories registered a larger-than-expected gain of 4.3 million bbl to 332.7 million bbl during the same period. Distillate fuel stocks were unchanged at 118 million bbl.

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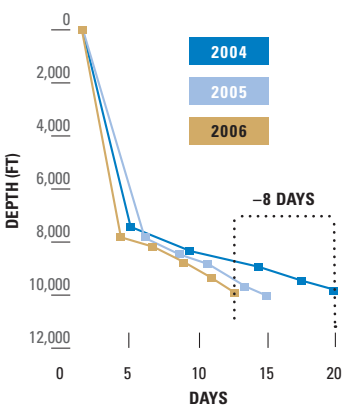

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