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Petrochemical	E1341	E1341C
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June 23, 2008
Volume 106.24

WORLDWIDE GAS PROCESSING

Global processing capacity flat; US construction pace quickens 50
Warren R. True

Global LPG markets react to high oil prices 58
Walt Hart, Ron Gist, Ken Otto, Darryl Rogers

Image from DCP Midstream Partners

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COVER

Williams's 750-MMcfd Milagro gas plant in northwestern New Mexico is one of 18 processing, treating, and production plants the company operates in North America. And it's one of the largest in the US. Oil & Gas Journal's exclusive, annual Gas Processing Report, which begins on p. 50, presents more detail on worldwide activity last year. A second article, beginning on p. 58, analyzes developments in global LPG trade. Cover photo from Williams Cos.

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June 23, 2008

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General Interest — Quick Takes

Bush urges Congress to lift bans on OCS leasing

US President George W. Bush urged Congress to lift oil and gas leasing bans on the Outer Continental Shelf as the first of four steps to increase domestic supplies in response to soaring prices.

"Experts believe that the OCS could produce about 18 billion bbl of oil. That would be enough to match America's current oil production for almost 10 years. The problem is that Congress has restricted access to key parts of the OCS since the early 1980s," Bush said on June 18.

"Since then, advances in technology have made it possible to conduct oil exploration in the OCS that is out of sight, protects coral reefs and habitats, and protects against oil spills. With these advances and a dramatic increase in oil prices, congressional restrictions on OCS exploration have become outdated and counterproductive," Bush said.

Bush also asked Congress to authorize oil and gas leasing within the Arctic National Wildlife Refuge, remove a moratorium on the development of a federal oil-shale leasing program, and expedite permitting for new US refineries or expansion of existing ones. But Bush's call to end OCS drilling bans produced the strongest responses (OGJ Online, June 17, 2008).

SEC staff advises updating reserves reporting

US Securities and Exchange Commission staff members have recommended that the commission consider updating its oil and gas reserves reporting requirements, the commission reported in a June 12 news release.

The commissioners have yet to consider and vote on the proposal. Current SEC reserves requirements were adopted more than 25 years ago. The recommended proposals would allow oil and gas companies to provide more reserves information to investors, the release said.

John White, director of the SEC's division of corporation finance, said that there are "tremendous changes in the way reserves are measured and oil and gas companies do business" that are not yet reflected in reserves reporting rules.

Details of the staff recommendations were not provided in the news release. Late last year, SEC solicited comment on whether changes in the reporting requirements were needed and appropriate.

The commission received 80 comment letters, generally supportive of updating the requirements.

The American Petroleum Institute said June 13 it intended to review the recommendations and then will comment if needed.

Large reserves writedowns by some oil and gas companies in 2004 rekindled debate about how companies estimate reserves, what regulators worldwide require of companies, and how investors use the information.

Adjustments are a normal part of reserves reporting but disclosure policies drew close attention after Royal Dutch/Shell Group reclassified its reserves estimates five times in a little over a year (OGJ, Feb. 21, 2005, Newsletter).

Reserves estimates and reporting standards have been the subject of much industry discussion (OGJ, June 20, 2005, p. 20).

OPEC maintains world well-supplied with oil

The Organization of Petroleum Exporting Countries, in its latest monthly oil market report, reiterates its position that the world is well-supplied with oil.

The organization's current forecast for 2008 OPEC crude demand stands at 31.8 million b/d, higher than other agencies' forecasts but still below its current production of 32.2 million b/d.

Expected higher OPEC oil exports and the planned halt in the filling of the US Strategic Petroleum Reserve should help to increase excess supply and further build commercial inventories, the report says.

Further, the market outlook says that current production levels combined with additional crude supply of 300,000 b/d from Saudi Arabia starting this month will lead to a higher-than-normal stockbuild in the third quarter and a contra-seasonal inventory build in the fourth quarter of this year.

"This clearly demonstrates that the market is amply supplied and that claims that the recent surge in prices is due to a supply shortage are unjustified," OPEC reported.

The reasons behind the recent oil-price surge were to be the focus of discussions at a June 22 meeting of producers, consumers, and other stakeholders in Jeddah. ✦

Exploration & Development — Quick Takes

Trinidad and Tobago awards exploration licenses

Trinidad and Tobago has reported granting approval for a consortium comprising OCNG Mittal Energy Ltd. (OMEL) and Petroleum Co. of Trinidad & Tobago (Petrotrin) to explore and develop Block NCMA 2 in the shallow marine area off northern Trinidad.

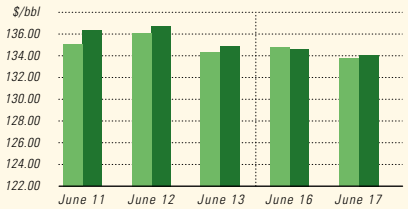
The consortium has undertaken to drill five exploratory wells, four to a depth of 9,000 ft and one to 13,500 ft.

The consortium also will undertake the shooting of 986 sq km of full fold 3D seismic.

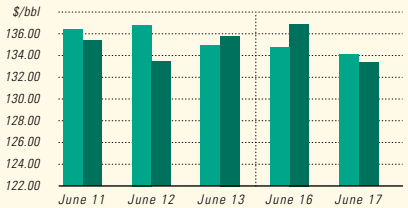
In addition, the Caribbean island nation has granted approval for a consortium comprising Petrotrin and Trinidad Exploration & Development Co. Ltd. (TED) to explore and develop the Southwest

Industry Scoreboard

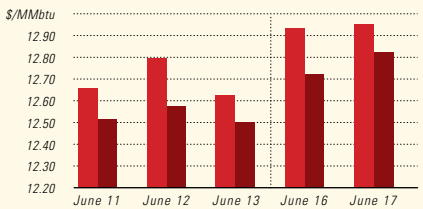
IPE BRENT / NYMEX LIGHT SWEET CRUDE



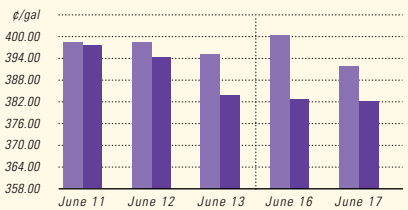
WTI CUSHING / BRENT SPOT



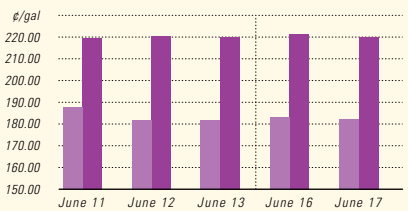
NYMEX NATURAL GAS / SPOT GAS - HENRY HUB



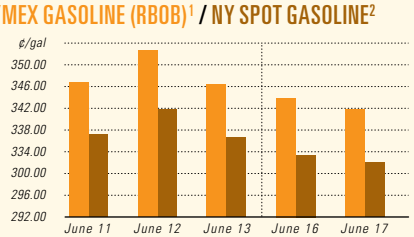
IPE GAS OIL / NYMEX HEATING OIL



PROPANE - MT. BELVIEU / BUTANE - MT. BELVIEU



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



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

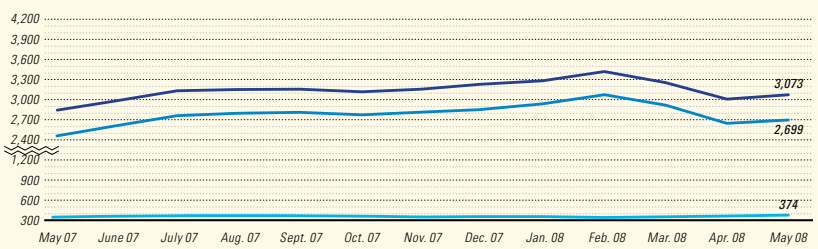
US INDUSTRY SCOREBOARD — 6/23

Latest week 6/6	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	9,318	9,444	–1.3	9,072	9,163	–1.0
Distillate	4,101	4,073	0.7	4,181	4,283	–2.4
Jet fuel	1,628	1,622	0.4	1,555	1,615	–3.7
Residual	670	747	–10.3	655	781	–16.1
Other products	4,671	4,764	–2.0	4,846	4,844	—
TOTAL DEMAND	20,388	20,650	–1.3	20,134	20,705	–2.8
Supply, 1,000 b/d						
Crude production	5,107	5,222	–2.2	5,111	5,195	–1.6
NGL production[2]	2,366	2,438	–3.0	2,280	2,353	–3.1
Crude imports	9,418	10,237	–8.0	9,707	10,026	–3.2
Product imports	3,278	3,809	–13.9	3,244	3,543	–6.4
Other supply[3]	1,416	1,177	20.3	1,414	911	55.2
TOTAL SUPPLY	21,585	22,883	–5.7	21,756	22,028	–1.2
Refining, 1,000 b/d						
Crude runs to stills	14,772	15,342	–3.7	14,772	14,989	–1.4
Input to crude stills	14,976	15,599	–4.0	14,976	15,305	–2.1
% utilization	85.6	59.4	—	85.6	87.7	—

Latest week 6/6	Latest week	Previous week[1]	Change	Same week year ago[1]	Change	Change, %
Stocks, 1,000 bbl						
Crude oil	302,197	306,757	–4,560	342,427	–40,230	–11.7
Motor gasoline	210,088	209,090	998	201,540	8,548	4.2
Distillate	113,981	111,704	2,277	122,566	–8,585	–7.0
Jet fuel-kerosine	39,863	39,751	112	42,029	–2,166	–5.2
Residual	39,505	38,166	1,339	35,353	4,152	11.7
Stock cover (days)[4]			Change, %		Change, %	
Crude	19.8	20.1	–1.5	22.1	–10.4	
Motor gasoline	22.5	22.5	—	21.3	5.6	
Distillate	27.8	27.1	2.6	29.4	–5.4	
Propane	39.4	40.9	–3.7	35.9	0.7	
Futures prices[5] **6/13**			**Change**		**Change**	**%**
134.73	128.73	128.14	6.59	65.82	68.91	104.7
Natural gas, $/MMbtu	12.62	12.36	0.27	7.97	4.66	58.5

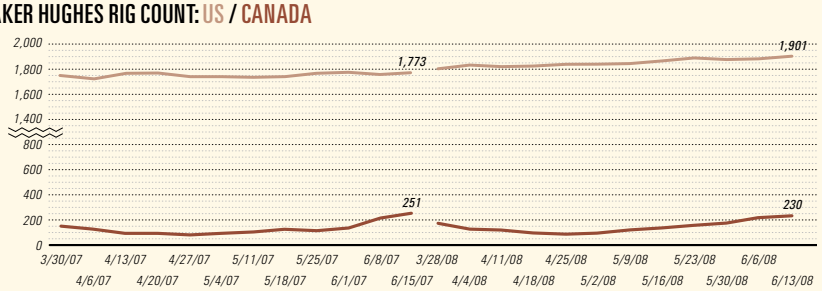
[1]Based on revised figures. [2]Includes adjustments for fuel ethanol and motor gasoline blending components. [3]Includes other hydrocarbons and alcohol, refinery processing gain, and unaccounted for crude oil. [4]Stocks divided by average daily product supplied for the prior 4 weeks. [5]Weekly average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

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



Note: Monthly average count

BAKER HUGHES RIG COUNT: US / CANADA



Note: End of week average count

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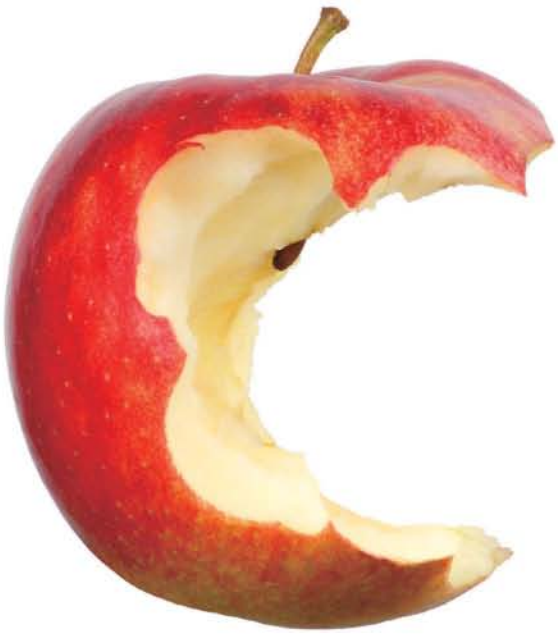

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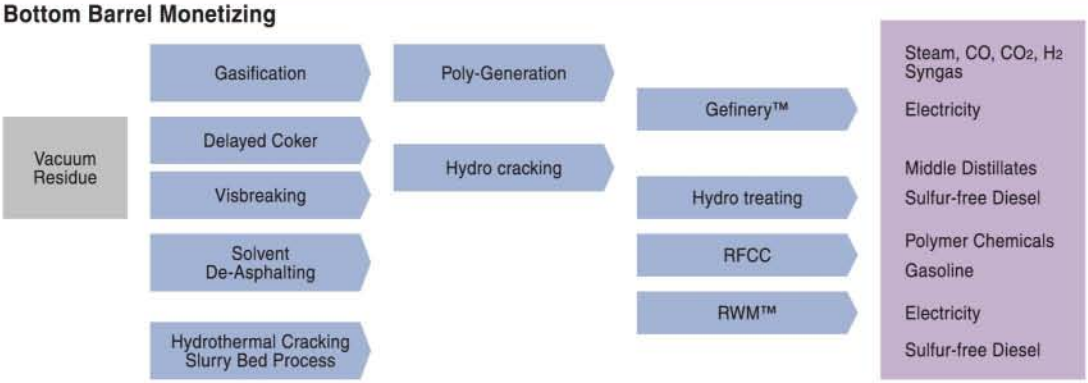

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Peninsula Shallow and Deep Horizon blocks onshore in Trinidad's Southern basin.

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ExxonMobil to step up Philippines exploration

ExxonMobil Corp. plans to undertake exploratory operations in the Sulu Sea in the Philippines and, based on the outcome of current seismic studies, could begin drilling exploratory wells in a year's time, according to a senior official.

ExxonMobil Exploration Co. Vice-Pres. Stephen Greenlee, after meeting with the Philippine's President Gloria Arroyo and Energy Secretary Angelo Reyes, said the US major is currently evaluating seismic data taken from the project area.

If the data are encouraging, Greenlee said, the company plans to drill exploration wells starting mid-2009 at a cost of around $100 million.

ExxonMobil E&P Philippines BV, meanwhile, said Manila has approved the company's acquisition of a 50% operating interest in Block SC 56 in the deepwater Sandakan basin.

ExxonMobil acquired the interest from Mitra Energy, which holds the remaining 50% interest in the block. The partners completed a 2D seismic survey in 2006 and a 3D seismic program in 2007.

Tap Oil outlines Philippines program

Australian independent Tap Oil plans to begin exploration drilling in midyear on its Service Contract 41 off the southern Philippines in the Sulu Sea.

Tap acquired 750 sq km of 3D seismic over the offshore block last year, and is eyeing reserves of 50-150 million bbl of oil. Tap holds a 50% stake in the block, while Salamander has 35%, and seven Philippine firms hold the remaining 15%.

Recently, the Philippines government announced that development of the Galoc oil field in Palawan has been completed and will start operation by June 16.

It followed a March announcement by Galoc Production Co. which pronounced the Galoc-3 development well ready to connect to the field's floating production, storage, and offloading vessel after it flow-tested at a constrained, stabilized 5,200 b/d of oil (OGJ Online, Mar. 10, 2008).

The Philippines government anticipates that Galoc will have a production rate of 20,000-30,000 b/d or about 10% of current domestic demand.

GTE completes Costayaco-4 well in Colombia

Gran Tierra Energy Inc. has completed drilling the Costayaco-4 well in Costayaco field on Colombia's Chaza block. The well reached 8,884 ft TMD.

Gran Tierra said log interpretations from data acquired after drilling indicate about 16 ft of potential hydrocarbon pay in the Kg sand unit of the Rumiyaco formation, 14 ft in the U sandstone unit of the Villeta formation, 38 ft in the T sandstone unit of the Villeta formation, and 125 ft in the Caballos formation.

"Significant progress is being made on defining production infrastructure requirements, advancing production capacity and setting new production targets for the field," said Dana Coffield, Gran Tierra president and chief executive officer.

In April, Gran Tierra completed the testing of its Costayaco-3 well, the third well drilled in Costayaco field, discovered in 2007.

Gran Tierra has a 50% interest and is operator on the Chaza block, with Solana Resources holding the remaining 50% interest. ✦

Drilling & Production — *Quick Takes*

US drilling hits new 22-year high

The US rig count during the week ended June 13 topped 1,900 working units for the first time in more than 22 years.

Baker Hughes Inc. reported 1,901 rotary rigs drilling in the US, 15 more than the previous week and up from 1,773 during the same period a year ago. The last time the rig count surpassed that level was during the week ended Jan. 3, 1986, when 1,915 units were working.

As usual, land operations accounted for the bulk of the increase, up 15 rigs to 1,808 drilling. Offshore drilling increased by 4 rigs to 68 in the Gulf of Mexico, resulting in a net increase of 2 rigs to 68 on all offshore federal leases. Inland waters activity was down 2 rigs to 25.

Among the rigs now working, 1,504 are drilling for natural gas, 389 are drilling for crude, and 8 are unclassified. Directional drilling increased by 10 rigs to 380. Horizontal drilling declined by 1 rig to 547.

StatoilHydro extends rig contract for Troll field

StatoilHydro has extended by 2 years the contract with Odfjell Drilling to use the Deepsea Trym semisubmersible drilling rig on Troll oil and gas field in the Norwegian North Sea. The contract extension is worth $347 million.

Odfjell is operator of the rig, which is owned by Songa Offshore ASA. The rig has worked on the field since 2005 and will continue to 2011. The contract with StatoilHydro includes an option for one more year, extending the contract period until the first quarter 2012 if the option is exercised.

Troll holds 60% of the country's total gas reserves on the Norwegian continental shelf, and in 2002 the oil production was more than 400,000 b/d. Production is expected to last another 70 years.

ERCB sees rise in Alberta CBM output

Alberta's coalbed methane production could reach 640 bcf/year in 2017, or 16% of the province's marketable gas output compared with 5% in 2007, the Energy Resources Conservation Board said.

CBM production may be higher than forecast if commercial output from Mannville coals is accelerated, the board said.

Alberta had more than 9,000 wells that produced CBM in 2007 with remaining established reserves estimated at 858 bcf, ERCB said.

The 9,339 wells that produced some CBM yielded a total of 240 bcf of gas in 2007, of which the ERCB estimates 77.7 bcf was CBM.

Industry drilled 2,055 CBM wells in 2007, down 24% on the year, and connected 2,259 wells, down 23%.

Alberta's first CBM was produced in 1970, ERCB defined the first CBM pool in 1995, and commercial production began in 2002.

Rigless intervention in Vincent field completed

Marine services company TSMarine has completed the first phase of a rigless intervention operation at Woodside Energy's Vincent field heavy-oil project off Western Australia.

The company's Havila Harmony monohull vessel deployed, installed, and tested seven subsea trees and carried out wireline operations on each well. It is the first rigless intervention job carried out in the Asia Pacific region, the company said.

The vessel was operating in 372 m of water.

TSMarine said the successful operation was the culmination of more than 2 years of planning and engineering working in collaboration with Woodside.

Vincent field on permit WA-28-L was found in 1998 and is estimated to contain 73 million boe. It is expected to come on stream later this year.

Woodside holds a 60% interest in the prospect and Mitsui E7P Australia the remaining 40%. ✦

Processing — *Quick Takes*

Valero resolves CWA violations after 2006 oil spill

Valero Refining Texas LP has agreed to resolve alleged violations of the Clean Water Act stemming from a June 1, 2006, spill of 3,400 bbl of oil into the Corpus Christi Ship Channel, which flows from Tule Lake into Corpus Christi Bay and into the Gulf of Mexico.

Under the consent decree lodged in federal court in Corpus Christi, Valero will pay a $1.65 million civil penalty and perform a supplemental environmental project that will cost $300,000. Under the agreement, the project will require Valero to design and construct a boat ramp that will aid emergency-response efforts in the vicinity of the oil spill.

The government's complaint, filed along with the consent decree, alleges that at least 142,800 gal of oil spilled from a containment berm on the edge of the Ship Channel at Valero's Corpus Christi Refinery-West Plant into the channel. Valero has since removed the containment berm and the associated above-ground storage tank from the edge of the Ship Channel in order to prevent future oil discharges.

The penalty paid for the spills will be deposited in the federal Oil Spill Liability Trust Fund, which is used to pay for the federal cleanups of oil spills.

S. Dakota residents okay land rezone for refinery

Residents of Union County, SD, have approved the rezoning of farm land north of Elk Point for privately held Hyperion Resources Inc., Dallas, to build a proposed refinery (OGJ, June 25, 2007, Newsletter).

About 3,300 acres of farmland would be rezoned for the proposed $10 billion, 400,000 b/d facility.

The Union County Board of Commissioners had approved the rezone in March, but both Hyperion and opponents of the refinery project requested a voter referendum.

The vote passed by a 3,932 (58%) to 2,855 (42%) margin.

TransAsia plans refinery relocation project

TransAsia Refinery Ltd. plans to relocate a 100,000 b/d refinery from Naples, Italy, to Port Qasim, Karachi.

The company is seeking formal approval from the Environmental Protection Agency and the Sindh government to implement the project on a fast-track basis, reported the EPA.

TransAsia awarded a contract on Apr. 21 to Descon Engineering of Lahore for the engineering, construction, products and utilities pipelines design and construction, crude and export products storage-handling facilities design and construction, and utilities and off-sites construction.

The project is scheduled for completion by April 2010.

IAG lets contract for CCRL refinery expansion

International Alliance Group (IAG) has awarded a detailed design services contract to Mustang Engineering for the Consumers' Cooperative Refineries Ltd. (CCRL) $1.9 billion refinery expansion project in Regina, Sask. (OGJ, Nov. 5, 2007, Newsletter).

IAG is the program manager for the grassroots portion of a proposed refinery expansion that would increase capacity to 130,000 b/cd from a current capacity of 100,000 b/cd.

In 2007, Mustang completed front-end engineering design for the project. Detailed design will take more than 600,000 man-hr of work to complete, according to Mustang.

Mustang's automation and control business unit is providing detailed design, configuration, staging, and integration of the process control system for five new process units and supporting utilities.

The grassroots expansion includes an FCC complex to help the refinery process additional light synthetic crude from Canada's oil sands. The expansion will be CCRL's second expansion this decade and is scheduled for completion in 2012.

Jorf Lasfar refinery plan in Morocco moves ahead

Abu-Dhabi's state-owned energy investment firm International Petroleum Investment Co. (IPIC) has approved a plan for construction of a refinery at Jorf Lasfar in Morocco, the latest of several projects announced for the port on the country's Atlantic seaboard.

UAE state news agency WAM said work is under way to set up a company to administer the project in cooperation with Moroccan partners, which were not named. WAM gave no further details concerning the size of the plant or investment.

In July 2007, Morocco's energy ministry announced plans for the construction of a 10-million-tonne, $3 billion refinery at Jorf Lasfar, which would become the country's second facility. The plans

called for completion of the refinery during 2015-16.

"Negotiations are under way with Spanish, UAE, Kuwaiti companies and other firms, with the view of building the second refinery," the ministry said.

Energy and Mining Minister Mohammed Boutaleb said, "Part of the new refinery output would be destined for exports to Asian, North American, and European markets."

The existing 136,000 b/d Samir refinery, at Mohammedia north of Casablanca, is owned by Corral Holding, a Swedish company controlled by Sheikh Mohamed Al Amoudi of Ethiopia.

Reports say Samir is working on a modernization scheme valued at more than $530 million to introduce hydrocracking technology and the latest refining processes.

Last July, Morocco's L'Economiste newspaper also reported that Samir, Casablanca-based diversified holding company Akwa Group, and Morocco's state-owned Office National de l'Electricite will build a 5 billion cu m LNG regasification terminal either in Tangiers or Jorf Lasfar.

L'Economiste said the gas would be piped to industrial centers at El Jadida and Kenitra for the production of electricity in combined cycle power plants and for the refining industry. It also said the LNG terminal could be connected to the Maghreb-Europe pipeline GME, linking North Africa with the Iberian peninsula.

Costs derail Petronas's planned Sudan refinery

Malaysia's Petronas has deferred plans for its 100,000 b/d refinery project in Sudan due to rising costs, according to a senior company official.

The Sudanese government had awarded Petronas a contract to build the refinery at Port Sudan on the Red Sea in 2005, with output from the refinery to be exported. The refinery, which would be jointly owned 50:50 by Sudan and Petronas, was due to come on stream in 2009 (OGJ, Sept. 12, 2005, Newsletter).

However the cost of the refinery has soared to $5 billion from the originally estimated $2 billion.

"We cannot justify its commercial viability because of the very high investment cost," said Petronas Pres. and Chief Executive Officer Tan Sri Mohd Hassan Marican. "We have to put it aside for now," he said. ✦

Transportation — *Quick Takes*

Yemen LNG secures financing, sales contracts

Yemen LNG has obtained $2.8 billion in financing for construction of its LNG liquefaction plant on the Gulf of Aden at Belhaf, including $1.1 billion from Total SA and $1.7 billion from export agencies in France and South Korea.

Altogether, eight banks—BNP Paribas, Societe Generale, Calyon, ING Bank, Bank of Tokyo-Mitsubishi, SumitomoMitsui Banking Corp, Royal Bank of Scotland, and Citigroup—acted as mandated lead arrangers for the $1.1 billion part of the package, and Coface of France, Kexim of South Korea, and various export agencies guaranteed the remaining $1.7 billion.

JGC, Technip, and KBR in September 2005 received a contract to build the two-train liquefaction plant, which will have a capacity of 6.7 million tonnes/year, as well as a 320-km pipeline and two 144,000-bbl storage containers. The project will receive gas from Block 18 in Marib.

Yemen LNG has signed long-term contracts to supply South Korea's Kogas with 2 million tonnes/year, Suez with 2.55 million tonnes/year, and Total Gas & Power with 2.15 million tonnes/year.

French major Total is the project leader with a 39.62% share. Its partners in the project are US-based Hunt 17.22%, the Yemen Gas Co. 16.73%, SK Corp. 9.55%, Kogas 6%, Hyundai Corp. 5.88%, and Yemen's General Authority for Social Security and Pensions 5%.

Sakhalin-2 loan secured; year-round flow to begin

The Japan Bank for International Cooperation (JBIC) and four private-sector banks are finalizing plans to provide a $5.3 billion loan for the Sakhalin-2 oil and natural gas development project.

Japan's Nikkei newspaper reported that JBIC will lend about $3.7 billion, with Bank of Tokyo-Mitsubishi UFJ, Mizuho Corporate Bank, Sumitomo Mitsui Banking Corp., and BNP Paribas providing the remaining $1.6 billion.

The financial institutions were scheduled to sign a lending agreement with Russia's OAO Gazprom as early as June 15. Gazprom partners, Royal Dutch Shell PLC, Mitsui & Co., and Mitsubishi Corp. have already committed about $15 billion to the project.

JBIC and the three major Japanese banks plan to offer financing for the project to support efforts by Japan's public and private sectors to obtain a stable source of energy, the paper said.

The financing announcement followed reports last month that year-round production will begin from the Sakhalin-2 project this summer.

"The current plan is to start year-round production in the second half of 2008, after commissioning and testing of the pipeline has finished," said Ivan Chernyakovsky, a spokesman for the consortium.

Oil will then be transported along the 800-km pipeline to an ice-free export terminal on Sakhalin Island's southern tip. The project produces 80,000 b/d of oil.

Habshan-Fujairah pipeline start-up delayed 1 year

Abu Dhabi's International Petroleum Investment Co. said its planned 1.5 million b/d Habshan-Fujairah oil pipeline will begin operating in March 2010, about a year later than originally planned.

No explanation was cited for the new start-up date for the 320-km, 48-in. pipeline, which will join state-owned Abu Dhabi National Oil Co's Habshan fields with the Port of Fujairah. The project also includes oil storage and terminal facilities for crude exports at Fujairah.

According to analysts, the pipeline will greatly enhance Abu Dhabi's supply security, bypassing the busy Strait of Hormuz, which generally is recognized as a strategic oil transport choke point. ✦

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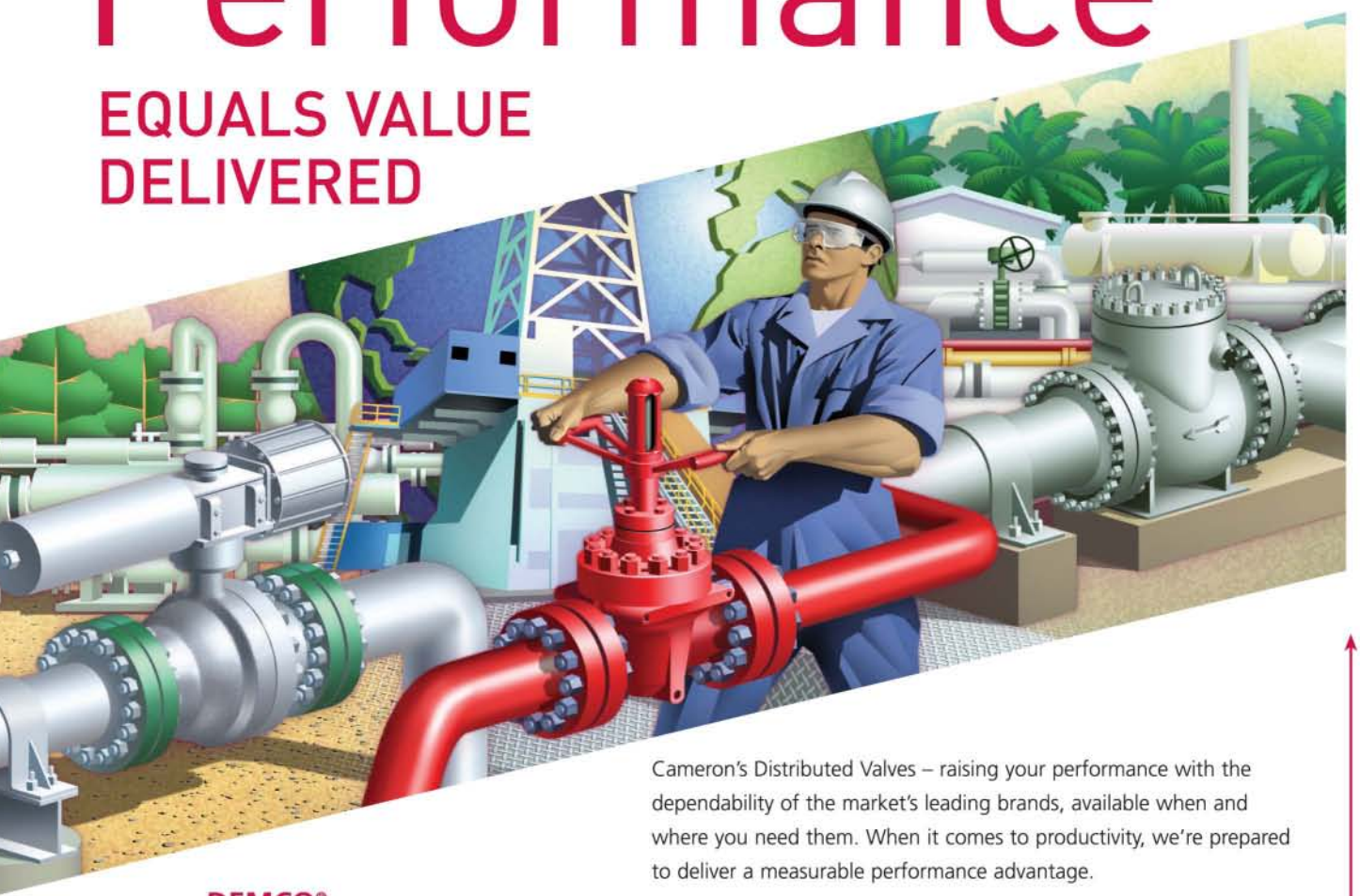

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Calendar

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

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2008

JUNE

API Tanker Conference, San Diego, (202) 682-8000, (202) 682-8222 (fax), website: www.api.org/events. 23-24.

Purvin & Gertz Annual Asia LPG Seminar, Singapore, (713) 331-4000, (713) 236-8490 (fax), e-mail: glrodriguez@purvingertz.com, website: www.purvingertz.com. 23-26.

API Exploration & Production Standards on Oilfield Equipment & Materials Conference, Calgary, Alta., (202) 682-8000, (202) 682-8222 (fax), website: www.api.org/events. 23-27.

PIRA Understanding Global Oil Markets Conference, Houston, (212) 686-6808, (212) 686-6628 (fax), e-mail: sales@pira.com, website: www.pira.com. 24-25.

Russian Petroleum & Gas Congress, Moscow, +44 207 596 5016, e-mail: oilgas@ite-exhibitions.com, website: www.ite-exhibitions.com/og. 24-26.

NEFTEGAZ Exhibition, Moscow, +44 207 596 5016, e-mail: oilgas@ite-exhibitions.com, website: www.ite-exhibitions.com/og. 24-26.

PIRA's Globalization of Gas Study Conference, Houston, (212) 686-6808, (212) 686-6628 (fax), e-mail: sales@pira.com, website: www.pira.com. 25.

PIRA Understanding Natural Gas Markets Conference, Houston, (212) 686-6808, (212) 686-6628 (fax), e-mail: sales@pira.com, website: www.pira.com. 26-27.

Russian Oil and Gas Exports International Forum, Amsterdam, +44 (0)20 7878 6888, website: www.C5-Online.com/OilGasExport. 26-27.

World Petroleum Congress, Madrid, +34 91 745 3008, +34 91 563 8496 (fax), e-mail: info@19wpc.com, website: www.19wpc.com. June 29- July 3.

JULY

International Offshore & Polar Engineering Conference, Vancouver, (650) 254 2038, (650) 254 1871 (fax), e-mail: meetings@isope.org, website: www.isope.org. 6-11.

Annual Rocky Mountain Natural Gas Strategy Conference & Investment Forum, Denver, (303) 861-0362, (303) 861-0373 (fax), e-mail: conference@coga.org, website: www.coga.org. 9-11.

AAPG/SPE/SEG Hedberg Conference, Casper,Wyo. (918) 560-2630, (918) 560-2678 (fax), e-mail: debbi@aapg.org, website: www.aapg.org. 14-18.

IADC Lifting & Mechanical Handling Conference & Exhibition, Houston, (713) 292-1945, (713) 292-1946 (fax); e-mail: conferences@iadc.org, website: www.iadc.org. 15-16.

Oil Sands and Heavy Oil Technology Conference & Exhibition, Calgary, Alta.,

(918) 831-9160, (918) 831-9161 (fax), e-mail: registration@pennwell.com, website: www.oilsandstechnologies.com. 15-17.

AUGUST

SPE Nigeria Annul International Conference & Exhibition, Abuja, (972) 952-9393, (972) 952-9435 (fax), e-mail: spedal@spe.org, website: www.spe.org. 4-6.

ACS National Meeting & Exposition, Philadelphia, 1 (800) 227-5558, e-mail: natlmtgs@acs.org, website: www.acs.org. 17-21.

✦International Petroleum Petrochemical Natural Gas Technology Equipment Exhibition, Shanghai, +86 21 55611008, +86 21 65282319 (fax), website: postmaster@aiexpo.com.cn, website: www.sippe.org.cn. 20-22.

IADC/SPE Asia Pacific Drilling Technology Conference, Jakarta, (713) 292-1945, (713) 292-1946 (fax); e-mail: conferences@iadc.org, website: www.iadc.org. 25-28.

DeepWater India Summit, New Delhi, +31 (0)26 3653 444, +31 (0)26 3653 446 (fax), e-mail: workshops@energywise.nl, website: www.energywise.nl. 26-27.

Offshore Northern Seas Exhibition & Conference, Stavanger, +47 51 59 81 00, +47 51 55 10 15 (fax), e-mail: info@ons.no, website: www.ons.no. 26-29.

Summer NAPE Expo, Houston, (817) 306-7171, (817) 847-7703 (fax), e-mail: info@napeexpo.com, website: www.napeonline.com. 27-28.

SEPTEMBER

Annual India Oil & Gas Review Symposium & International Exhibition, Mumbai, (0091-22) 40504900, ext. 225, (0091-22) 26367676 (fax), e-mail: oilasia@vsnl.com, website: www.oilasia.com. 1-2.

China Power, Oil & Gas Conference & Exhibition, Guangzhou, (918) 831-9160, (918) 831-9161 (fax), e-mail: registration@pennwell.com, website: www.chinasenergyfuture.com. 2-4.

ECMOR XI-European Mathematics of Oil Recovery Conference, Bergen, (972) 952-9393, (972) 952-9435 (fax), e-mail: spedal@spe.org, website: www.spe.org. 8-11.

✦Rice Global Engineering & Construction Forum, Houston, (713) 552-1236, ext. 3, (713) 572-3089 (fax), website: www.forum.rice.edu. 9.

IADC Drilling HSE Europe Conference & Exhibition, Amsterdam, (713) 292-1945, (713) 292-1946 (fax); e-mail: conferences@iadc.org, website: www.iadc.org. 9-10.

Rocky Mountain GPA Annual Meeting, Denver, (918) 493-3872, (918) 493-3875 (fax), email: pmirkin@gasprocessors.com, website: www.gasprocessors.com. 10.

API Fall Refining & Equipment Standards Meeting, Los Angeles, (202) 682-8000, (202) 682-8222 (fax), website: www.api.org/events. 15-17.

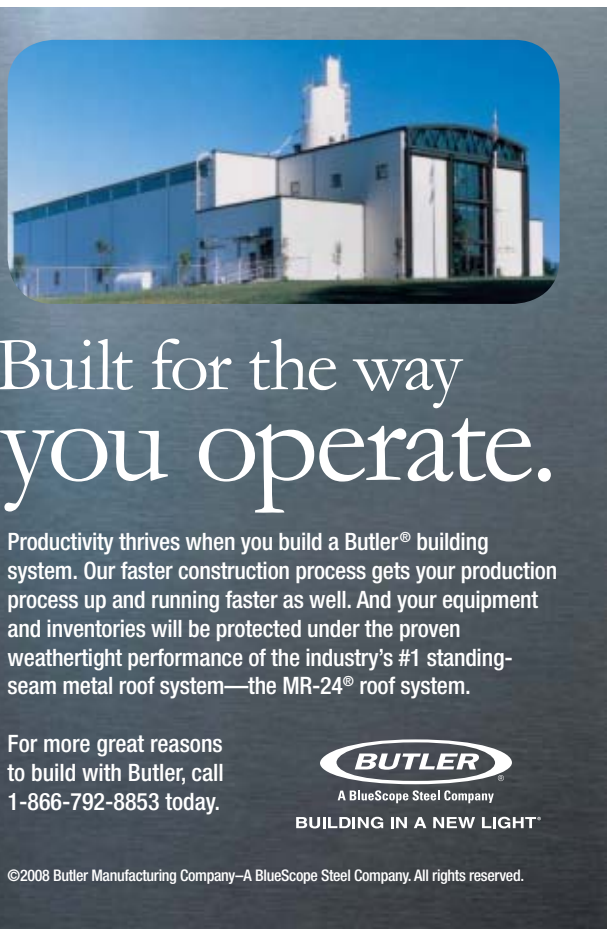
Rio Oil & Gas Conference & Expo, Rio de Janeiro, 55 21 2112 9078, 55 21 2220 1596 (fax), e-mail: riooil2008@ibp.org.br, website: www.riooilegas.com.br. 15-18.

API/NPRA Fall Operating Practices Symposium, Los Angeles, (202) 682-8000, (202) 682-8222 (fax), website: www.api.org/events. 16.

GEO India South Asia's Geosciences Conference & Exhibition, New Delhi, +44 (0)20 7840 2100, +44 (0)20 7840 2111 (fax), e-mail: geo@oesallworld.com, website: www.geo-india.com. 17-19.

SPE Annual Technical Conference & Exhibition, Denver, (972) 952-9393, (972) 952-9435 (fax), e-mail: spedal@spe.org, website: www.spe.org. 21-24.

ERTC Petrochemical Conference, Cannes, +44 1737 365100, +44 1737



Calendar

365101 (fax), e-mail: events@gtforum.com, website: www.gtforum.com. Sept. 29- Oct. 1.

International Pipeline Exposition, Calgary, Alta., 403) 209-3555, (403) 245-8649 (fax), website: www.petroleumshow.com. Sept. 30-Oct. 2.

Unconventional Gas International Conference & Exhibition, Ft.Worth, Tex., (918) 831-9160, (918) 831-9161 (fax), e-mail: registration@pennwell.com, website: www.unconventionalgas.net. Sept. 30-Oct. 2.

OCTOBER

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

AAPG International Conference & Exhibition, Cape Town,

(918) 560-2679, (918) 560-2684 (fax), e-mail: convene@aapg.org, website: www.aapg.org. 26-29.

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

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

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

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

NOVEMBER

ASME International Mechanical Congress & Exposition, Boston, (973) 882-1170, (973) 882-1717 (fax), e-mail: infocentral@asme.org, website: www.asme.org. 2-6.

Abu Dhabi International Petroleum Exhibition & Conference (ADIPEC), Abu Dhabi, website: www.adipec.com. 3-6.

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

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

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

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

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

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

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

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

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

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

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

IADC Well Control Middle East Conference & Exhibition, Muscat, (713) 292-1945, (713) 292-1946 (fax); e-mail: conferences@iadc.org, website: www.iadc.org. 24-25.

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

DECEMBER

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

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

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

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

Calendar

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

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

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

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

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

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

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

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

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JANUARY

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

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

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

FEBRUARY

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

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

Deep Offshore Technology International Conference & Exhibition (DOT), New Orleans, (918) 831-9160, (918) 831-9161 (fax), e-mail: registration@pennwell.com, website: www.dotinternational.net. 3-5.

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

ASEG International Conference & Exhibition, Adelaide, +61 8 8352 7099, +61 8 8352 7088 (fax), e-mail: ASEG2009@sapro.com.au. 22-26.

MARCH

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

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

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

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

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

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

APRIL

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Gastech International Conference & Exhibition, Abu Dhabi, +44 (0) 1737 855000, +44 (0) 1737 855482 (fax), website: www.gastech.co.uk. 25-28.

JUNE

✦ AAPG Annual Meeting, Denver, (918) 560-2679, (918) 560-2684 (fax), e-mail: convene@aapg.org, website: www.aapg.org. 7-10.

Oil and Gas Asia Exhibition (OGA), Kuala Lumpur, +60 (0) 3 4041 0311, +60 (0) 3 4043 7241 (fax), e-mail: oga@oesallworld.com, website: www.allworldexhibitions.com/oil. 10-12.

IADC World Drilling Conference & Exhibition, Dublin, (713) 292-1945, (713) 292-1946 (fax), e-mail: conferences@iadc.org, website: www.iadc.org. 17-18.

AUGUST

IADC Well Control Conference of the Americas & Exhibition, Denver, (713) 292-1945, (713) 292-1946 (fax), e-mail: conferences@iadc.org, website: www.iadc.org. 25-26.

SEPTEMBER

IADC Drilling HSE Europe Conference & Exhibition, Amsterdam, (713) 292-1945, (713) 292-1946 (fax), e-mail: conferences@iadc.org, website: www.iadc.org. 23-24.

OCTOBER

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Small steps

Warren R. True
Chief Technology Editor-LNG/Gas Processing

Oil and gas companies often hear that consumers want them to be "energy" companies. This seems to mean generating electricity, heating homes and businesses, and moving cars and trucks with something other than fossil fuels.

Some companies have certainly heard that message and have decided—if you believe their advertisements—to go beyond petroleum. Their planned expenditures, however, often reveal other priorities.

Turns out, most oil and gas companies prefer to remain just that: hydrocarbon finders, producers, processors, transporters, and marketers and those that serve and supply this process. They know too well that, for the immediate future, burning hydrocarbons is how the world must meet its energy demand, however unpopular among some that approach might be.

Nonetheless, trickling out with greater frequency in the last several months have come stories about industry companies—service companies, in two cases cited below—that illustrate some of the "greener" projects in which parts of the industry are getting involved.

Nature's other gases

In late April came news that New Jersey-based Linde North America and Houston-based Waste Management would join forces to convert landfill gas into clean vehicle fuel.

The venture plans to build an LNG production plant at the Altamont Landfill near Livermore, Calif., to convert landfill gas into a clean vehicle fuel. The announcement touted the project for offering a "unique opportunity to 'close the loop' by fueling hundreds of collection trucks with clean fuel produced from garbage."

The companies will install systems to purify and liquefy landfill gas that Waste Management collects from the natural decomposition of organic waste in landfill. When it begins operating next year, said the announcement, it will produce up to 13,000 gpd of LNG.

'One small step for a man…'

The US Department of Energy website states that 1.5 gal of LNG is about 1 gal equivalent of gasoline. Not much conservation there. But, the attraction of natural gas as a vehicle fuel in any form has always been its clean-burning nature: less CO_2 going into the atmosphere. But what about the energy needed to keep it refrigerated to –260° F.? Details; details.

Linde North America Pres. Pat Murphy said the companies' efforts are "capturing and reusing landfill gas for vehicle fueling, and reducing greenhouse gas emissions" by more than 30,000 tons/year. The announcement doesn't reveal how reaching that level is calculated.

In Europe, gas from another biological source appears to hold some promise.

GE Energy's Jenbacher gas engine is powering an Italian farm's first biogas plant, the Baita del Latte farm's plant in Limena, in the north of Italy near Venice. According to the GE energy announcement earlier this month, the power plant uses biogas created by the digestion of a wet mixture of animal waste and "agricultural biomass" materials, such as corn and rye.

The Jenbacher type J320 GS cogeneration has an installed electric-generation capacity of 1.06 Mw, with an efficiency of 40.8%, according to GE Energy. The power plant is equipped with a heat-recovery system that uses waste heat from the jacket water.

The electricity produced is supplied to the Italian power distribution network, while thermal energy is recovered and used to power the biomass digestion process, the farm's housing facilities, and cattle sheds. The Jenbacher engine is fueled by biogas created from 20 cu m of cattle effluent and about 50 tons of biomass each day.

By using biogas instead of fossil fuels to generate power, said the company, the project will reduce the equivalent of about 5,000 tons/year of CO_2. That's what 257 US residents emit in a year, according to latest figures from the Netherlands Environmental Assessment Agency (www.mnp.nl).

Another small step.

Giant leap?

It remains to be seen if such projects can form sufficient critical mass with other small steps to generate a "giant leap for mankind" (Sorry, Neil). "We can put a man on the moon, but we can't …." Some leaps are easier than others.

Whether these isolated and often curious projects really hold the promise for efficient use of waste and significant reduction of greenhouse gases, their proliferation is encouraging. Human ingenuity never ceases to amaze.

One larger fact seems abundantly clear, however: We need all sources and forms of fuel to meet global energy demand, no matter how esoteric the technology or smelly the source. ✦

Editorial

McCain on energy

Sen. John McCain of Arizona, who will be the Republican Party's nominee in this year's presidential election, traveled to Houston last week to address energy policy. His performance was not encouraging.

The senator offered one constructive proposal: allowing exploration of areas of the Outer Continental Shelf now closed to oil and gas leasing. But he couched the proposal in a self-contradictory tirade that exhibited scant understanding of his subject.

The speech was a huge opportunity. McCain is running against liberal Sen. Barack Obama (D-Ill.), whose platform contains nearly every government-centered mistake the US ever has made on energy: special taxation of producers, massive public expenditure on noncommercial energy forms, consumption mandates, and other horrors. To distinguish himself, McCain needed only to display economic judgment. He blew it.

What about ANWR?

While reversing an earlier stance to champion OCS leasing, the Arizona senator couldn't bring himself also to support limited leasing on Alaska's northern coast. "When America set aside the Arctic National Wildlife Refuge," he explained, "we called it a 'refuge' for a reason." Greenpeace couldn't have said it better.

Incongruity didn't end there. Apparently seduced by Washington's compulsion to find villainy in fuel prices, the politician who calls himself a maverick took his turn lambasting energy speculators. "We all know that some people on Wall Street are not above gaming the system," he said. But his suspicion of "reckless wagering" didn't make him back away from support of the cap-and-trade scheme he proposes for emissions of greenhouse gases. Maybe he thinks righteously green emissions allowances will be less likely than dirty energy derivatives to tempt unscrupulous traders into misbehavior.

As a matter of fact, the speculators so popularly disparaged these days in Washington, DC, are essential to a market that dilutes an antique worry that McCain put at the core of his energy message. Conflating formation of the Organization of Petroleum Exporting Countries with the oil embargo of the early 1970s, he regretted that oil had become "a strategic weapon."

Yes, Arab exporters—not OPEC, as McCain said—imposed a targeted embargo in 1973-74. But the move didn't achieve its strategic purpose—ending US and Dutch support of Israel during and after the Yom Kippur War. The inconvenience it caused US oil consumers resulted more from market controls in place at the time than from disrupted supply. The changes the embargo uncorked in the oil market would have occurred one way or another.

The biggest change was that oil, previously sold under long-term, bilateral contracts, became an internationally traded commodity. Inevitably, a paper market developed alongside its physical counterpart. Oil prices, once nearly invisible and mostly static, came into clear view, subject to every change—or rumor about change—in relationships between supply and demand. A once-brittle market thus became fluid and much more adaptable to upset than it had been before. The adaptability makes it much less susceptible to politically motivated manipulation of supply.

McCain told his Houston audience that oil had been a commodity before the embargo but became a strategic weapon. That's backwards. If oil is still a strategic weapon, it's not a very powerful one, and the US deploys it more readily as a buyer than exporters do as sellers.

Military response

McCain described oil exporters as "often hostile and undemocratic regimes in the Middle East and elsewhere" and declared, "Oil revenues are enriching the enemies of the United States." He made energy policy sound like a military response and came off sounding truculent, even dangerous. Not all Middle Eastern exporters are Iran, but McCain seemed little inclined to acknowledge distinctions.

McCain was right to emphasize, however selectively, the importance of long-neglected domestic energy supply. But he was wrong to advance as the central reason to do so a view of energy trade that can be described only as xenophobic. Treating energy as a military threat rather than an economic problem is a prescription for waste—or worse. McCain has time to demonstrate on energy sophistication wholly absent in his opponent. But he has a long way to go. ✦

Import jolt highlights ironies of Iranian gas

Justin Dargin
Harvard University
Boston

Residents of Iran's north must surely have experienced chagrin at a visceral level in December 2007 when they froze after Turkmenistan halted natural gas exports to the country. Surely the irony was not lost that, even though Iran sits atop the world's second largest gas reserves after Russia's, it is beholden to Turkmenistan for imports supplying as much as 5% of its gas needs.

Turkmenistan cited pipeline issues as the cause of the gas curtailment, but most insiders believed that Turkmen authorities, who wanted price increases, were upset at payment delays and at Iran's refusal to submit to the dynamics of the new pricing realities. Iran had paid Turkmenistan $75-140/1,000 cu m for its gas; however, the Turkmen leadership wanted its deliveries to reflect the new market. Under the new agreement, Turkmen gas will now cost $130/1,000 cu m until June 30, 2008, when the price will increase to $150/1,000 cu m.

While upwards of 40 million people endured frigid temperatures that plummeted to –4° to –30° C., Iran's President Mahmoud Ahmedinejad darkly proclaimed that the gas halt was a conspiracy and done "at the behest of some domestic actors." Domestic confidence crumbled with the government's inability to meet its national gas needs without the Turkmen imports. How is it that a country with the world's second largest gas reserves found itself in this perverse situation?

2007 DOMESTIC PERSIAN GULF FEEDSTOCK PRICES

Country	Price, $/MMbtu
Egypt	1.19
Iran	0.35
Oman	0.90
Qatar	0.87
Saudi Arabia	0.75
UAE	0.75

Source: Natural Gas Market Review 2007

Huge gas reserves

Iran's dilemma actually is common to many resource-rich countries. Iran's gas reserves are intimidating—28 trillion cu m (995 tcf). However, 62% of the reserves are in nonassociated fields that have not yet been fully prepared for investment. Given the growth of gas in the world energy market and the concordant development of the global LNG market, Iran's oil and gas development should be at its peak like that of Qatar, its erstwhile rival and North field neighbor adjoining Iran's South Pars field.

However this is not the case. Iran's clerical leadership had set its sights on rapidly developing the country's gas reserves even in the face of stringent opposition from the US and the United Nations. The deficiency of Iran's gas development lies more with its internal economic policies than with external, international economic pressure. As the price of gas rises, Iran's inability to secure investment and provide domestic energy for its citizens will be thrown into sharper relief. The conundrum revolves around the economic term of "perverse incentives" active in the gas sector, and to a certain extent played out in the gasoline arena.

To soothe domestic discontent over its stagnant economy, Iran subsidizes domestic gas consumption at a rate of $0.35/MMbtu, which places its cost to domestic consumers at one of the lowest rates in the Middle East (see table).

This low price is a reason for the extreme difficulty the National Iranian Gas Co. (NIGC) has in seeking to monetize its large gas resources, especially those in offshore South Pars (see map).

The gas crunch is not unique to Iran; it occurs across the Persian Gulf as governments struggle to maintain their domestic pricing schemes and the stark gap between domestic and international prices. For example, the UAE is experiencing an electric power generation crisis because gas prices have increased more than tenfold in less than a decade, and further strain is expected as production costs are projected to soar by more than 100% in the next 2 years.

Last summer the UAE experienced such an acute gas shortage—about 1 bcf—that it was compelled to switch to crude oil and coal for power generation. Gulf governments are caught in

the trilemma of needing to fuel domestic industrialization while providing inexpensive power in the face of increasing domestic demand for a populace that views cheap power as the essence of the social contract.

Nuclear energy

Nuclear energy appeared to be the best option to the quandary in which the gas-producing countries in the Persian Gulf found themselves when gas became unavailable and oil too valuable to be used for domestic power generation—a nearly insoluble problem. The current Iranian nuclear program, even though of front page news concern to the international community, is not unique to the region when taken in proper focus.

For example, Egypt is pursuing its own nuclear energy vision, with President Mubarak's lauding the national goal to build six 2,000-Mw nuclear reactors, and in 2006 the six-nation Gulf Cooperation Council released plans to develop a comprehensive nuclear energy program for the region.

This year French President Nicolas Sarkozy traveled to the UAE to finalize a deal that will give Total SA permission to join forces with the reactor-designer Areva and the utility company Suez to build nuclear power stations within the UAE. This indicates that Iran's Bushear nuclear plant, built with Russian support, is not necessarily an aggressive step towards nuclear weapon proliferation in the region but could likely be the blowback from a misguided energy policy symptomatic of many energy-producing countries.

The crisis with Turkmenistan challenged Iran's status as a stable gas supplier. With the European Union's fear of a Kremlin-dominated Gazprom and gas diversification as a high priority, many EU countries may be willing to gamble on an Iranian supply of gas. By 2030, it is estimated that Europe will depend on foreign suppliers for as much as 85% of its gas supply, quite a jump from the current 55%.

Possible reinvigoration

Iran, with its large reserves, presents a very attractive option because energy needs and supply diversification may trump current geopolitical issues connected with Iran's nuclear ambitions. Iranian gas could find a place in the EU energy security mix. Even though current international sanctions and internal technical and political problems have hindered both gas production and the development of Iran's energy industry, potential investment from Europe could reinvigorate Iran's energy sector.

Portugal has been holding negotiations with Iran since 2006, and Italian-based Edison is discussing possible Iranian gas sales to the Italian market. Meanwhile, Austria's EconGas GMBH signed a gas supply agreement for Iran to begin deliveries in 2013.

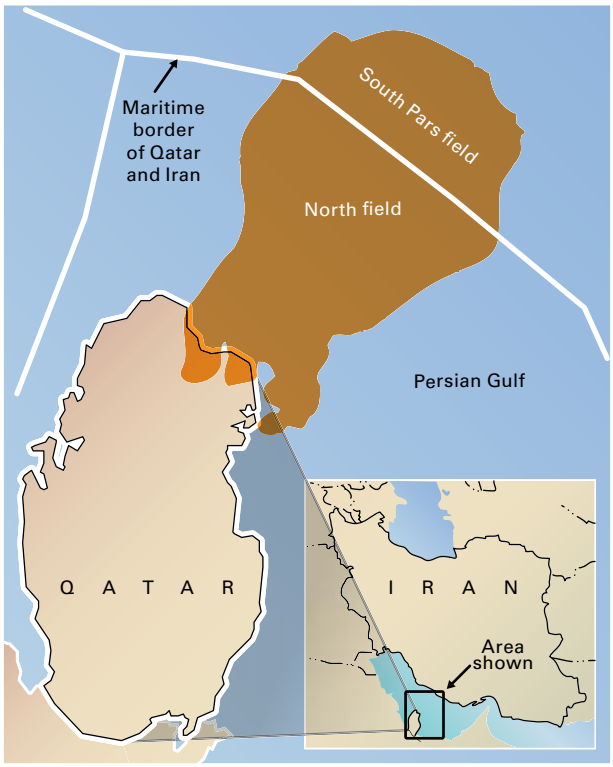
Austria's OMV planned to develop Iran's South Pars gas field for the planned Nabucco pipeline, but the marked tension between the US and Iran prompted OMV to turn instead to negotiations with Azerbaijan.

As a further reflection of the increased US pressure on international oil companies (IOCs) operating in Iran, Shell and Repsol are negotiating to leave the $10 billion gas project planned for Block 14 in South Pars field. Unwilling to fully sever the energy umbilical cord, these two companies want to reserve the right to return and bid on future blocks if and when US-Iranian relations improve.

By far, Iran's largest investment contract was with the Swiss company, Elektrizitaets-Gesellschaft Laufenburg (EGL), which signed a 25-year contract with NIGC Mar. 17 for gas supplies valued at €18-27 billion ($28-42 billion) over the contractual life. This deal anticipates the delivery of 5.5 billion cu m/year of gas to Europe. The final value of the agreement—which depends on the evolving price of gas over the coming years—is structured to provide a fourth avenue for gas to enter Western Europe apart from Russia, the North Sea, and North Africa. The anticipated route is from Turkey through Greece and Albania. For the gas to reach Italy, a pipeline may be constructed under the Adriatic Sea in 2010.

EGL has concluded final negotiations with possible partners, and this summer it anticipates public announcements of the pipeline construction partners. The pipeline—which is expected to begin operations in 2012—will connect existing gas supply chains in Greece with those in Italy.

IRAN'S SOUTH PARS, QATAR'S NORTH FIELD



Source: Energy Information Administration, adapted from IHS Energy

When the EGL deal was announced, the US vigorously protested it, vowing to review it for possible violations of the Iran Sanctions Act. However, Joachim Conrad, who heads EGL, brushed aside concerns on the grounds that Europe's long-term energy security is more important than short-term political disagreements. Swiss Foreign Minister Micheline Calmy-Rey also argued that the deal did not violate the Iran Sanctions Act.

Placed in the broader context, Iran is merely one prong in the EU's multipronged strategy to achieve gas diversification. The "Iran card" allows the EU to exercise leverage with Gazprom ahead of 2010, when many major gas supply contracts are slated to be renegotiated. The EGL deal dramatizes the attractiveness of Iranian gas, assessed at €90-200/1,000 cu m, compared with Gazprom gas at €240/1,000 cu m—which may increase to €260 at yearend.

Iran doubtlessly provides a useful counterweight to Gazprom's singular influence over the EU's gas supply. On the most practical basis, there is no other viable supplier for the EU from the fourth corridor. Potential gas volumes from Azerbaijan cannot support the deliveries needed. And developing gas fields from Iraqi Kurdistan or obtaining associated gas from the northern Iraqi oil fields are illusory stratagems until the security situation improves and the political dispute between the central and regional authorities finds a solution, which may not be any time soon.

Stable Iran supply?

The persistent question, however, is whether Iran will be a stable supplier. It has curtailed gas shipments to Turkey twice, initially in 2006 and again earlier this year when Turkmenistan ceased shipments to Iran. In December 2006 Turkmenistan stopped supplies until a new gas pricing agreement could be concluded. As a result of the 2008 Turkmen cutoff, Iran cut shipments to Turkey by 75%, reducing them to 5 million cu m from 20 million cu m.

The Turkmenistan cutoff to Iran had a ripple effect, causing Ankara to dip into its stored supply by a third and Turkey to further cut off Azeri shipments transiting to Greece. This halt came at an unfortunate moment for Turkey, which experienced a stellar jump in consumption due to the unusually cold weather.

Granted, the issue behind Iran's stoppage did not seem political in nature as did the Russia-Ukraine gas crisis. However, there is a very real possibility that if Iran and Turkmenistan bicker, Turkey and the EU will suffer the consequences. And judging from the past, it appears that in order to encourage agreement, Turkmenistan will resort to gas reductions at the peak of winter to encourage compliance.

Turkmenistan's current strategy is to modify the 2006 price schedule with Iran that stipulates an increase in gas exports of up to 14 billion cu m/year from the base volume of 8 billion cu m/year. With tremendous momentum from its successful price renegotiations with Gazprom and PetroChina, and enjoying the rising price from the Asian market, Turkmenistan was emboldened to press Iran for the price increases.

The latest Iran-Turkmenistan price dispute raises questions about the proposed $7.5 billion, 3,000 km Nabucco pipeline, construction of which is expected to begin in 2010. Nabucco, if constructed, will allow Iranian gas to flow through pipelines from eastern Turkey to Austria's Baumgarten gas hub, via Bulgaria, Romania, and Hungary, and transport some 30 billion cu m/year of gas.

However, the fear is that an export halt anywhere along the gas line could affect the entire network and prompt each participating country to hoard gas for its domestic consumers. Even though Moscow and Tehran are allies in many areas, the scramble for the EU market whets Gazprom's desire to frustrate an Iranian attempt to enter the EU market.

The Nabucco negotiations, which encouraged Russia to step up support for the South Stream pipeline, show the potential for Iranian gas to disrupt the energy balance of power in the region.

Price liberalization

For Iran to truly reach its potential and become a stable supplier for the EU, price liberalization must bring sufficient investment into the gas industry. Leaving aside for a moment the political pressures from the US and UN Security Council, gas and oil power are too cheap in Iran.

Its clerical leadership is politically divided as to how best to exploit its gas resources. Part of the leadership contends that the gas should be used primarily for oil field reinjection to take advantage of high oil prices; another group believes that gas should fuel the domestic market at prices below market to encourage industrial development and provide low domestic energy prices to the populace; while a third group says Iran should emulate Qatar and develop its gas and LNG more actively for export.

As this article goes to press there is no clear winner in this dispute, and it appears that in making concessions to each viewpoint, Iran is incorporating all of them. However, if another gas shortage occurs, populist calls will be strong to halt any gas export or LNG programs. Herein lies the danger of relying on Iranian gas.

The Iranian domestic gas market will probably experience some minor price liberalization in the near-to-midterm. The nation's budgetary strains from supporting domestic consumption are beginning to unravel the economy. The June 2007 riots, which started from the government's decision to ration gasoline while increasing the price, proved that the leadership must tread carefully. In the past, the commercial and political costs of producing gas for domestic power generation were slight, and it could be contended that the best possible use of domestic energy was to encourage industrialization and provide cheap energy.

But current conditions are quite

different; there is a very real opportunity cost for providing extra gas for domestic power generation at below market rates as opposed to supplying the international market. Additional gas production requires major investment in an industry that faces great cost increases and that demands increased technical skill.

Additional gas sold to international buyers in the EU rather than to domestic consumers will yield a much higher return under the current pricing scheme. Iran's uranium enrichment activities likely will chill some foreign investment, as shown by the fact that OMV, Shell, and Repsol moved away from the Iranian blocks. But the EGL deal suggests that long-term energy security ultimately will trump the political debate.

South Pars field offers investment bargains to IOCs. Since gas, rather than oil, is one of the last provinces where IOCs retain technological dominance and the ability to achieve contractual leverage, South Pars eventually will experience increased investment.

However, as Turkmenistan and Gazprom have shown, market-based pricing is the future, as is the reality that rate hikes will be passed down the line. The Iran-Turkmenistan pricing dispute shows the growing clout and confidence of the Central Asian gas producers. Burdened with its subsidized internal market, Iran has no real choice but to recognize these artificially low domestic gas prices as perverse incentives that create chaos in the domestic economy and feed an unrealistic thirst for cheap energy in the citizenry.

Of course, raising gas prices in the face of rapid inflation and record unemployment will be a difficult maneuver, but history has shown that if proactive stratagems are taken, worse case scenarios, which might include domino-like chains of events, can sometimes be avoided. ✦

The author

Justin Dargin is a research fellow at Harvard University where he researches energy policy in the Persian Gulf region. Specializing in international law and energy law, he is a prolific author on energy affairs. He is a cofounder and director of the nonprofit International Institute of Ideas (Interintel), which seeks to address the concerns of global energy poverty and sustainable development by providing developing communities access to inexpensive energy supplies. During his graduate legal studies, Dargin interned in the legal department at the Organization of Petroleum Exporting Countries, where he advised senior staff on the implications of European Union and American law in multilateral relations. Dargin also was a researcher at the Oxford Institute for Energy Studies, where he studied Middle East gas issues, and pioneered a substantive work on transnational gas trade in the form of the Dolphin Project. Dargin holds a BBA in management and information systems from University of Michigan and a JD degree from Michigan State University. Fluent in Spanish, English, and Arabic, Dargin also has been active in energy issues involving Latin America and the Middle East.

McCain promises 'bold' energy program, NAFTA support

Speaking June 17 in Houston—"the oil capital of America"—US Sen. John McCain, the apparent Republican nominee for president, endorsed ending federal embargoes of offshore drilling, temporarily removing federal taxes on gasoline, and the increased construction of nuclear plants to help reduce high energy costs.

McCain said, "We must be bold in our plans to break our strategic dependence on oil, and over the next 2 weeks, I'll be offering a vision that will be bold. But we must also address the concerns of Americans, who are struggling right now to pay for gasoline, groceries, and other necessities of life." He said, "These citizens believe their government has a duty to finally assure the energy security of this country, and they are right."

McCain supports the pragmatism of bringing more fossil fuels to market until other alternative forms of energy are developed. "We have proven oil reserves of at least 21 billion bbl in the US. But a broad federal moratorium stands in the way of energy exploration and production. And I believe it is time for the federal government to lift these restrictions and to put our own reserves to use," he said.

Those states that permit offshore exploration should get a bigger share of the royalties from those leases. "As a matter of fairness to the American people, and a matter of duty for our government, we must deal with the here and now, and assure affordable fuel for America by increasing domestic production."

While he supports drilling off all US coasts, McCain reiterated his opposition to opening the Artic National Wildlife Refuge to exploration. "Quite rightly, I believe, we confer a special status on some areas of our country that are best left undisturbed," he said.

McCain noted, "There's so much regulation of the industry that the last American refinery was built when Jerry Ford was president." He said, "We haven't built a new reactor in 31 years. In Europe and elsewhere, they have been expanding their use of nuclear energy. But we've waited so long that we've lost our domestic capability to even build these power plants."

High oil prices "may come as good news in Moscow, Riyadh, or Caracas, where economic growth and rising oil prices are more or less the same thing," he said, adding, "But their oil prosperity is our energy vulnerability. And the jobs, family budgets, and futures of the American people should not depend on the whims of foreign powers."

NAFTA support

McCain used the occasion to reiterate his support of the North American Free Trade Agreement with Canada and

Mexico—two of the largest suppliers of oil and gas to the US. "There is a world of difference between relying on two democratic neighbors and partners in NAFTA, and relying on often hostile and undemocratic regimes in the Middle East and elsewhere. When critics of trade talk about unilaterally renegotiating NAFTA, as my opponent has done, that's one more concern they might want to keep in mind," he said.

McCain said, "Whoever controls oil controls much more than oil. And in our time, much of the world's oil supply is controlled by states, regimes, and a cartel for which America's well being is not exactly a priority. Many occupy a violent part of the world—a region all the more violent for the influence of oil wealth. Their opinion of America runs the full spectrum from indifference to hatred. And yet these regimes are today the masters of the oil market."

He decried "the vast wealth we shift to the Middle East, Venezuela, Angola," and other producing countries "to enrich undemocratic, unjust, and often corrupt regimes." He said, "Some of the most oil-rich nations are also the most stagnant societies on earth. ...In effect, our petrodollars are underwriting tyranny, anti-Semitism, the brutal repression of women in the Middle East, and dictators and criminal syndicates in our own hemisphere."

He charged, "Somehow the US—in so many ways the most self-reliant of nations—has allowed and at times even encouraged this state of affairs." However, he said, "Starting in the term of the next president, we must take control over our own energy future, and become once again the master of our fate."

Blaming speculation

McCain acknowledged the growing demand for oil outside the US. "When demand exceeds supply, prices always rise, and this has happened very dramatically in the demand for oil," he said. "Two powerful forces in the oil market today are China and India, nations in which a third of humanity is suddenly entering the industrial

WATCHING GOVERNMENT

Nick Snow, Washington Editor

Real work begins behind the scenes

US Senate rejection of punitive oil taxes and a global climate change bill within days of each other doesn't mean the ideas are dead; they simply have moved behind the scenes where oil and gas industry lobbyists expect intense negotiations.

"Our real work has begun. We are busier 2 days after the Senate votes than we were for a month before," said William F. Whitsitt, president of the American Exploration & Production Council, when I met him at a Canadian oil sands conference on June 11. "There are still some very pernicious ideas out there. "

Two days earlier Lee O. Fuller, vice-president, government relations, Independent Petroleum Association of America, told me: "I tend to think there's a good chance that Congress will be up to some sort of mischief. With oil prices at $135[/bbl] and the prospect of their reaching $150[/bbl], that's what they're hearing about from their constituents."

Fuller said he expected the global climate-change focus to shift to the US House Energy and Commerce Committee. "It seems to be looking more at the big issues that need to be addressed rather than simply trying to write a bill," he said.

Fuller suggested that the committee's chairman, Rep. John Dingell (D-Mich.), may feel less pressure to quickly produce global climate-change legislation after the Senate's experience debating the measure, which Joseph I. Lieberman (I-Conn.) and John W. Warner (R-Va.) introduced in October 2007.

Likely in 2009

Fuller added that a bill seems likely in 2009 because the two major parties' apparent presidential nominees, Sens. John McCain (R-Ariz.) and Barack Obama (D-Ill.), support a cap-and-trade program.

Days later, the committee made its first move when Rep. Rick Boucher (D-Va.), the chairman of its Energy and Air Quality Subcommittee, introduced a bill aimed at accelerating the availability of carbon capture and storage technology—a key climate-change program component.

Boucher's bill, which has nine Democrats and five Republicans as cosponsors, would establish a $1 billion annual CCS technology fund. It would be financed from taxes on the generation of electricity from coal, oil, and gas. Residential costs would be an additional $10-12/year.

Punitive proposals

Meanwhile, many congressional Democrats continue to demand punitive measures for the oil and gas industry. Proposals range from repeals of tax incentives to giving federal regulators more authority to investigate and prosecute oil market manipulation allegations.

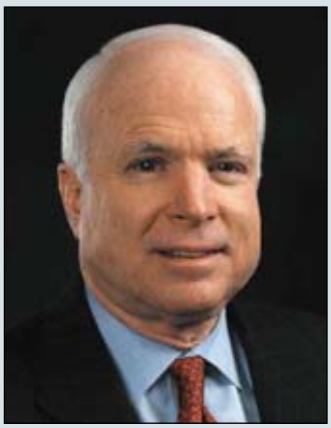
Some federal lawmakers also want to reimpose the windfall profits tax. Fuller and Whitsitt separately said the idea may be growing harder to sell.

"Some blogs suggest that not everyone accepts the idea that a windfall profits tax will reduce energy prices. Whether they make a difference will depend on the congressional office's sophistication," Fuller said.

Whitsitt added, "We're starting to hear that more of the public recognizes that major oil companies aren't responsible for these higher prices. They're beginning to get it." ✦

"We must be bold in our plans to break our strategic dependence on oil, and over the next 2 weeks, I'll be offering a vision that will be bold. But we must also address the concerns of Americans, who are struggling right now to pay for gasoline, groceries, and other necessities of life."

—US Sen. John McCain



era—with all the cars, construction, and consumption of oil that involves."

But he joined others—including ministers of the Organization of Petroleum Exporting Countries—in blaming speculation for pushing up energy prices. "We all know that some people on Wall Street are not above gaming the system," McCain said. "Investigation is under way to root out this kind of reckless wagering, unrelated to any kind of productive commerce, because it can distort the market, drive prices beyond rational limits, and put the investments and pensions of millions of Americans at risk. Where we find such abuses, they need to be swiftly punished. And to make sure it never happens again, we must reform the laws and regulations governing the oil futures market, so that they are just as clear and effective as the rules applied to stocks, bonds, and other financial instruments. In all of these markets, reform must assure transparency, prevent abuse, and protect the public interest."

McCain also wants to reduce energy demand while increasing supply in an environmentally friendly way. "In the face of climate change and other serious challenges, energy conservation is no longer 'just a moral luxury or a personal virtue.' Conservation serves a critical national goal. Over time, we must shift our entire energy economy toward a sustainable mix of new and cleaner power sources. This will include some we use already, such as wind, solar, biofuels, and other sources yet to be invented. It will include a variety of new automotive and fuel technologies, clean-burning coal and nuclear energy, and a new system of incentives, under a cap-and-trade policy, to put the power of the market on the side of environmental protection." ✦

US CFTC unveils new foreign market data pact

Nick Snow
Washington Editor

The US Commodity Futures Trade Commission improved its access to data on US commodities traded on overseas exchanges as it amended terms under which ICE Futures Europe is permitted direct access to US customers, the CFTC's top official told a joint hearing of two US Senate committees.

The amended "no-action relief letter" will require ICE Futures Europe to adopt equivalent US position limits and accountability levels on its West Texas Intermediate crude oil contract, which is linked to the New York Mercantile Exchange crude oil contract, said CFTC Acting Chairman Walter L. Lukken.

It also will require ICE Futures Europe to follow similar US hedge exemption requirements and report any violations to the CFTC, he told a joint hearing of the Senate Agriculture, Nutrition and Forestry Committee and the Appropriations Committee's Financial Services and General Services Subcommittee. "The CFTC will also require other foreign exchanges that seek such direct access to provide the CFTC with comparable large trader reports and to impose comparable position and accountability limits for any products linked with US regulated futures contracts," Lukken said.

"This combination of enhanced information data and additional market controls will help the CFTC in its surveillance of its regulated domestic exchanges while preserving the benefits of its mutual recognition that has enabled proper global oversight over the last decade," he maintained.

'No one knows'

The announcement was applauded by several House and Senate members, but critics on both sides of the Capitol said CFTC still needs to do more. Sen. Richard J. Durbin (D-Ill.), the Appropriations subcommittee chairman who ran the hearing, said, "With the economy in a tailspin and with the average price for a gallon of [gasoline] topping $4 across the country, people are asking why this is happening. Is excessive speculation taking place or is it simply supply and demand? The answer is that no one knows, and the CFTC lacks the information, resources, and in some cases, legal authority to tell us."

He said the joint hearing by these two committees was unprecedented but reflected intense interest in CFTC's regulatory role and resources. Fifteen senators made opening statements or asked Lukken questions, Durbin noted, before introducing a second group of witnesses. "Those who wanted to get

government off our backs ended up taking cops off the beat," he said.

In the House, Energy and Commerce Committee Chairman John D. Dingell (D-Mich.) and Bart Stupak (D-Mich.), who chairs its Oversight and Investigations Subcommittee, released a letter to Lukken commending CFTC for issuing a special call to obtain more information about passive investments in commodity indexes and single commodities and for efforts to get more information from ICE Futures Europe and its British regulator, the Financial Services Administration.

"Despite these initiatives, the futures markets remain far from transparent to regulators or the public," the two House members continued. Congress particularly needs to understand the role and activities of sovereign wealth funds in commodity markets to better determine if oil-producing countries may be contributing to upward pressure on commodity prices through undisclosed oil and other investments, they said. Dingell and Stupak asked Lukken 11 questions in their letter and requested answers by June 20.

Four Senate bills

Four separate Senate bills were filed on June 12-13 to address possible speculation and increase CFTC's authority and resources. S. 3130, which Durbin introduced, would give the agency money to hire another 100 employees, make its inspector general independent, order the US comptroller general to study the international regime for trading energy futures and derivatives and submit a report to Congress within 120 days of the bill's enactment, and require a non-US board of trade selling an energy commodity for US delivery to operate under US regulations.

Several senators at the hearing asked Lukken about specific energy commodity market issues. Ken Salazar (D-Colo.) said an independent oil and gas producer in Colorado wondered why Congress had not increased margin requirements from 5 to 40%. "Margins are a very blunt instrument when used in that fashion and could send many businesses overseas," Lukken replied.

Amy Klobuchar (D-Minn.) asked him if CFTC would support repealing the provision in the 2000 Commodity Futures Modernization Act that created exempt commercial markets—the so-called Enron loophole—and moved the burden of regulatory proof from traders to the commission. When Lukken said he did not believe this had prevented CFTC from investigating market manipulation allegations since the CFMA became law and the agency had won all of its cases, Klobuchar said, "I understand that you have taken measures. I don't understand why you apparently don't want a stronger law."

One difference that emerged was the difference between CFTC's definition of market manipulation and that of federal lawmakers, which Lukken said might more accurately describe a speculative bubble. "Manipulation in the CFTC's eyes is an illegal act where someone tries to push prices higher without taking any risk. We've seen cases in the past where someone has tried to manipulate a market by holding one leg of their position in clear view while doing something more on the outside," he explained.

Republicans' assessments

Republicans said CFTC should be given a chance to implement its new responsibilities. "Mr. Lukken, your challenge is: before you can put all the changes in your authority into operation, some people in Congress are trying to push it further," said Sam Brownback (Kan.).

"Simply blaming foreign boards of trade and the CFTC will not lower energy prices," said Saxby Chambliss (Ga.), the Agriculture Committee's ranking minority member. Several bills have been introduced and hearings held about commodity markets and higher energy prices, he pointed out. "We should not rush to legislate an uninformed solution, particularly when we might create more problems by driving speculators into markets from which the CFTC receives no trading data and has no ability to monitor," he said.

Lukken said the commission already is extending its inquiries into major new areas. When Agriculture Committee Chairman Tom Harkin (D-Iowa) asked about "netting out" by index traders to possibly camouflage their true positions, the CFTC official said: "We typically have not looked at markets to get information on traders. Swap dealers take different positions for their clients so this will be unprecedented. We will be going through large investment bank clients' portfolios and trying to determine what they are doing."

The agency is doing this because it is concerned that some investors may be using swaps to evade commodity position limits, he added. "It's imperative that we get this data. That's why we announced 2 weeks ago that we were putting out special calls for it," Lukken said. ✦

Alberta to rebut oil sands' environmental foes

Nick Snow
Washington Editor

In response to environmental organizations' opposition to oil sands development, Alberta plans to emphasize the strategic and economic benefits of continuing production, said an official of the Canadian province's government June 11.

"Alberta's success in developing its estimated 1.7 trillion bbl of oil sands has vaulted it onto the world stage because it is the only non-OPEC government capable of dramatically increasing

its production," said Gary Mar, the province's minister-counselor at the Canadian Embassy in Washington.

It also has become the target of groups intent on restricting development as a way to stop the growth of fossil fuels, he told participants at a conference on Canada's potential for reducing US reliance on imports from Organization of Petroleum Exporting Countries members.

Alberta and Canada's democratic governments stand in contrast to those of most other oil-producing nations, Mar said. Canada and the US developed a close and beneficial trading relationship long before Canada became the largest foreign oil supplier to the US, he noted.

"We also have strict environmental standards. Strict limits are placed on water use, and water quality is continuously monitored. Fort McMurray's air quality is better than many major Canadian cities," Mar said. Technology has reduced the amount of water needed to produce a barrel of oil from oil sands to 2-3 bbl from 5 bbl, compared with more than 100 bbl of water to produce a barrel of ethanol, he noted.

'Tremendous' CCS potential

The province also is moving ahead on developing carbon capture and storage (CCS) capabilities because its geology and that of Saskatchewan are ideal, he said. "CCS has tremendous potential for Alberta as a technology we can market throughout the world. We think it should be impressed on US policymakers that this technology is not new, and that it works," Mar said.

His statements prompted a response from an audience member at the conference, which was sponsored by the Canadian American Business Council during its annual meeting. "In addition to global warming, there are other environmental concerns. Mining will be the primary source of oil sands for some years to come," said Susan Casey-Lefkowitz, a senior attorney at the Natural Resources Defense Council. "In situ processes have impacts from sedimentary fragmentation and pipeline construction. Water impacts also are substantial. More action is needed," she said.

"As we've met with oil companies, we see that many have made commitments to fight global warming but are also investing in higher-carbon fuels. We believe that more investments need to be made in new and developing alternatives," she continued.

Matt Fox, senior vice-president for oil sands at ConocoPhillips Co., said that the company believes its Alberta oil sands holdings could produce 1 billion bbl of bitumen, 90% of which would come from an in situ process, steam-assisted gravity drainage (SAGD), instead of mining. SAGD uses the same amount of land and much less water than conventional oil field development. The water comes from underground, it is generally saline, and 90% of it is recycled, he said.

Greenhouse gas (GHG) emissions during production are 3-4 times the amount produced in a conventional oil field, Fox conceded. "That's an issue we have to look at," he said, adding that Alberta's forthcoming CCS standard should bring the overall GHG footprint closer to conventional oil field levels. ConocoPhillips is developing its own CCS and alternative fuels capabilities in the meantime, he said. "This is not a bridge where we'll sit back and wait," Fox said.

Issues for pipelines

Pipelines to move the oil sands-derived crude to inland US refineries also face obstacles that could be significant, according to Shirley Neff, president of the Association of Oil Pipe Lines. Many proposed pipelines from Canada involve line reversals and conversion of existing systems, she told conference participants.

Unlike their natural gas counterparts, crude oil pipelines have no federal eminent domain authority but are subject to the same environmental and permit requirements on the state level, she continued. "The politics around some of these projects has been unbelievable," Neff said. Trans-border pipelines also must get a border crossing permit from the US Department of State, which used to be a fairly straightforward process but has recently become more difficult, she said.

Neff noted that the US Environmental Protection Agency is about to issue a notice associated with GHG emissions in various transportation modes. While pipelines' emissions are lower than highway or rail transportation, their pump stations could be monitored. Biofuels pose yet another set of questions, she said.

"The most important issue for liquids pipelines is a stable regulatory environment. Once you've put pipe in the ground, you can't redeploy the asset. The problem is that nothing is ever as straightforward as it seems," Neff observed. Since Canada is the only source for many inland refineries' feedstock except for US Rocky Mountains production, pipelines will be under political pressure to respond, she said. "We're increasingly being asked to address reliability and security issues. All of this will require getting the necessary permits promptly and in a straightforward manner," she said.

The current atmosphere of record high prices in the absence of a significant supply interruption makes wider US recognition of Canada's oil supply role vital, noted Jonathan M. Baron, founder and principal of Baron Communications LLC and a consultant to Securing America's Future Energy (SAFE).

"Not every barrel of oil is created equal. In the current US debate, oil sands oil from Canada is costly to produce and environmentally dirty. But that does not recognize its energy security value. We're not going to have environmental improvements without economic growth to support them. Canada will play a major role in this," he said. ✦

US oil firms urged to prep for global reporting standards

Paula Dittrick
Senior Staff Writer

Oil and gas companies in many countries are preparing to follow International Financial Reporting Standards (IFRS), and at least one major accounting firm is urging US public companies to start their preparations as well.

Publicly listed companies in the European Union have used IFRS since 2005. A popular discussion is whether IFRS will replace US Generally Accepted Accounting Principles (GAAP).

Accounting firm Ernst & Young is encouraging the US Securities and Exchange Commission (SEC) to adopt international accounting standards and set a target date for the transition to IFRS.

The SEC has made no such decision. The International Accounting Standards Board and the US Financial Accounting Standards Board are working on convergence of IFRS and GAAP.

US companies file statements to SEC in accordance with US GAAP. Numerous countries are scheduled to convert to IFRS during 2009-12, including Canada. Public companies in more than 75 countries use either IFRS or some modified form of it.

Various accounting firms are briefing clients worldwide on making the switch, and most accountants warn companies against underestimating the importance of being prepared to implement IFRS.

KPMG's web site suggests the worst-case scenario is that a company would have to restate its financial results because of failings in its IFRS conversion process.

Ken Marshall, an Ernst & Young partner and the firm's IFRS markets leader, believes SEC will require US companies to adopt IFRS at some point, although the timetable remains unknown.

Conversion process

Marshall advises US companies to take a structured approach to an anticipated IFRS conversion. He suggests the first step is to identify accounting differences between GAAP and IFRS requirements.

"The IFRS literature doesn't have the same amount of rules or interpretation as GAPP," Marshall said.

During a June 2 Ernst & Young briefing in Houston, Marshall said corporate boards should ensure that communication has been established with all key stakeholders, especially with a company's auditors.

He said European companies learned that it takes 2-3 years to implement IFRS reporting.

Chester Abell, Ernst & Young partner and national director of tax accrual services, said the IFRS conversion is not just an accounting exercise.

"All financial statement changes resulting from conversion have tax implications," Abell said.

Marshall said it is difficult to predict what the costs of conversion might be or how balance sheets might change under IRFS.

Royal Dutch Shell Group adopted IFRS in 2005. During 2004, Shell Controller Tim Morrison told analysts that the change cut asset values on Shell's balance sheet by $4.7 billion. The changes relate mostly to the prepayment of pensions, he said (OGJ, Dec. 13, 2004, p. 31).

Canada to switch

Sabra Harrington, vice-president and controller of Spectra Energy Corp., said her company has begun the conversion process because IFRS is going to be required in Canada by Jan. 1, 2011.

"It's taking longer than we thought, and it's fairly complex," Harrington said. "It's not black and white. There are decisions to be made."

The deadline requires comparative IFRS 2010 data to be included in 2011 financial reports, she said. Meanwhile, Spectra also must comply with US GAAP reporting.

"We think we are going to end up with multiple sets," of reporting accounts, Harrington said. Spectra Energy reports to the Ontario Energy Board, Canada's National Energy Board, and US government agencies.

Harrington said Spectra's anticipated IFRS conversion will involve company-wide training and communication.

For instance, the business department will be involved with income tax planning while the information technology department figures out how many sets of records Spectra Energy's general ledger system can handle.

PricewaterhouseCoopers Canada has posted information on its web site about IFRS and the Canadian oil and gas industry.

"The impact of IFRS is felt all along the oil and gas value chain, but many of the key dilemmas and judgments are greatest at the exploration and production stage," PWC said.

For instance, IFRS limits full-cost accounting to exploration and evaluation activities. This differs from full-cost accounting as applied under Canadian GAAP. The US SEC allows the use of either full cost or successful efforts accounting for oil and gas activities.

"Companies beyond the exploration and evaluation stage using full cost accounting will have significant hurdles to overcome in respect of identifying and tracking individual cash-generating units by which to assess impairment and calculate depletion expense," PWC said.

Oil and gas companies making the transition to IFRS also need to consider other differences, such as production-

sharing arrangements, royalties, and excise taxes.

IFRS criticized

Michael Starkie, chief accountant for BP PLC, wrote a letter to the Financial Times in which he called IFRS "unhelpful."

Starkie said he wrote the letter in a personal capacity. He is a member of the European Financial Reporting Advisory Group Technical Expert Group.

"Recent years have seen major changes in the topography of accounting standards," Starkie wrote. "What a wasted opportunity then, that the current body of IFRS is so unhelpful for the markets when the accounting world was given this historic opportunity to create something that should have been useful for markets."

He called upon the International Accounting Standards Committee's Foundation to "reconstitute the board," saying the IASB "continues to develop an accounting model about which users of financial information have grave misgivings." ✦

Rolling strike delays oil shipping through Marseille port

Eric Watkins
Senior Correspondent

A rolling strike, which already has halted oil shipping through the Port of Marseille, is set to continue for a further 5 days, according to officials of the state-run port administration.

Marseille, the world's third-largest oil port, after Rotterdam and Houston, receives about 40% of France's crude oil.

At the moment, 22 tankers are waiting to offload their cargoes at Marseille's Fos-Lavera terminals, France's largest oil port.

But the ships could be delayed until June 18 due to a sequence of day-long strikes which, by then, will have brought the port to a halt for 7 consecutive days.

Officials issued a statement saying the port "regrets this decision, which risks durably compromising the future of the port, of its personnel, of the companies, of the 40,000 regional jobs that depend on its activity."

The delay follows an earlier one on June 6 when workers at Fos-Lavera extended the port blockage initiated on June 5. That time, the strike blocked a total of 21 oil tankers from entering the port or from being loaded or unloaded.

The current series of supply chain disruptions began on Mar. 26 when French port workers called a strike at state-owned ports to protest against government plans to privatize the loading activities of seven out of nine of the public ports: Marseille, Dunkirk, Le Havre, Rouen, Nantes Saint-Nazaire, La Rochelle, and Bordeaux.

At the time, the strike that blocked the Fos hydrocarbon terminal for more than 2 weeks, cost refineries in the area about €25 million (OGJ, Apr. 9, 2007, Newsletter). Four refineries are in the Fos-Lavera hub, including ExxonMobil Corp.'s 119,000 b/d Fos refinery, Ineos's 207,000 b/d Lavera refinery, Total SA's 158,000 b/d La Mede refinery, and Royal Dutch Shell PLC's 80,000 b/d Berre l'Etang refinery.

Other refineries, such as the 300,000 b/d Miro facility in Karlsruhe, Germany, are also served by the Fos-Lavera hub.

Last November, France's CGT workers union called for 4-hr strikes at ports across the country including Marseille, Saint-Nazaire, and Le Havre. That strike was called over pay and working conditions.

In December, 90% of workers at five refineries owned by Total went on strike to protest against a pay agreement signed in November between management and unions at the company. ✦

Ship guarding Addax facility off Nigeria attacked

Eric Watkins
Senior Correspondent

Even as Royal Dutch Shell PLC announced a continuation of its force majeure for Nigerian Bonny oil exports, militants in southern Nigeria ambushed a naval vessel guarding an offshore concession operated by Addax Petroleum Corp., killing one person and wounding several others.

"We strongly believe that this unfortunate incident was a premeditated act by criminal elements seeking personal benefit," rather than political activists, said Addax president and CEO Jean Claude Gandur referring to the attack that left one Nigerian naval officer dead and four others wounded.

Addax said the attack on Block OML126, located 90 km south of Port Harcourt some 40 km offshore, took place at around 11:45 pm on June 8 when the Nigerian naval vessel was approached and fired upon by unknown assailants in two speedboats.

The speedboats were repelled and departed without any adverse effect on Addax's operations or its technical infrastructure on OML126, which produced some 41,250 b/d in 2007. The naval personnel and vessel were taken to LNG Bonny Island where the injured personnel were given medical attention, Addax said. An investigation of the attack is under way.

The attack followed Addax's recent announcement that a combination of discoveries at Ofrima North 50 km south of Brass, Nigeria, justifies standalone development with a floating production, storage, and offloading vessel and subsea tiebacks (OGJ, May 5, 2008, Newsletter).

The attack on OML126 also coincided with a Shell announcement that its force majeure remains in place for Nigerian Bonny oil exports despite ear-

lier plans to lift it by the end of May.

In late April, production of about 164,000 b/d of Bonny Light crude was shut in after militant attacks, causing Shell to declare the force majeure to free it from supply contract obligations on Bonny Light for late April through May. Further attacks in late May saw some 130,000 b/d of Nigerian production shut in (OGJ Online, May 28, 2008). Recent reports say that more than 600,000 b/d of Nigerian crude remain shut in due to militant assaults, amounting to some 20-25% of the country's typical oil production. ✦

Saudi Arabia again delays bids for Jizan refinery

Eric Watkins
Senior Correspondent

Saudi Arabia has delayed for the third time a tender for bids for a projected 250,000-400,000 b/d refinery in the southwestern province of Jizan, according to local media.

"We were informed of the delay... and we are awaiting more clarifications," a source from one of the consortia bidding for the project told the Al Watan newspaper. No reason was cited for the delay.

Al Watan did not name the source, but said Bechtel, Foster Wheeler, Technip, and Snamprogetti are among the foreign companies that have set up consortia with Saudi firms to bid for the project.

Other interested firms include Petronas, Formosa Petrochemical Corp., Reliance Industries, China National Offshore Oil Corp., and Petroleo Brasileiro SA (Petrobras).

The Saudi government has approved eight domestic firms to participate in joint ventures: Nama Chemicals, al-Arabiya for Water and Energy Development, Advanced Petrochemicals and Refineries, National Industrialization, Obeikan Investments, Arabian Peninsula for Industrialization and Petroleum Services, Taqaat, and Adbel-Kader al-Bakry and Sons Industrialization.

In April, the Saudi oil ministry said it planned to proceed with the project and would invite bids in May to build and operate the Jizan facility.

"It will be opened at the end of May," said Abed Al-Saadoun, the oil ministry point person for Jizan, regarding the bidding. He added that the refinery would have capacity of as much as 400,000 b/d. Saudi officials earlier said the plant would have capacity of 250,000-400,000 b/d.

Under the original tendering schedule, a request for proposals was to be issued to prequalified companies in the second quarter of 2007, with bids submitted early in the fourth quarter.

The ministry's aim was to award the license before the end of 2007, but its plans changed due to a delay in July that year. Revised plans were pushed back again in January.

Various reasons have been cited for the earlier delays, including the need to relocate due to the potentially adverse environmental effects in the originally chosen location.

Other reasons concern project financing. The Saudi government wants international oil companies to participate in the project. But several IOCs have declined to participate, citing concerns over commercial drawbacks to the project.

"The refinery in the west is not something that Chevron [Corp.] would be participating in," Chevron Vice-Chairman Peter Robertson told reporters in Saudi Arabia on the sidelines of the February 2007 Jeddah Economic Forum. "It wouldn't make strategic sense to participate in a refinery there," Robertson said. ✦

Indonesia modifies E&P cost-recovery process

Eric Watkins
Senior Correspondent

Indonesian President Susilo Bambang Yudhoyono met with top foreign oil and gas company executives in a closed-door meeting also attended by Vice-President Jusuf Kalla, Energy and Mineral Resources Minister Purnomo Yusgiantoro, PT Pertamina president director Ari Soemarno, and R. Priyono, newly appointed head of BPMigas, the oil and gas regulatory body.

Officials did not disclose the purpose of the meeting, saying only that it focused on "oil-related" issues to enable the president and vice-president to meet with foreign oil and gas firms holding concessions in Indonesia. The meeting coincided with concerns in the country over oil and gas contractors' cost recovery claims to the government.

According to a recent editorial in the Jakarta Post, "Aside from the whopping total cost, a major concern [of cost recovery claims] has been the dubious nature of many expenses, especially when the country is in dire need of higher revenues from the oil and gas sector to help provide better public facilities."

An audit by the Supreme Audit Agency (BPK) published late last year on the 2005 accounts of nine oil and gas blocks (of a total 80) unveiled some $525 million in questionable claims for government refunds under the cost recovery scheme, according to the newspaper. Citing BPK, the newspaper said the refunds were filed by Total E&P Indonesie, ExxonMobil, Chevron, ConocoPhillips, and CNOOC.

"Items claimed for refund ran the spectrum from a Pinocchio DVD to a complicated chain of transactions often involving drilling," it said. According to the BKP report, such expenses reduced

WATCHING THE WORLD

Eric Watkins, Senior Correspondent

Do McCain and the Saudis agree?

US Sen. John McCain will probably smile with satisfaction after learning of remarks by members of Saudi Arabia's legislative body, the Majlis Shura, who feel that the US should begin producing more oil at home.

"There are a great deal of restrictions in many areas of the world—not the least of which is the United States—that could be producing oil," said Bandar bin Mohammed Al Eiban, part of a 5-man Shura delegation to the US.

The delegation's visit came ahead of a special producer-consumer meeting hosted by Saudi Arabia aimed at reducing crude prices. In particular, Saudi Arabia wants the US to reduce market speculation, focus on increased access for exploration, and build new refineries to process crude.

McCain's view

The Saudi view seemed to chime with McCain, who said the "next president must be willing to break with the energy policies not just of the current administration, but the administrations that preceded it, and lead a great national campaign to achieve energy security for America." In particular, McCain wants to reverse the current federal ban on offshore drilling.

"As for offshore drilling," said McCain, "it's safe enough these days that not even hurricanes Katrina and Rita could cause significant spillage from the battered rigs off the coasts of New Orleans and Houston. Yet for reasons that become less convincing with every rise in the price of foreign oil, the federal government discourages offshore production."

Of no less interest to the Saudis, perhaps, were McCain's words about the effect of speculation on oil prices.

Focus on speculators

"There is the further problem of speculation on the oil futures market, which in many cases has nothing to do with the actual sale, purchase, or delivery of oil," McCain said. "When you have enough speculators betting on the rising price of oil, that itself can cause oil prices to keep on rising. And while a few reckless speculators are counting their paper profits, most Americans are coming up on the short end—using more and more of their hard-earned paychecks to buy gas for the truck, tractor, or family car."

Still, the Saudis might well have been a bit concerned by his references to high oil prices "that may come as good news in Moscow, Riyadh, or Caracas," as well as his statement that "much of the world's oil supply is controlled by states, regimes, and a cartel for which America's well being is not exactly a priority."

That might seem somewhat undiplomatic to the Saudis, who as producers are looking for a truly cooperative attitude from consumers over pricing.

"We may be at an important junction as far as oil is concerned. The increase has been so dramatic that it is really impacting the ability of nations to pay for their oil, and I expect some very serious cooperation between producers and consumers," Al Eiban said. ✦

the government share of revenue from the oil and gas sector. In 2005, it said, the government received $19.9 billion net take from the oil and gas sector after paying out $7.68 billion in refunds.

While the compensation for questionable items was small compared to the profit, the BPK stressed the impact of "regulation loopholes and reckless supervision by the oil and gas regulator BPMigas" (OGJ, Mar. 24, 2008, Newsletter).

Bureaucracy cut

In April, the newly appointed head of BPMigas, R. Priyono, vowed to cut the bureaucratic processes that oil and gas companies currently must undergo in order to obtain their exploration licenses. "If they (oil and gas companies) have to go through three or four tables, let's make it just one," Priyono said, adding, "Such a bureaucratic system is simply out of date."

The new system would help BPMigas implement its main task of increasing the country's oil production, which has declined over the past 5 years due to depletion at aging fields and reduced exploration for new ones.

Priyono said some positions in the agency will be restructured to improve efficiency, adding that the plan was being negotiated with the energy and mineral resources ministry.

At the time, Purnomo said Priyono also must improve the monitoring of cost recovery, which has come under public criticism for its alleged lack of transparency.

Priyono promised he would ensure that each department had a standardized financial surveillance system to guarantee that cost-recovery funds were well-spent. He also said a new system would be introduced to tighten the cost recovery mechanism, by refunding exploration costs only in producing fields.

According to BPMigas' latest report, the government paid some $8.33 billion to oil and gas producers in 2007 for recovery costs, up 6.4% over the $7.8 billion paid in 2006. ✦

Voxel volumetric visualization aids oil sands production optimization

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This article outlines a volumetric visual method (voxel volumetric method) to visualize and model underground geological structures for optimizing in situ steam assisted gravity drainage (SAGD) well placement.

This voxel volumetric method uses logged well data from 257 shallow wells drilled in a 10 sq km area of a multibillion dollar tar sands project. Well log data are input into a voxel imagery method that creates an accurate visualization of complex underground structures relevant to optimizing bitumen sands production.

The difficulty is the complex geology of the tar sands deposits. Lack of understanding of the stratigraphy and sedimentology of the reservoir sands can hinder exploitation from regional exploration aspects as well as site-specific production and development.[1]

Brief SAGD review

In the SAGD process, steam injected into an upper injection well heats the surrounding bitumen-saturated sand and mobilizes bitumen oil. The mobilized bitumen, under the force of gravity, migrates to production wells.

Geological structures underground can form permeability barriers that hinder the above SAGD process. Such structures can cause oil production rates to decline, steam/oil ratios to increase, and reserves to be left behind as a result.

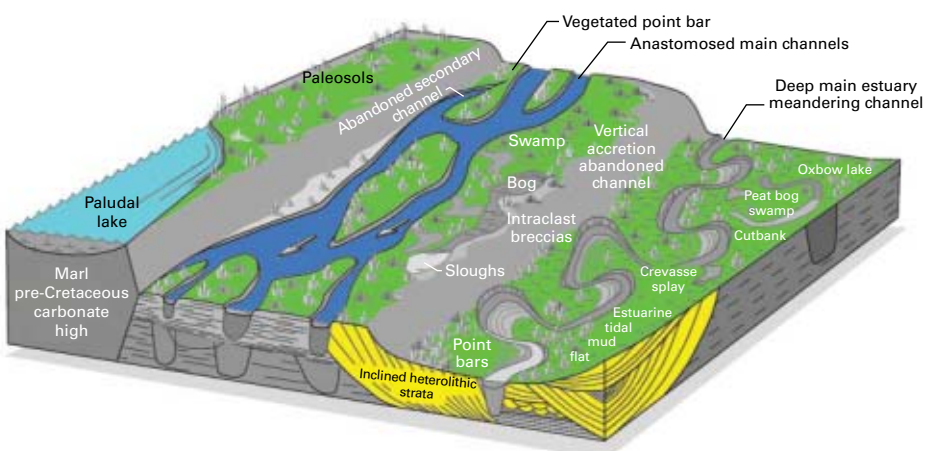
Optimal SAGD design is achieved when volume of steam coverage is unimpeded by impermeable layers of shale or clay (otherwise known as lateral accretions) associated with meandering fluvial systems. Careful well placement also minimizes steam requirements.[2]

Due to sound wave physics limiting the nature of seismic methods, geologists and geophysicists are finding that it is a difficult and complex task to fully integrate finer details of geological structures in tar sands deposits, such as sand-dominated bedding packages, precise vertical continuity of individual channel deposits, and the erosional contacts between similar lithologies. Seismic methods are limited to mapping large-scale features, such as the lateral extent of major meandering channels.[3]

Well data were used from a project that consists of a surface mine development and partly of SAGD development in the Lower McMurray formation. In the Lower McMurray formation (defined by the Alberta Geological Society as the lower part of Upper McMurray formation), significant sedimentation for hydrocarbon accumulation occurs in low-stand fluvial-estuarine incised valleys, where a meandering river system deposited reservoir-quality point bar sands, said point bars contain several distinct facies, each with different reservoir properties (Fig. 1). The McMurray

LOWER PART OF UPPER MCMURRAY FORMATION, ATHABASCA, NORTHERN ALBERTA

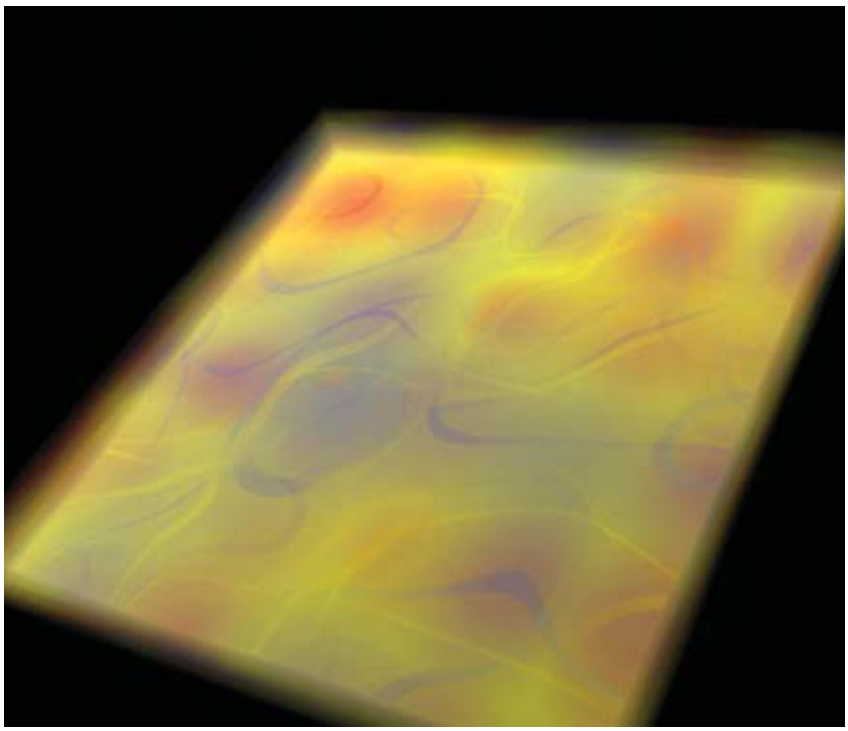
Fig. 1



Source: Modified from Hein, Cotterill, and Berhane

VOLUMETRIC VISUALIZATION OF 10 SQ KM OF OIL SANDS

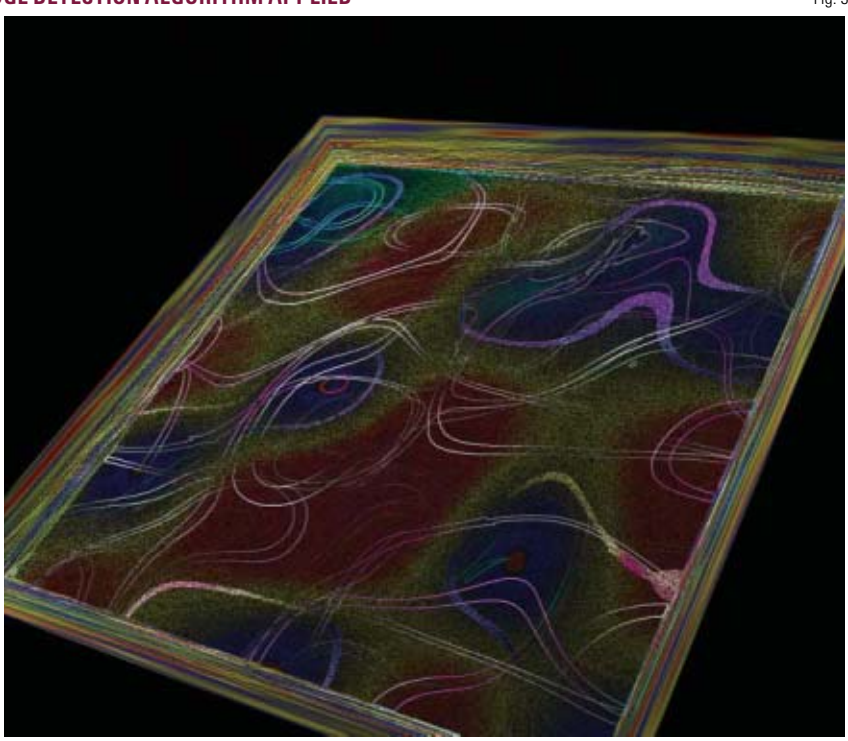
Fig. 2



Note working mine exists at upper left corner of figure at confluence of several stacked channel point bars. Also note promising reservoirs in upper right corner (red indicates economic reservoirs).

EDGE DETECTION ALGORITHM APPLIED

Fig. 3



The algorithm applied to this volumetric visualization of the same 10 sq km area of oil sands as in Fig. 2 emphasizes point bars, meandering channels of estuarine-fluvial environment, and layering.

sands range from 20 m to 58 m thick, maintain high porosities from 30% to 35%, and are extremely permeable with permeabilities commonly ranging from 3 to 10 darcies.[2]

The facies of particular concern with respect to excellent bitumen extraction potential consists of medium to large-scale trough crossbedded, fine to medium-grained sand with rare mud drapes and laminae. The voxel visualization in this article is based on this particular formation of concern, as logged by client company geologists.

Voxel imagery

Voxel is short for voxel volume pixel, the smallest distinguishable box-shaped part of a three-dimensional image.

Voxelization is the process of adding depth to an image using a set of cross-sectional images known as a volumetric dataset. These cross-sectional images or slices are made up of pixels. The space between any two pixels in one slice is referred to as interpixel distance, which represents a real-world distance. And, the distance between any two slices is referred to as interslice distance, which represents a real-world depth.

The dataset is processed when slices are stacked in computer memory based on interpixel and interslice distances to accurately reflect the real-world sampled volume. Next, additional slices are created and inserted between the dataset's actual slices so that the entire volume is represented as one solid block of data.

Now that the dataset exists as a solid block of data, the pixels in each slice have taken on volume and are now voxels. For a true 3D image, voxels must undergo opacity transformation along with tricubic interpolation. The tricubic interpolation ties structural elements tagged between wells together to form a picture of an underground structure.

Opacity transformation gives voxels different opacity values. This is important: It is crucial to expose interior details of an image that would otherwise be hidden by darker, more opaque outside-layer voxels.

Voxel images are primarily used in the field of medicine and are applied to X-rays, computed axial tomography (CAT) Scans, and magnetic resonance imaging (MRI) so surgeon professionals can obtain accurate 3D models of the human body.

We developed voxel imagery software and techniques that took core descriptions tagged by geologists as "excellent bitumen intervals." Excellent bitumen intervals were considered by geologists as any bitumen core that had greater than or equal to 13% weight to weight bitumen content.

These excellent bitumen intervals were converted into three dimensional spatial references that served as useful input in the voxel volumetric method developed by our firm.

Company project geologists had logged several thousand meters of core data. Using a cutoff criterion of 13% bitumen content weight to weight, company geologists had tagged the well latitude, longitude, and depth of each of these high-percentage bitumen content cores.

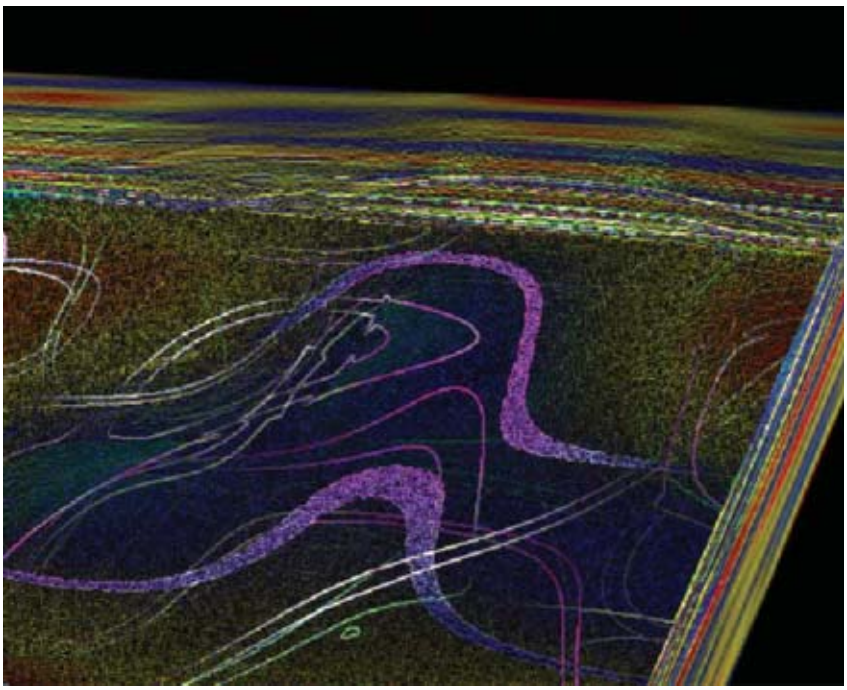
Longitude, latitude, and depth is equivalent to the X, Y, and Z axis on our figures. The Z axis, or the dimension that represents depth underground, has been exaggerated nine times in our voxel figures in order to better show geological structures.

Bitumen content greater than or equal to 13% weight to weight bitumen content, considered at the time of the project 4 years ago as an economically significant cutoff value, was logged visually by project geologists, followed by a laboratory program that provided quantitative numerical weight to weight figures that had excellent correlation with geological observations.

Our technique only used as input logged core data meeting the 13% economic cutoff criterion or above this criterion. In other words, only structures of economic resource interest are mapped by this 3D method in three dimensions, and only data logged from project geologists were used, filtered by a greater than or equal to company-specific 13% bitumen weight to weight content.

Stacked point bar of potential interest for SAGD development

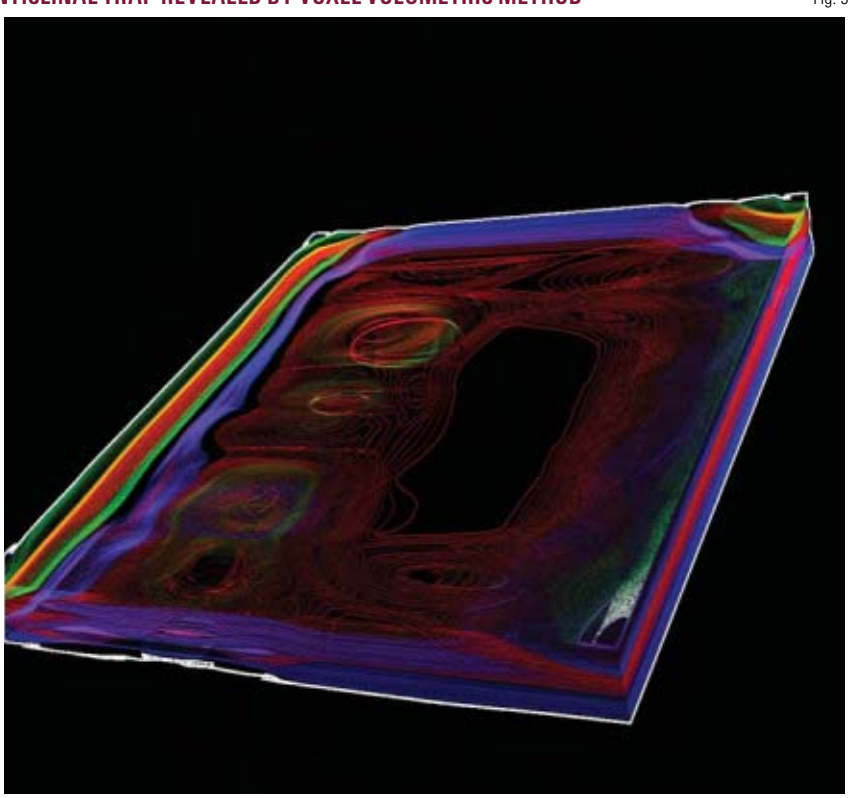
Fig. 4



Note subtle changes in layering. This technology was developed in response to the inadequacy of seismic-based techniques to clearly define point bar structures in underground estuarine environments. Accurate visualizations of underground structure can provide production and geological planning teams with the necessary means to develop an optimal production plan for SAGD technology/surface mine developments.

Anticlinal trap revealed by voxel volumetric method

Fig. 5



This resulted in the following comprehensive visualization of 10 sq km of tar sands north of Fort McMurray (Figs. 2 and 3). These figures show a complex estuarine environment composed of interfingered channel deposits.

Fig. 4 represents a blowup of Fig. 3. One can observe the confluence of several point bar structures in the blowup figure which represents a future potential mine. Estuarine channels, which represent low bitumen potential and bounding structures for point bars, can be readily observed in the figure as sinuous structures.

It is easy to observe sediment mounding and one incised valley in profile along the upper edge of the voxel image. In the horizontal X and Y plane of the figure, subtle textural and color changes represent inner to outer point bar structural detail. Cross-cutting relationships between meandering channels illustrate for geologists the time sequence of channel development in this estuarine underground environment. These cross-cutting relationships can be readily observed in Figs. 3 and 4.

This voxel visualization technology was developed in response to the inadequacy of seismic-based techniques to clearly define point bar structures in underground estuarine environments. Accurate visualizations of underground structure can provide production and geological planning teams with the necessary means to develop an optimal production plan for SAGD technology/surface mine developments.

The same technology is also applicable to visualization of underground structures in traditional oil and gas plays as demonstrated by an image of an anticline trap based on well data (Fig. 5).

Summary

The described voxel volumetric techniques and software provide the means to accurately visualize an estuarine-fluvial environment, and in particular point bar structures associated with excellent bitumen extraction potential. ✦

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Nigeria

Nigeria awarded Express Petroleum & Gas Co. Ltd. and Petroleum Prospects International Ltd., both of Nigeria, and Addax Petroleum Corp., Calgary, rights to OPL 227 in the west-central Niger Delta off Nigeria. The lightly explored block covers 210,300 acres in shallow water northeast of OML 79, where Shell operates giant EA oil field.

Four wells drilled in OPL 227 in 1974-88 had shows or were noncommercial.

Express, operator, and PPI hold 39% and 21% interest, respectively. Addax Petroleum will conduct technical operations, has paid a farm-in fee to Express and PPI and a signature bonus to the government, and is obligated to fund 80% of a work program.

The work program is for a minimum of 500 line-km of 3D seismic. Express will fund the other 20%. Addax and Express will initially fund 80% and 20%, respectively, of all capital and operating costs.

Sri Lanka

The government of Sri Lanka awarded the Indian subsidiary of Cairn Energy Ltd., Edinburgh, an exploration license in the Mannar basin 100 miles north of Colombo.

Block SL 2007-01-001 covers 3,400 sq km in 200-1,800 m of water in the Gulf of Mannar. The petroleum resources agreement will be signed in due course, Cairn Energy said.

It is the northern of three blocks offered in a licensing round in 2007.

Florida

BreitBurn Energy Partners LP, Los Angeles, plans an infill drilling program in late 2008-early 2009 on its properties in the Cretaceous Sunniland lime oil trend in the South Florida basin.

The properties, acquired from Calumet Florida Inc. in May 2007, consist of 25 producing wells on 33,422 net acres in five fields.

Production from the carbonate reserviors, which averaged 1,539 b/d of oil in 2007 from 11.4 million bbl of proved reserves, is declining at about 5%/year, the company said.

Mud-pulse telemetry sees step-change improvement with oscillating shear valves

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After 30 years of refinements, mud-pulse systems transmit data more quickly and more accurately, through increasingly deep wellbores. Operators are pushing telemetry systems to transmit real-time data quickly, in lieu of using wired pipe or waiting for wireline data.

The economic success of many drilling operations depends on the availability of real-time information about the drilling process. Mud-pulse telemetry is currently the most common method of transmitting measurement-while-drilling (MWD) and logging-while-drilling (LWD) data. Advances in downhole sensing for drilling optimization and formation evaluation are placing heavy demands on equipment to provide faster data rates from greater depths.

As a result, mud-pulse telemetry rates have improved to more than 20 bits/sec (bps) at depths shallower than 20,000 ft, and in excess of 3 bps from depths of more than 36,000 ft. In 1978, a typical data rate was 0.4 bps.

This article describes the evolution of mud-pulse telemetry and the technology advances that have resulted in today's improvements in reliability and data rates. In particular, new self-oscillating shear valves give mud-pulse systems new flexibility and adaptability in highly variable drilling environments, used by Norsk Hydro ASA and Statoil AS.

Rationale—higher data rates

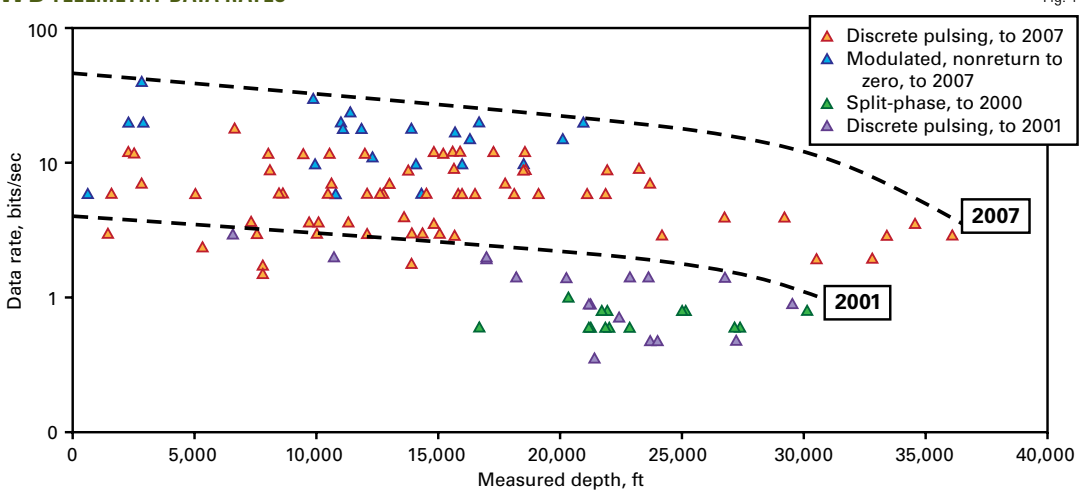
The effectiveness of MWD and LWD services depends on the scope of downhole measurements available to the operator, the data density (points/foot on a real-time log), and the data accuracy. Because the telemetry uplink from downhole to surface can convey only limited data, MWD and LWD services compete for the same resource. Therefore, the number of downhole measurements directly affects real-time data density.

Assuming the same rate of penetration (ROP), an increase in the number of real-time MWD and LWD services directly results in a reduced log density for every measurement. To maintain data density for increasingly complex MWD bottomhole assemblies, we can either boost the telemetry data rate or lower the ROP.

With expensive rig rates, particularly for offshore drilling, the economic impact of lowering ROP renders this choice unacceptable. Thus, increasing telemetry data rate is the only reasonable option to cope with the large amount of data generated downhole.

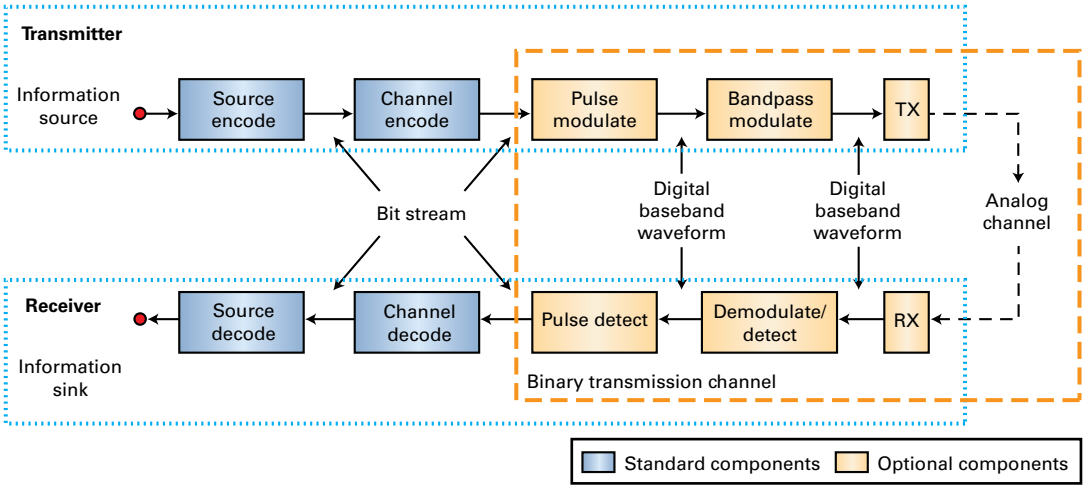
MWD TELEMETRY DATA RATES

Fig. 1



DIGITAL COMMUNICATION SYSTEM

Fig. 2



System evolution

Various telemetry systems have been and are under investigation: wired pipe,[1] mud pulse,[2,3] electromagnetic,[4] and acoustic.[5] Mud-pulse telemetry has proven to be reliable and cost-effective and is the most common MWD telemetry system.

The earliest telemetry patent was issued in 1929, but current mud-pulse telemetry systems date from work by J.J. Arps published in 1964.[6]

Teleco introduced the first commercial MWD mud-pulse tool in 1978. This tool transmitted directional information to surface at about 0.4 bps.

Data rates stabilized in the 1980s and 1990s at 0.4 to 3 bps. This rate was sufficient to transmit reliably MWD and LWD data at that time. In the 1990s, development of new LWD tools and introduction of rotary steerable drilling systems and real-time drilling dynamics tools placed considerable pressure on the ability of this transmission link to maintain data density. In response, engineers developed a reliable MWD telemetry system that was delivering unprecedented raw data rates by the close of 2007 (Fig. 1).

System design

As with any digital communication system, a mud-pulse telemetry system has distinct components (Fig. 2). The receiver side of the system mirrors the transmission side. An information source—the downhole sensor—provides the data for transmission to the surface information sink—personnel controlling the drilling operation.

To reduce the amount of transmitted data and to cope with limited bandwidth, an optional source encoder performs source compression. A corresponding source decoder decompresses at the receiver. Source compression algorithms either discard information ("lossy" compression) or retain all the information ("lossless" compression).

To protect the bit stream from errors introduced by the transmission channel (flowing mud-filled pipe bore), an optional channel encoder adds error protection. The channel decoder in the receiver uses this information for error detection and correction. Since the additional information reduces the available net bandwidth, there is a trade-off between telemetry reliability and net data-rate reduction for each measurement.

After channel encoding, a digital modulator transforms the data bits into analog waveforms that propagate readily in the mud column (modulation). The typical waveform is a pulse and the process is known as pulse modulation.

On the receiver side, the pulse detector interprets pulses and transfers data back to the bit. The pulse waveform can either be directly emitted by the pulser (positive and negative pulsers used by several MWD companies) or it can be shifted towards a higher frequency before transmission ("passband modulation"). The mud siren style of an MWD pulser uses the latter type of shifting, for example.

On surface, pressure sensors measure the transmitted waveforms. In the case of passband-modulated data, the receiver signal is demodulated before passing it to the pulse detector to reconstruct the binary data.

To increase the pulse detection quality and thus the reliability of the telemetry link signal, the signal needs to be reconstructed before demodulation and pulse detection to remedy the destructive effects of the analog mud channel on the signal shape. Signal reconstruction is one of the most critical steps in reliably boosting the transmission data rate and was rigorously investigated during the development of this MWD telemetry system.

Attenuation, reflection

In mud-pulse telemetry, the transmission channel is the mud-filled bore of the drill string. Pressure waves travel up the mud column, are attenuated, and partially reflected. The energy of the pressure wave received on surface is just a fraction of the energy emitted by the mud pulser downhole. The attenuation increases with depth, frequency of the signal and compressibility of the mud. For example, oil-based mud is highly compressible relative to water-based mud and higher transmission frequencies are, therefore, more attenuated.

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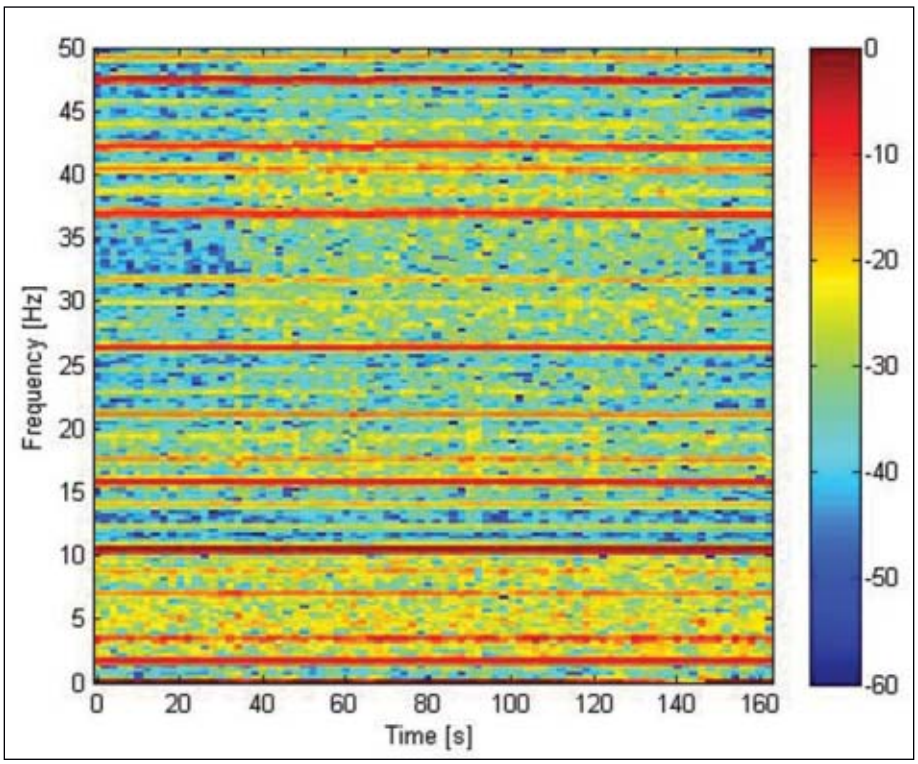


This spectrogram of a modulated, 40-hz carrier frequency signal shows mud-pulse telemetry data transmitted from about 3,000 ft through water-based mud and recorded at the Baker Hughes experimental test area in Beggs, Okla. Pump noise is clearly visible as brown horizontal lines. The telemetry signal is recognizable as the yellow shaded area from 40-140 sec in the range of 28-45 hz. The telemetry signal energy level is at least 25 db below that of the pumps. In terms of signal amplitude, the telemetry signal is 1/18 that of the mud pumps (Fig. 3).

In 1972, Desbrandes et al. published a comparison of theoretical and measured pulse attenuations.[7] Their results have been referenced extensively in numerous publications on mud-pulse telemetry. This work, however, oversimplifies the effects of the mud-pulse channel because it neglects the fact that the signal reflects at pipe diameter changes, hoses, T-pieces, pump pulsation dampeners, etc.

The reflections add constructively for some frequencies and destructively for others, which means certain frequencies are amplified while others are attenuated. This "frequency selectivity" effect causes signal transmission to fail on certain frequencies while transmitted successfully on other frequencies.

In addition to frequency selective attenuation, the signal suffers from interfering noise signals (mud pressure fluctuations induced by mud pumps and the drilling process, thermal noise of the electronics, etc.). The dominant noise component is pump noise generated by the pistons of the pumps. Fig. 3 shows a spectrogram of the modulated signal; the pump noise is clearly visible as brown horizontal lines. The telemetry signal is recognizable as the yellow shaded area from 40-140 sec in the range of 28-45 hz.

The success of data transmission depends not only on the attenuation of the individual frequencies but also on their distortion, and on the level of noise present in the measured signal. Real-time modeling of the signal traveling through the mud channel, as shown in Fig. 4, allows us to achieve higher data rates. After correcting for attenuation and distortion, and removing additive noise, we get to the spectrogram shown in Fig. 5.

Mud pulser design

Since mud-pulse attenuation depends on depth and mud type, it is advantageous for optimum MWD signal transmission to have a pulser capable of transmitting data in different frequency bands. For shallow water-based mud systems, passband modulation provides a bandwidth unmatched by pulse-based systems. For deeper wells or oil-based muds, it is necessary to be able to switch to discrete pulsing for reliable transmission, since these lower frequency waveforms suffer less attenuation.

Various types of valves generate pulse pressure in the flowing mud (Fig. 6). These valves either bypass flow to the annulus (negative pressure pulsers) or restrict flow (positive pressure pulsers). Most mud pulsers used in the oil industry are positive pulsing valves. Various valve options include cone valves (act in or against flow direction), rotary valves (open and close perpendicular to the fluid flow), or fluidic valves (change the flow pattern).

In the early 1960s, Mobil Oil published a patent for an LWD system using a rotary valve to transmit data to the surface (the "screamer").[8] This transmitter used a continuous wave up to 24 hz and transmitted data by phase-shifting the signal to encode the data. The system had a source signal amplitude of 100 psi and was successfully tested at rates up to 3 bps downhole.

Schlumberger adapted this idea of using a rotary valve in the development of its "Mud Siren."

In 1978, the first commercial MWD system marketed by Teleco contained a hydraulically driven poppet valve, powered by a powerful multistage turbine and oil pump.[10] In contrast to the small signal amplitudes of rotary valves, the Teleco pulser created strong, discrete signals easily detected on surface, even from deep wells or in situations with high pump noise. This pulser achieved data rates up to 2 bps in commercial applications.

Dresser developed another commonly used mud-pulser system, especially suited to the low electrical power consumption required of battery-powered MWD systems.[11] The initial

system monitored the revolutions of a downhole turbine and Spinnler, at Teleco, used an electrically driven pilot valve to drive a main valve for mud-pulse telemetry.[12]

Design optimizations continued after the 1992 merger of Eastman Christensen and Teleco. These companies were incorporated into Baker Hughes INTEQ in 1993.

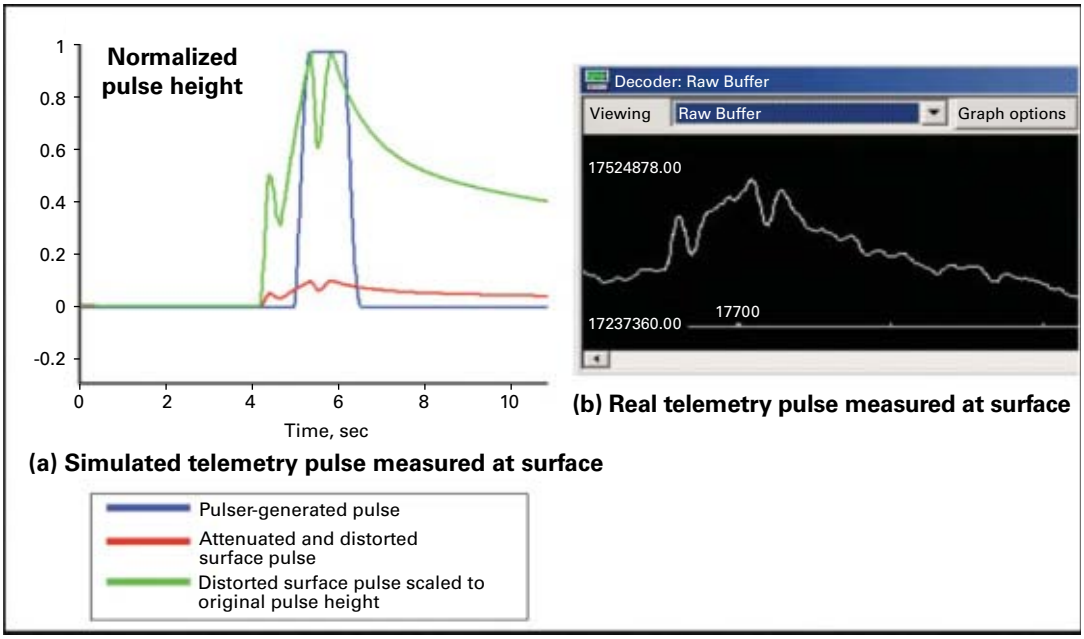
These pulser systems provided sufficient telemetry data rate to deliver the required data density to surface when there was relatively low availability of real-time formation evaluation services and relatively low ROP.

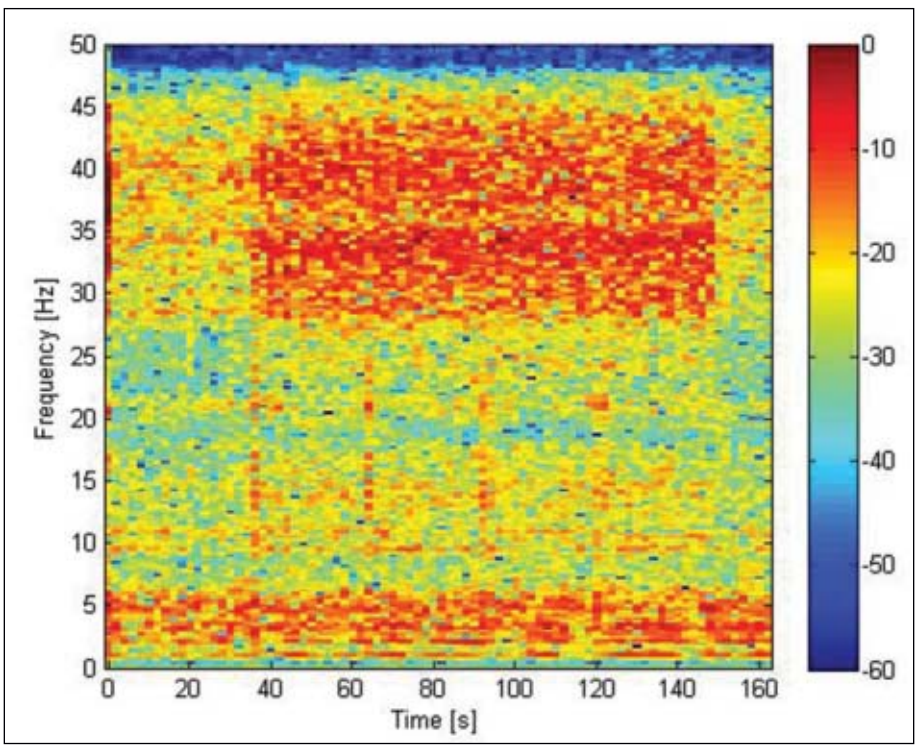
With the introduction of rotary closed coop drilling systems, penetration rates increased dramatically. The available telemetry data rates led to ROP restrictions or low data density. In addition, an expansion of LWD and MWD services put severe demands on the available MWD transmission data rate.

In 1977, the US Energy and Development Administration published a report giving a broad overview of the available MWD and telemetry systems.[13] By the early 2000s, not much had changed in terms of data rate or mud-pulse systems, although the systems had been optimized for reliability.

Modeled vs. measured mud pulse

Fig. 4





This spectrogram shows the same modulated signal from Fig. 3 after suppression of the interference (from mud pumps, etc.) and reconstruction. The signal is corrected for attenuation and distortion, and additive noise is removed (Fig. 5).

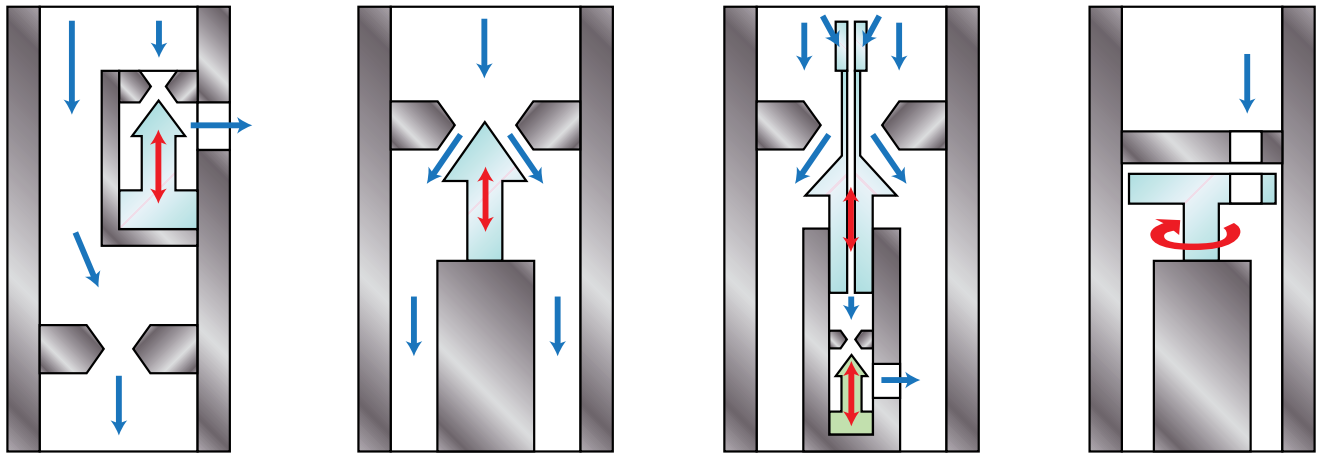
Oscillating pulser

The existing systems delivered either strong, discrete pulses or low- amplitude continuous waves. Engineers needed a new pulser combining both options to ensure independence from the highly variable drilling environment: deep or shallow wells, oil- or water-based mud systems, complex or simple bottomhole assemblies, high or low drilling rates or, indeed, any combination of these conditions.

An oscillating shear valve pulser driven by a precise motor controller is able to fulfill these needs (Fig. 7). Designed as a self-oscillating system, such a pulser is capable of delivering a

COMMON MUD PULSE TELEMETRY VALVES

Fig. 6



a) Negative pulse b) Positive pulse c) Pilot-operated valve d) Shear valve

telemetry bandwidth of 40 hz or more with low power consumption.

Norsk Hydro ASA used shear valve pulser technology in deep water off Norway in 2006, at depths to 22,000 ft. Petrobras also used shear valver pulser systems off Brazil in 2007.

The oscillating movement has various advantages over the legacy rotary valves. The system can self-oscillate with low power consumption at high speeds. During each oscillation cycle, the valve runs through a zero speed state, in which phase or frequency can be changed instantaneously for efficient telemetry modulation, providing high telemetry data rates.

In contrast to rotary valves, oscillating valves can be adapted to flow rate and mud weight changes even when the tool is downhole. Only the oscillation amplitude must change to keep the pulse pressure constant, and the oscillation angle can be easily adjusted by a downlink when flow rate or mud weight changes are required.

Another advantage of an oscillating valve is that it can transmit discrete pulses to surface, in addition to the passband-modulated signal. In cases where high frequencies are attenuated, the oscillating valve can be set to discrete pulsing. With high-end motor controllers, even the pulse pattern can be changed at each oscillation cycle.

Either higher harmonics of the pressure signal can be reduced by shaping the motor speed profile, or the shape of the pressure pulse can be fully controlled to create sinusoidal, trapezoidal, rectangular, or any other shaped signals to enable maximum signal pressure at the source and optimum downhole signal quality for high decoding quality at surface. These features are not possible with legacy rotary valves.

Oscillating systems are also less prone to jamming from foreign bodies within their moving components. These pulsers open and close in opposite directions. A jammed foreign body is released as soon as the valve opens again. Only the signal amplitude decreases while the foreign body passes through the valve. In a rotational valve, the foreign body gets stuck, and backward rotation is required to free the body.

The basic idea behind this adaptable mud pulser is that each drilling application is different. Because the rig environment cannot be easily changed, the pulser must be adapted to the application, even when already run downhole. The adaptability of the pulser to its environment ensures optimum signal quality.

Mud-pulse receiver

The receiving antennas in a mud-pulse telemetry system are one or more pressure sensors mounted in the standpipe. For good decoding of the received signals, the telemetry signal energy has to be significantly above the noise energy.

To boost mud-pulse data rates, there are generally two options; either (a) increase the telemetry signal energy so that the received energy on surface is sufficiently higher than the energy of interfering noise, or (b) cancel out noise by signal reconstruction algorithms before handing the signal over to the demodulator and pulse detector.

Since the mud pumps are a major source of noise and are located on surface, pump noise cannot be attenuated. The energy of the telemetry signal would have to be increased by several orders of magnitude, which renders approach (a) difficult. Signal reconstruction by surface-processing algorithms, Option (b), is more viable.

Surface signal reconstruction is the key to reliable high data rate mud-pulse telemetry. It has to remedy two types of distortion: noise and frequency selectivity. Noise usually is assumed to be additive and can be subtracted as soon as we have an idea what it looks like, which is the difficult part.

We can either model noise or estimate it from measurements. A measurement-based approach is much more robust since it inherently includes

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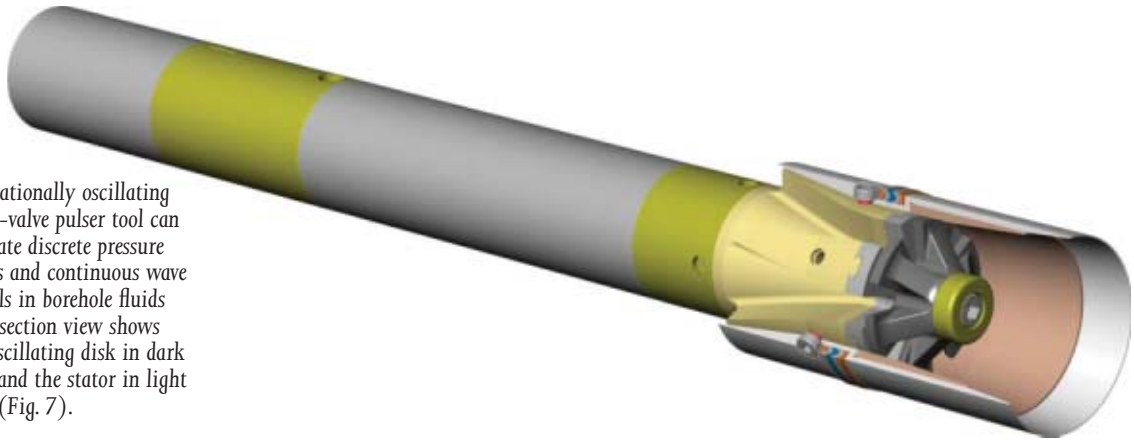


A rotationally oscillating shear-valve pulser tool can generate discrete pressure pulses and continuous wave signals in borehole fluids This section view shows the oscillating disk in dark grey and the stator in light grey (Fig. 7).

the effects of every detail of the particular rig setup. The level of complexity required to model the equivalent would be too great.

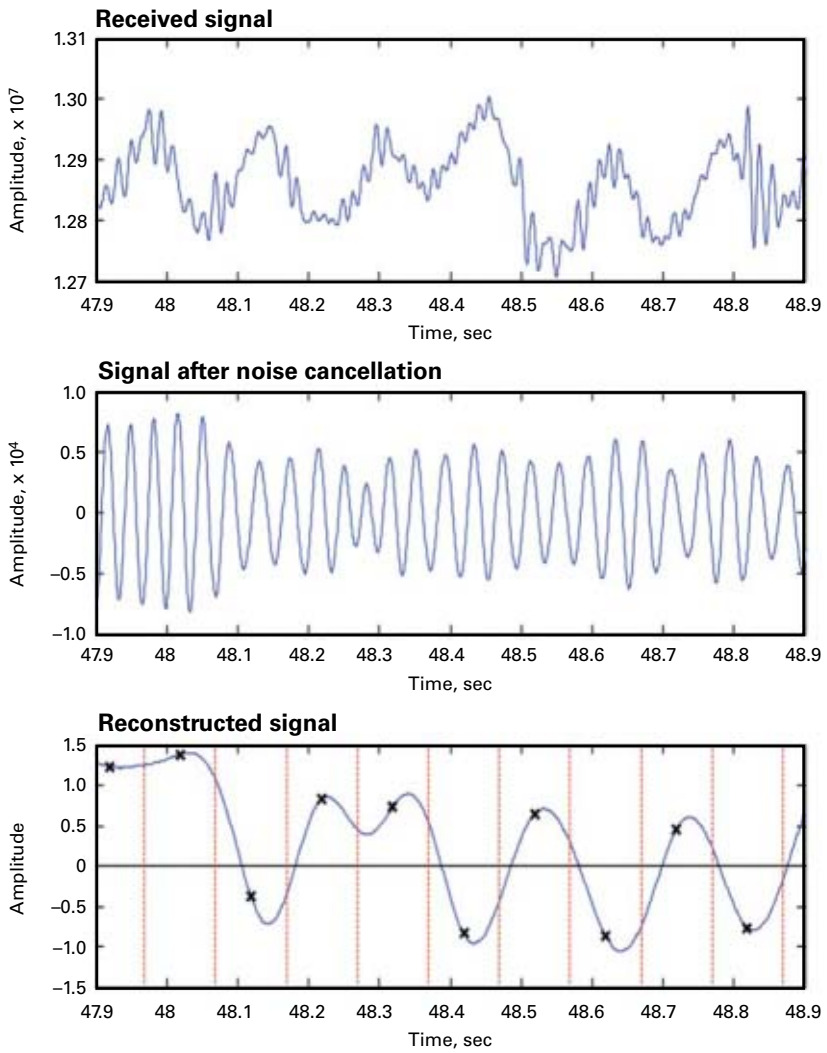
For noise cancellation, we apply linear prediction and space diversity processing similar to the description in literature.[14] Fig. 8 shows receiver signal processing of data transmitted through water-based mud in a Troll field well drilled by Norsk Hydro off Norway. These data came from about 17,400 ft MD, at 10 bps on a 30-hz carrier frequency. The middle drawing depicts the signal, after canceling out the effects of the transmission channel (distortion and interfering noise). It clearly shows the recovered, sinusoidal, 30-hz carrier signal. The bottom drawing depicts the corresponding demodulated signal. The vertical red lines mark the beginning of a bit and the black cross on top of the signal in the middle of a bit indicates the logical decision of the pulse detection logic. If the cross is above the zero line, a '1' was transmitted and '0' otherwise.

After noise cancellation, we can estimate the frequency-selective attenuation and equalize it based on transmitted reference signals (i.e., known signals). The optimum parameter set for signal transmission (discrete pulsing or passband modulation, data rate, and if applicable, signal frequency) is determined by the resulting signal after noise cancellation and equalization.

Only this signal shows the final ratio of signal energy to noise energy, which needs to be maximized for optimum telemetry data rate. Therefore, it is inevitable to have a downhole transmitter capable of full parameter adjustment via downlink. This closed-loop approach to MWD telemetry systems has enabled the high data rates demonstrated by the new system.

RECEIVER SIGNAL PROCESSING, TROLL FIELD*

Fig. 8



*Telemetry data transmitted through water-based mud from about 17,400 ft MD in Troll field, off Norway (Norsk Hydro ASA).

Achievements

While it is certainly possible to describe the achievement of MWD telemetry in terms of signal reconstruction under adverse transmission condi-

tions, it is also instructive to list the raw data rate milestones through late 2007. All data was generated with shear valve pulsers, except for Sakhalin:

- 40 bps from 3,000 ft, Baker Hughes experimental test area, Beggs, Okla.
- 30 bps from 9,865 ft, onshore North America.
- 27 bps from 11,394 ft (40 bps while off-bottom), off Brazil.
- 20 bps from 20,991 ft, off Norway.
- 9 bps from 23,215 ft, Trollfield.
- 4.0 bps from 29,123 ft, Sakhalin.
- 3.5 bps from 34,570 ft, Sakhalin.
- 3.0 bps from 36,075 ft, Sakhalin.

We can expect raw data rates to push both higher and deeper in the near future. ✦

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Software facilitates deepwater development off Nigeria

Dean Forbes
Primavera Systems Inc.
Bala Cynwyd, Pa.

Management software helps project managers navigate the complexity of delivering large construction projects, on time and on budget.

In the case of Shell Nigeria Exploration and Production Co. (SNEPCo), the company used Primavera Systems Inc.'s project management and Primavera's Pertmaster schedule risk analysis software to assess project feasibility, schedule maturity, and risk readiness of its Bonga Southwest-Aparo deepwater development off Nigeria.

Deepwater exploration, drilling, and construction projects place large demands on people and machines. For this work, project managers need to orchestrate smoothly a complicated array of schedules, deadlines, deliverables, people, and equipment.

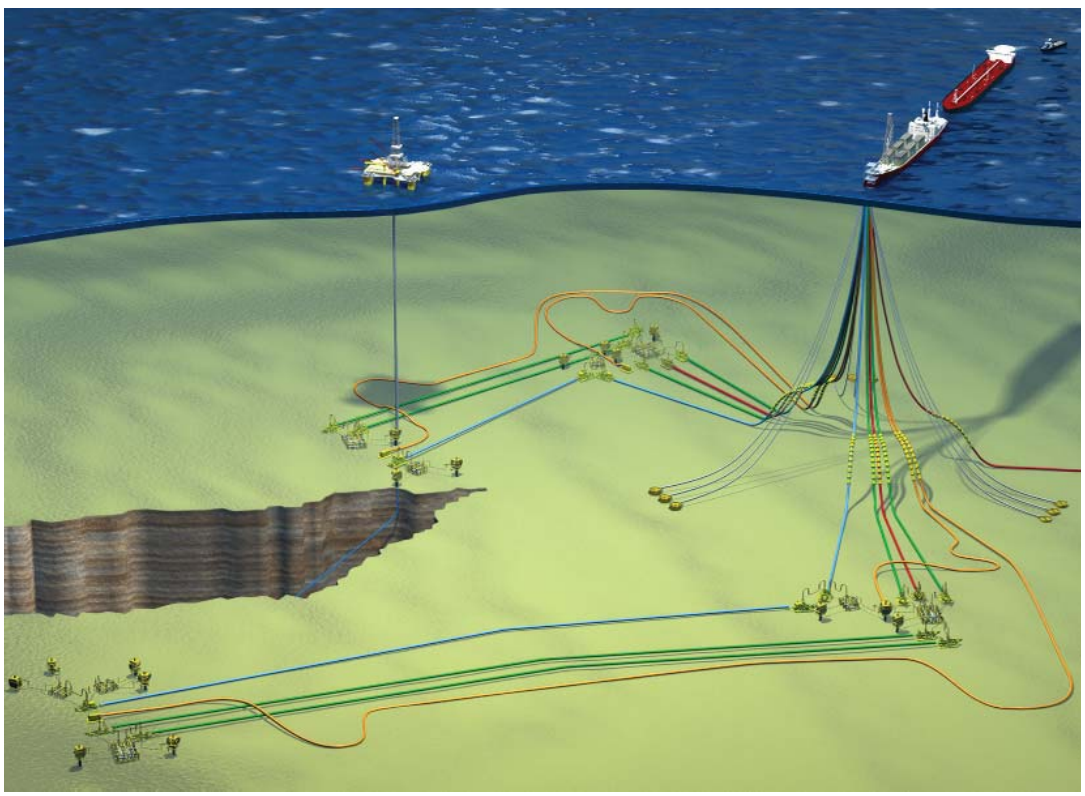
Project managers face many random events, such as changes in the weather and mechanical failures. With thousands of people working in concert, even minor delays can result in millions of dollars of lost revenue.

Where the spreadsheet and printed schedules once tracked progress, project management software now enables project managers to work together seamlessly with a single version of the truth to plan for and create what-if scenarios for addressing the innumerable contingencies that arise and to ensure that all resources are managed for utmost efficiency.

Off Nigeria

The Bonga Southwest-Aparo project provides an example of the use of this software. The SNEPCo managed project is about 10 km from its first major deepwater project Bonga, which is 120-km off Nigeria and went on stream in 2005.

BONGA SOUTHWEST - APARO PROJECT



The Bonga Southwest-Aparo facilities (see figure) will be in 1,300 m of water and include subsea completed wells, manifolds, flowlines, risers, and a floating production, storage, and offloading vessel (FPSO). Production will start after 2011.

The project also will have a pipeline for carrying gas to an onshore LNG plant.

One main prerequisite for sanc-

tioning the project was to determine its commercial viability. To asses this, SNEPCO had to develop an estimate of the schedule, cost, and risks associated with the venture.

The design, procurement, and construction of wells, subsea facilities, pipelines, and the FPSO, involve hundreds of thousands of activities and require construction in multiple international locations. The project also was the first to comply fully with the Nigerian government's Nigerian Content Directives with regard to in-country engineering, procurement, fabrication, construction, and integration activities.

Risk assessment

Shell has mandated use of a single project management platform across the corporation to provide project managers with a consistent, accurate planning environment.

The project planners have access to a networked Oracle database and to Primavera project management and Primavera Pertmaster schedule risk-analysis software. Use of this software enables Shell's management to assess project feasibility, schedule maturity, and risk readiness.

The project planners first created an estimated project schedule in Primavera's P5, using benchmarked data from Shell's knowledge base and localized construction standards. The team then considered risks to the schedule and created a register of risks and opportunities.

After assessment of probabilities and distribution of impact for the registered risks, the team loaded the data into Pertmaster to create a risk model. An interface between P5 and Pertmaster allowed fast data interchange between the tools to create a risk-considered probabilistic schedule.

The added use of Pertmaster allowed the project to put probabilities around possible outcomes and highlight most likely and extreme dates for delivery. The team then judged confidence levels for project success and formed contingency plans as well as cost-exposures risks, which it evaluated and adjusted as necessary.

By using P5, local planners have access to the same schedule at the same time and can view the project at a high level or drill down to a more detailed schedule.

Longer term after sanctioning of the project, multiple planners globally will have simultaneous access to the same project data and master schedule in P5. Everyone will be up-to-date and able to incorporate changes live into the schedule from different locations.

Without project management software, it would be virtually impossible to create, review and collaborate on the complex schedules and risk profiles this large multisource, multifaceted project required. Desktop planning tools are too simplistic for such complex needs.

The team also identified some project risks that may require mitigation planning, such as local labor strikes, potential changes in project scope, and interface issues with multiple contractors. ✦

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Dean Forbes is vice-president, international business, at Primavera Systems Inc. He previously worked for Isis Telecoms and Motorola. Forbes has a BA from Greenwich University.

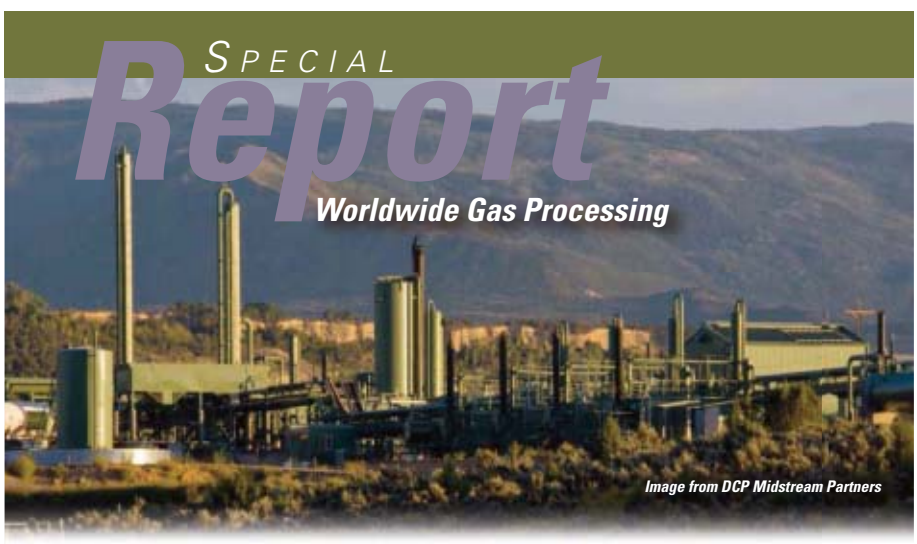
Global processing capacity flat; US construction pace quickens

Warren R. True
Chief Technology Editor-LNG/Gas Processing

Global natural gas production growth in 2007 was flat, with decline in Western Europe and nearly invisible increases in Eastern Europe, the FSU, Africa, and countries of Asia-Pacific (OGJ, Mar. 10, 2008, p. 70).

Global natural gas processing capacity, therefore, had little incentive to increase. In the US, capacity crawled ahead at barely 1% growth and Canada was essentially flat. (Table 1). For the entire world, Middle East processing advanced by slightly more than 2%.

Worldwide, total natural gas processing capacity outside the US and Canada continued to outpace combined capacities in the world's two largest gas processing countries, a trend that emerged in 2005. For 2007, gas-plant capacities in the US and Canada reached slightly less than 50% of world capacity. That trend was pushed by plants' capacities in the US advancing by only 1.2%, while Canada's plants increased capacities by only 0.2%.



Highlights

During 2007, natural gas production increased slightly in all the world's regions except, as noted, in Western Europe, OGJ numbers show. The US led the growth by producing 2.2% more gas in 2007 than in 2006. But in aggregate, increases among the rest of the world's regions were smaller than seen between 2004 and 2006 (OGJ, June 18, 2007, p. 50). The marginal advantage in gas processing capacity for regions outside the US and Canada continued in 2007, the third year in a row to show this imbalance.

Canadian NGL production advanced marginally last year, by less than 1%. Combined with production in the US, NGL output from the two countries' gas plants staged a recovery from a declining trend by reaching 130.4 million gpd, comprising more than 44% of global NGL production last year. For 2006, the figure was 38.7% of world totals; for 2005, slightly more than 33%; for 2004, more than 34%; in 2003, more than 40%; and in 2002, 42%.

Middle East liquids production, however, continued to outrun not only the US but also any other single region. Persian Gulf countries, especially Iran, Saudi Arabia, Qatar, and the UAE have embarked on ambitious projects to produce feedstocks for local and export markets, especially petrochemicals production.

Rolling Mexican data into those for the US and Canada (removing Mexico for the exercise from the Latin America column) reveals that for 2007 North America held:

- Only 51.3% of the world's capacity, the same as in 2006, down from barely 52% for 2005, from more than 53% for 2004, from 52% in 2003, and off from 54% in 2002.
- 44.4% of the world's NGL production, from nearly 47% for 2006.

Canadian natural gas production fell

The Hawiyah NGL recovery plant (shown here in late 2007) at the Hawiyah gas processing plant near Ghawar oil field south of Dhahran is on track for start-up this year. Photograph from Saudi Aramco.

off by 123 bcf (–2%) from its rebound in 2006. Mexico's production rose by more than 255 bcf over its 2006 output.

On Jan. 1, 2007, OGJ data show that US gas processing capacity stood at 71 bcfd, up from 70 bcfd for 2006; throughput in 2007 was essentially flat with that for 2006 and 2005, averaging a bit more than 45.5 MMcfd (about 64% utilization); and NGL production, nearly 76,230 gpd, compared with nearly 75,500 gpd for 2006 (Fig. 1).

Fig. 2 shows pricing differentials in the US between LPG—the most widely traded NGL on the world market—and crude oil for the first trading day of each month in 2007. With crude oil prices escalating sharply during the year, the chart nonetheless shows the historically normal relationship between LPG and crude oil continued throughout 2007. (An accompanying article, beginning on p. 58, discusses international trade in LPG.)

Sources

Oil & Gas Journal's exclusive, plant-by-plant, worldwide gas processing survey and its international survey of petroleum-derived sulfur recovery provide industry activity figures.

Canadian data are based on information from Alberta's Energy and Utilities Board that reflect actual figures for gas that moved through the province's plants and are reported monthly to the EUB. For 2000 for the first time, OGJ took these data for all of Alberta and compiled annual figures and thereby created a new baseline for data comparisons thenceforth.

(Effective Jan. 1, 2008, the province realigned the EUB into two separate regulatory bodies: the Energy Resources Conservation Board (ERCB) to regulate the oil and gas industry and the Alberta Utilities Commission (AUC) to regulate the utilities industry.)

In addition to EUB figures for Alberta and to operator responses to its annual survey, OGJ has supplemented its Canadian data with information from the British Columbia Ministry of Employment & Investment's Engineering and Operations Branch and the Saskatchewan Ministry of Energy & Mines.

As 2008 began, gas processing capacity outside Canada and the US stood at 112 bcfd, off from 126 bcfd for 2007; throughput outside Canada and the US for 2007 averaged only

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WORLDWIDE GAS PROCESSING ROUNDUP

Table 1

Region	[1]2006	[2]2007	Change	Change, %
US				
Gas capacity, MMcfd	70,218.2	71,062.7	844.5	1.2
Gas throughput, MMcfd	45,537.4	45,501.7	–35.7	–0.1
NGL production, 1,000 gpd	75,468.2	76,227.6	759.4	1.0
Proved reserves, bcf	204,385.0	211,085.0	6,700.0	3.3
CANADA				
Gas capacity, MMcfd	52,900.8	53,010.0	109.2	0.2
Gas throughput, MMcfd	29,515.9	29,946.6	430.7	1.5
NGL production, 1,000 gpd	32,330.9	32,521.8	190.9	0.6
Proved reserves, bcf	57,946.0	58,200.0	254.0	0.4
WESTERN EUROPE				
Gas capacity, MMcfd	24,349.0	24,495.0	146.0	0.6
Gas throughput, MMcfd	9,466.7	9,501.2	34.5	0.4
NGL production, 1,000 gpd	9,484.0	9,689.6	205.6	2.2
Proved reserves, bcf	168,349.0	160,132.0	–8,217.0	–4.9
EASTERN EUROPE				
Gas capacity, MMcfd	2,796.0	2,796.0	—	—
Gas throughput, MMcfd	1,426.5	1,426.5	—	—
NGL production, 1,000 gpd	10,142.4	10,142.4	—	—
Proved reserves, bcf	2,026,753.0	2,026,709.0	–44.0	—
LATIN AMERICA				
Gas capacity, MMcfd	18,448.2	18,448.2	—	—
Gas throughput, MMcfd	12,475.3	12,427.3	–48.0	–0.4
NGL production, 1,000 gpd	[3]37,202.9	35,929.9	–1,273.0	–3.4
Proved reserves, bcf	255,302.0	260,860.0	5,558.0	2.2
MIDDLE EAST				
Gas capacity, MMcfd	38,404.2	39,264.2	860.0	2.2
Gas throughput, MMcfd	26,898.0	27,318.0	420.0	1.6
NGL production, 1,000 gpd	84,358.4	86,323.1	1,964.7	2.3
Proved reserves, bcf	2,566,038.0	2,548,900.0	–17,138.0	–0.7
AFRICA				
Gas capacity, MMcfd	17,254.2	17,254.2	—	—
Gas throughput, MMcfd	9,642.4	9,642.4	—	—
NGL production, 1,000 gpd	16,777.3	16,777.3	—	—
Proved reserves, bcf	484,433.0	489,630.0	5,197.0	1.1
ASIA-PACIFIC				
Gas capacity, MMcfd	24,960.2	24,960.2	—	—
Gas throughput, MMcfd	20,173.6	20,290.8	117.2	0.6
NGL production, 1,000 gpd	25,764.7	25,799.1	34.4	0.1
Proved reserves, bcf	419,487.0	415,393.0	–4,094.0	–1.0
TOTAL-excl. US				
Gas capacity, MMcfd	179,112.6	180,227.8	1,115.2	0.6
Gas throughput, MMcfd	109,598.4	110,552.8	954.4	0.9
NGL production, 1,000 gpd	216,060.6	217,183.2	1,122.6	0.5
Proved reserves, bcf	5,978,308.0	5,959,824.0	–18,484.0	–0.3
TOTAL-incl. US				
Gas capacity, MMcfd	249,330.8	251,290.5	1,959.7	0.8
Gas throughput, MMcfd	155,135.8	156,054.5	918.7	0.6
NGL production, 1,000 gpd	291,528.8	293,410.8	1,882.1	0.6
Proved reserves, bcf	6,182,693.0	6,170,909.0	–11,784.0	–0.2

[1]Proved gas reserve totals for 2006 are as of Jan.1, 2007 (OGJ, Dec. 18, 2006, p. 22). [2]Proved gas reserve totals for 2007 are as of Jan.1, 2008 (OGJ, Dec. 24, 2007, p. 24). [3]Corrected from 2007 report.

WORLDWIDE GAS PLANT CONSTRUCTION*

Table 2

Country	2008	2007
Africa	2	2
Asia-Pacific	3	1
Canada	1	—
Eastern Europe	2	1
Middle East	4	2
Latin America	5	2
US	7	7
Western Europe	—	—
Total	**24**	**15**

*Includes new plants, expansions, and modifications scheduled for completion in the year listed. 2008 data are from OGJ, Apr. 7, 2008. 2007 data are from OGJ, Apr. 16, 2007.

WORLD'S MAJOR GAS RESERVES

Table 3

Country	Est. proved reserves, tcf	Share, %
Russia	1,680.0	27.2
Iran	948.2	15.3
Qatar	905.3	14.6
Saudi Arabia	252.6	4.1
US	211.1	3.4
Abu Dhabi	198.5	3.2
Nigeria	184.0	3.0
Venezuela	166.3	2.7
Algeria	159.0	2.6
Iraq	112.0	1.8
Kazakhstan	100.0	1.6
Turkmenistan	100.0	1.6
Indonesia	94.0	1.5
Malaysia	83.0	1.3
China	80.0	1.3
Norway	79.1	1.3
Uzbekistan	65.0	1.1
Egypt	58.5	0.9
Canada	58.2	0.9
Kuwait	55.5	0.9
Libya	50.1	0.8
Netherlands	50.0	0.8
Ukraine	39.0	0.6
Australia	30.0	0.5
Oman	30.0	0.5
Argentina	15.8	0.3
UK	14.5	0.2
Subtotal	**5,819.7**	**94.1**
Others	366.0	5.9
Total	**6,185.7**	**100.0**

Source: OGJ, Dec. 24, 2007, p. 24

77.8 bcfd, off from 80 bcfd in 2006 and more than 81 bcfd for 2005; and NGL production in 2007 outside the US and Canada averaged 163 million gpd, down from 170 million gpd in 2006 and well off 2005 production of more than 201 million gpd.

The current state of gas plant construction in the world appears in Table 2, based on OGJ's worldwide construction surveys. Table 3 ranks the world's major natural gas reserves by country at the start of 2008; Table 4, the world's top natural gas producing countries for 2007; and Table 5, the world's leading NGL producers.

Costs

No gas processor—for that matter, no oil and gas operator—needed reminding last month that costs for expansions and new buildings were rising at a dizzying pace. But, that's just what Cambridge, Mass.-based IHS/Cambridge Energy Research Associates did with two reports based on project costs for the preceding 6 months.

Issued simultaneously, the reports—one covering capital costs for building new upstream facilities (OGJOnline.com, May 19, 2008) and one covering capital costs for building downstream facilities—each cited a 6% rise for the previous 6 months for building facilities. Midstream facilities fall into both categories, with a preponderance in the downstream group.

The upstream index has been tracking costs since 2000; its index of 210 points for early 2008 reflects an overall growth of 210%. That set a record for the years of coverage. The downstream index has been tracking since 2003; its index of 176 points for early 2008 reflects an overall growth of 176% in inception.

For operators, engineering and construction companies, and manufacturers, this is not news; it only makes

WORLD'S 20 TOP GAS PRODUCING COUNTRIES: 2007

Table 4

Country	Production, bcf	Share, %
Russia/FSU	27,940.0	27.7
US	19,951.0	19.8
Canada	5,934.8	5.9
Algeria	3,310.0	3.3
Norway	3,161.8	3.1
Iran	2,970.0	2.9
Netherlands	2,705.0	2.7
UK	2,696.5	2.7
China	2,432.9	2.4
Indonesia	2,350.0	2.3
Mexico	2,211.2	2.2
Saudi Arabia	1,955.0	1.9
Qatar	1,825.0	1.8
Malaysia	1,713.0	1.7
UAE	1,577.0	1.6
Argentina	1,517.7	1.5
Pakistan	1,414.0	1.4
Australia	1,407.6	1.4
India	995.7	1.0
Venezuela	867.0	0.9
Top 20 total	**88,935.2**	**88.1**
Other	12,002.3	11.9
Total	**100,937.5**	**100.0**

Source: OGJ, Mar. 12, 2007, p. 62

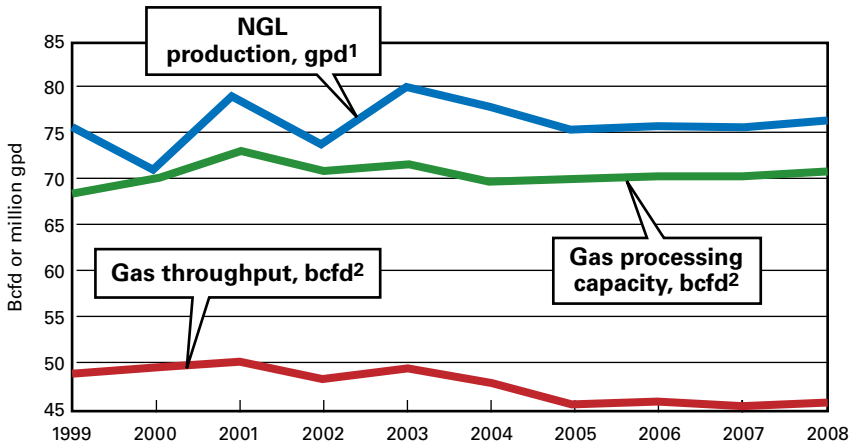
WORLD'S TOP 10 NGL PRODUCING COUNTRIES: 2007

Table 5

Country	Production, bcf	Share, %
US	76,227.6	26.0
Saudi Arabia	37,044.0	12.6
Canada	32,521.8	11.1
Mexico	21,649.0	7.4
Kuwait	18,684.8	6.4
Australia	10,939.3	3.7
Russia/FSU	9,127.9	3.1
UAE	8,978.6	3.1
Venezuela	7,312.9	2.5
India	6,534.5	2.2
Norway	6,201.2	2.1
Top 10 subtotal	**235,221.6**	**80.2**
Rest of world	58,189.1	19.8
Total worldwide	**293,410.7**	**100.0**

US GAS PROCESSING TRENDS

Fig. 1



[1]Based on a 12-month average for previous year. [2]As of Jan. 1 of each year.

concrete what all have been seeing in their daily businesses: It's costing more and more to build anything.

Rising costs for raw materials, especially iron ore needed to produce steel, and transportation, mainly in rising fuel prices, are driving the increases.

"Specialized deepwater equipment that is required for the subsea, particularly umbilicals and control systems, shows the largest increase of any area on the index," said the announcement. "Continued manufacturing constraints coupled with higher materials and labor costs" led to increases in upstream costs of 12% in the 6 months leading up to May 2008.

Downstream, a "high number of active projects" has driven the latest cost increases, according to CERA's Jackie Forrest. CERA expects energy projects to "continue to move forward. Despite project delays owing to capital costs and record activity levels," she said. The inventory of refining projects remains 20-30% higher than recorded in recent years.

Raw materials for steel, such as iron ore, she said have increased 65% just in 2008.

Activity

The relatively flat growth evident in global gas processing over recent years is coming to an end. The following reviews plans for projects announced in the last 15 months or so and reflects a surge of expansion and new buildings not seen in midstream for many years.

North America

In the Peace River Arch area of northeastern British Columbia, Spectra Energy Income Fund will add 30 MMcfd of sour-gas processing capacity to the West Doe plant, bringing the plant's full processing capability to 53.5 MMcfd. The $41-million project includes 50% ownership in a 58-km, 8 and 10-in. gathering pipeline from the Sundown area in British Columbia. The increased capacity is due on stream in first-quarter 2009. The Sundown gathering pipeline began delivering to the existing West Doe plant this quarter.

In the US Gulf of Mexico in August 2007, Williams was expanding its deepwater gathering and processing infrastructure for production dedicated by units of Shell, Chevron, and BP in the Perdido foldbelt.

Williams has invested about $480 million in its Perdido Norte project, which the company will own and operate. Infrastructure investment, said the company, includes 184 miles of pipeline and expanded gas processing capacity.

The company began pipeline construction in early 2008 with pipelines and additional processing capacity to be ready to receive production by 2010.

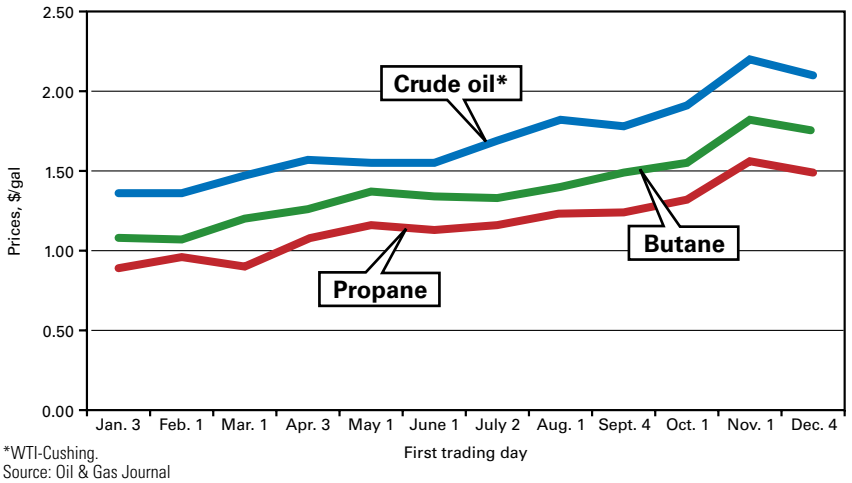
Williams's new infrastructure will originate at floating production the producers will construct in about 8,000 ft of water about 220 miles south of Galveston, Tex.

Great White, Silvertip, and Tobago fields are the sources of initial production. By design, said Williams, its facilities will be able to accommodate future production from other Perdido foldbelt prospects and from potential tie-ins along the new pipeline route.

Design includes 107 miles of natural gas gathering pipeline able to transport about 265 MMcfd of production. The

US LPG DIFFERENTIAL, PRICE TRENDS: 2007

Fig. 2



*WTI-Cushing.
Source: Oil & Gas Journal

pipeline will extend from producers' floating production platform to Williams's existing Seahawk gathering system. This system connects at Brazos Block 538 with a Williams Transco-operated pipeline that moves gas to the company's Markham, Tex., processing plant.

To accommodate the new production, Williams also will increase capacity at Markham to more than 500 MMcfd from 300 MMcfd.

Elsewhere on the Gulf Coast at mid-2007, Enterprise Products Partners LP completed expanding NGL and LPG handling capacities at its import-export terminal on the Houston Ship Channel.

The expansion doubles unloading capacity to 480,000 b/d from 240,000 b/d and allows the flexibility to unload product from two vessels simultaneously or two separate products from the same vessel. In addition, the terminal's maximum loading rate for exports increased 14% to 160,000 b/d from 140,000 b/d.

The nearly $60-million project included expanding capacity on pipelines that connect the terminal to the company's fractionation and storage at Mont Belvieu, Tex.

To handle the additional volumes, Enterprise had already hiked Mont Belvieu's capacity to fractionate butanes by 20,000 b/d. It now can separate up to 300,000 b/d of mixed imported and domestic butanes, as well as butanes from isomerization at Mont Belvieu.

Also at Mont Belvieu last year, Enterprise completed installation of its fourth propylene fractionator. The new unit allows the company to increase production of polymer-grade propylene there by 26%, to about 4.8 billion lb/year (73,000 b/d) from 3.8 billion lb/year. With the additional 1 billion lb, said the company, its Mont Belvieu facility accounts for more than 19% of US polymer-grade propylene manufacturing capacity.

Complementing the fractionation facilities is a network of pipelines that gathers product for delivery to Mont Belvieu and transports fractionated products to refiners and petrochemical manufacturers for use as feedstocks, in addition to providing access to storage facilities. As part of the plan to expand the capabilities of these facilities, Enterprise in late 2007 expanded its 48-mile refinery-grade propylene pipeline between Texas City, Tex., and Mont Belvieu to move refinery-grade propylene from the Texas City area. Enterprise also completed connecting a Beaumont-Port Arthur, Tex., refinery to the company's propylene fractionation and storage at Mont Belvieu via its 66-mile, 8-in. pipeline.

Earlier this year, Enterprise connected the pipeline to a second Beaumont-Port Arthur refinery, adding 50,000 b/d of gathering capacity into Mont Belvieu.

Further ashore late last year, Madisonville Gas Processing LP started up a gas-treatment plant expansion at Madisonville field in Madison County, 100 miles north of Houston, to handle sour gas from the Cretaceous Rodessa formation at 12,000 ft.

The expansion takes up to 50 MMcfd, according to GeoPetro Resources Co., San Francisco. MGP purchased the field's existing 18-MMcfd treatment plant from Hanover Compression LP in July 2005.

In East Texas, PVR Midstream, a unit of PennVirginia Resource, has just completed the 80-MMcfd Crossroads natural gas processing plant. The plant can operate in high ethane-recovery mode or in ethane-rejection mode and has instrumentation allowing for unattended operation 16 hr/day.

Gas on the Crossroads system will originate from Bethany field, Panola County. PVR expected average gas quality on the system to be 3.1 gal/Mcf (GPM). The Crossroads system delivers residue gas from the plant into the CenterPoint Energy pipeline for sale or transportation to market. Produced NGLs will be delivered into Panola pipeline for transportation to Mont Belvieu for fractionation.

In April, Crosstex Energy LP announced plans to build an $80-million gas plant in the Barnett Shale region of North Texas. The Bear Creek plant, which will be in operation in third-quarter 2009, will have inlet capacity of 200 MMcfd and increase the company's total processing capacity in the Barnett Shale to 485 MMcfd.

Bear Creek will sit in Hood County, near Crosstex's other midstream assets. Its construction closely follows completion last year of the Silver Creek plant.

Crosstex currently operates three gas plants in the Barnett Shale with a total capacity of 285 MMcfd: the 50-MMcfd Azle plant in Azle, Tex.; the 50-MMcfd Goforth plant in Parker County; and the 200-MMcfd Silver Creek plant, also

in Parker County. Bear Creek will be a sister plant to Silver Creek.

Also last year in North Texas, Enbridge Energy Partners LP expanded natural gas processing capacity through the $93 million project that added 35 MMcfd of capacity at Weatherford Plant II and 40 MMcfd of capacity at Weatherford Plant III. These plants increased Enbridge's aggregate processing capacity to 1.2 bcfd.

Later in the year out in West Texas, Enterprise completed its new Hobbs NGL fractionator in Gaines County (OGJ, June 18, 2007, p. 50). The plant can separate up to 75,000 b/d of ethane, propane, isobutane, normal butane, and natural gasoline.

Located at the interconnection of Mid-America Pipeline and Seminole Pipeline systems, the fractionator can supply the NGL hub at Mont Belvieu. The Hobbs fractionator will also be able to export to northern Mexico through existing pipelines.

Out west in Wyoming last year, in a joint venture with TEPPCO Partners LP, Enterprise completed the first part of a two-phase expansion of the Jonah natural gas gathering system that serves Jonah and Pinedale fields in the Greater Green River basin of southwestern Wyoming (OGJ, May 5, 2008, p. 74). The additional compression increased system capacity to 2 bcfd and will reach 2.3 bcfd following completion of the second phase this summer. In anticipation of the additional volumes, Enterprise built a new cryogenic processing plant at Opal, Wyo.

Elsewhere in the Piceance basin, Enterprise in October completed the first phase of its Meeker cryogenic natural gas processing plant in northeastern Colorado; second phase will be completed in third-quarter 2008 (OGJ Online, May 21, 2008).

In February 2008, Enterprise Products Partners started up the 750-MMcfd Pioneer gas plant in Sublette County, Wyo., near the Opal hub. Photograph from Enterprise Products Partners LP.

The new Hobbs fractionator in West Texas can accommodate NGLs recovered by Meeker, which will move south along the Rocky Mountain segment of the MAPL system. To handle the increased volume demands, the company has expanded this portion of the MAPL system to provide 50,000 b/d more capacity for NGLs. In all, Enterprise says it has dedicated more than $1.9 billion over 2 years for projects and acquisitions as part of its Rockies program.

Phase I of Enterprise's Meeker processing complex is designed to process up to 750 MMcfd of natural gas and be able to extract as much as 35,000 b/d of NGLs. Phase II, which will double capacity of the facility to 1.5 bcfd and 70,000 b/d of NGLs, will begin operations this summer.

In Wyoming in February 2008, Enterprise Products Partners LP started up its 750-MMcfd Pioneer natural gas processing plant in Sublette County, Wyo., processing gas from the Jonah gathering system and extracting about 25,000 b/d of NGLs.

The company has maintained operations of the adjacent silica gel processing plant as a backup to provide producers with additional assurance of the company's processing capability at Pioneer.

That capability was tested in late March by a fire that shut down Pioneer for several weeks; natural gas was diverted to the silica gel plant during the period. Enterprise was able to restart Pioneer on Apr. 24. Processing at that time reached nearly 560 MMcfd with extraction of about 20,000 b/d of NGLs.

Also late last year in the Piceance basin in northwest Colorado, an Enterprise affiliate signed a long-term contract with Marathon Oil Co. to provide a range of midstream services, including natural gas gathering, compression, treating, and processing, for Marathon's natural gas production.

Under the contract, Enterprise Gas Processing LLC built about 50 miles of new gathering lines to connect Marathon's multiwell drilling sites, production from which is to peak at about 180 MMcfd, to Enterprise Partnership's 48-mile, 36-in. Piceance Creek gathering system. From there, the natural gas moves to the Meeker processing complex, described earlier, the first phase of which was placed in service in fourth-quarter 2007.

Also in late 2007 and in Utah, Anadarko Petroleum Corp.'s midstream unit started up the 250-MMcfd Chapeta gas processing plant west of Bonanza in giant Natural Buttes gas field in Uintah County. A lateral now transports liquids that the new refrigeration plant extracts from the field's gas to the Mapco NGL pipeline in western Colorado for shipment to Mont Belvieu for fractionation.

Anadarko has diverted to the Chapeta plant about 200 MMcfd from the Uinta basin that was being delivered into various dewpoint-control plants operated by others. The company is currently expanding Chapeta to 500 MMcfd with a planned start-up for first-quarter 2009. Upon completion, the plant could be further expanded to 750 MMcfd.

Processed gas from Chapeta moves through the 400-MMcfd Kanda lateral, operated by El Paso Western Pipelines and owned by Wyoming Interstate Co., to the Colorado Interstate Gas mainline for transport out of the Rockies, Anadarko said.

Europe and elsewhere

In mid-2007, Phoenix Park Gas Processor Ltd. hired Black & Veatch to build a new butanes fractionator at the company's Port Lisas natural gas processing and NGL fractionation site in Trinidad.

Upon completion, the fractionator will produce 3,500 b/d of isobutane, which will flow to a nearby 165,000-b/d refinery for use in a new alkylation unit to enhance gasoline production. The butanes fractionator project is set to start up later this summer.

In the Middle East, the Ebla gas project in Syria, being developed by Petro-Canada Palmyra BV, will include multiple well sites, flowlines, a gas gathering station, an 88 MMscfd gas-treatment plant, and an 88-km, 16-in. trunkline.

Upon completion by August 2010, development will include two fields, Ash Shaer and Cherrife, in central Syria, northwest of Palmyra. The new gas-treatment plant will sit next to another plant already under construction for the Syrian Gas Corp. as part of the SMAG project. Some utilities and services will be shared between the two plants.

At the field, the gas gathering station will separate water for reinjection, and the gas will be dehydrated for pipeline transportation to the treatment plant.

The plant will extract LPG from the feed gas for road tanker transport and produce export-specification sales gas and condensate using a turboexpander and liquids fractionation process.

Five gas well sites and three oil well sites are initially planned for Ash Shaer field with one gas well site planed for Cherrife field.

In the Persian Gulf, Bahrain National Gas Co. last year hired Foster Wheeler Ltd. to conduct a pre-front end engineering design for revamp and expansion of the Banagas LPG plant in Bahrain. The expansion will accommodate gas throughput up to 530 MMscfd by 2020. Design for the expanded plant will include high-yield LPG recovery units.

Also last year, Saudi Aramco hired Foster Wheeler for FEED and program management services for the Karan onshore gas processing facilities at Khursaniyah. The facilities will process 1 bcfd of gas from Karan offshore gas field, which is being developed to come on stream in 2011.

The new onshore facilities will deliver sales gas to meet growing Saudi demand. In addition, a small portion of the sales gas will be used for plant fuel and 640 tonnes/day of sulfur will be produced. Facilities will consist of gas processing trains for acid-gas removal, dehydration, and sulfur recovery, and substations and all associated utilities and infrastructure.

The project is part of the kingdom's Master Gas System to provide fuel and feedstock to its petrochemical industries.

In Africa, Dana Gas PJSC's Bahraini affiliate Danagaz Bahrain is building and will own and operate by late 2009 the Gulf of Suez gas liquids plant in Egypt. The 150-MMcfd plant, to be built near Ras Shukheir on the western shore of the gulf, will produce 120,000 tonnes/year of propane and butane.

Egyptian General Petroleum Corp. will supply gas for the plant under a long-term supply contract. The plant will recover 99% of the propane in the gas stream and 100% of the butane, said the company.

The composition of the feed gas will permit production of 110,000 tonnes/year of exportable international specification propane, which will represent about 90% of the total NGL product from the plant. The butane produced, about 10,000 tonnes/year, will be sold on long-term contracts to help meet Egypt's domestic requirements.

Danagaz Bahrain is owned 66% by Dana Gas and 34% by Bahraini partners (OGJ Online, July 23, 2007).

Sulfur production

A seemingly inexorable slide in worldwide refining and natural gas processing's production of petroleum-derived sulfur continued in 2007, to 82.7 million tonnes/day from 84.2 million tpd in 2006, and from slightly less than 85 million tpd in 2005. Capacity increased slightly to 178.8 million tpd, from 178.5 million tpd in 2006, and from slightly more than 178 million tpd in 2005.

Canada and the US continued to dominate last year with 46.9% of processing capacity, exactly even with its share for 2006, a slip from 47% in 2005. The two countries' share of actual production rose in 2007, to 49.7% from 48.6% in 2006 and 49% for 2005.

In 2007, Canada produced barely more than 23.2 million tpd, down from 23.3 million tpd in 2006 and 23.4 million tpd in 2005. US production in 2007 advanced, to 17.8 million tpd from more than 17.6 million tpd in 2006 but down from more than 18.5 tpd in 2005.

Canada continued to account for less than 24% of the overall total capacity, level with 2006, and more than 28% of production last year, ahead of 27.6% for 2006 and 27.5% in 2005. ✦

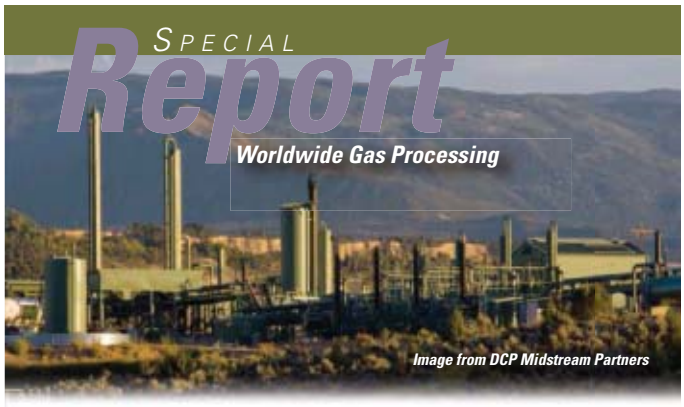
WORLDWIDE GAS PROCESSING

Leena Koottungal, Survey Editor

Capacities as of Jan. 1, 2008, and average production

Country	No. plants	MMcfd Gas capacity	MMcfd Gas throughput	Production, 1,000 gpd (average based on the past 12 months) Ethane	Propane	Iso-butane	Normal or unsplit butane	LPG mix	Raw NGL mix	Debut. natural gasoline	Other	Total products
Algeria	4	5,335.2	4,268.2	—	—	—	—	632.8	—	—	5,449.2	6,082.0
Angola	2	200.0	137.0	—	—	—	—	—	199.0	—	—	199.0
Argentina	14	4,885.3	3,076.0	712.0	654.7	—	414.0	—	7.0	493.2	—	2,280.9
Australia	5	4,340.5	3,307.5	2,500.0	710.0	—	1,034.9	—	1,931.0	345.0	4,418.4	10,939.3
Austria	2	86.0	80.5	—	—	—	—	—	—	58.6	76.0	134.6
Azerbaijan	1	—	—	—	—	—	—	—	—	—	—	—
Bahrain	1	280.0	260.0	—	118.4	112.5	—	—	—	204.9	—	435.8
Bangladesh	4	140.0	83.4	—	—	—	—	—	—	—	41.9	41.9
Bolivia	12	882.8	622.4	—	—	—	—	171.0	238.0	132.4	383.0	924.4
Brazil	15	1,083.4	370.3	—	—	—	—	669.8	101.6	108.0	1.6	881.0
Brunei	2	1,182.0	967.4	52.2	9.1	—	—	—	—	290.0	—	351.3
Canada	967	53,010.0	29,946.6	7,540.3	1,149.1	—	899.5	805.3	11,718.7	3,184.3	7,224.7	32,521.8
Chile	2	477.0	381.6	—	39.6	12.9	14.3	—	185.0	19.3	—	271.1
Colombia	7	333.0	247.3	76.5	58.0	—	63.0	88.8	27.0	63.0	—	376.3
Denmark	1	933.0	680.0	—	—	—	—	—	—	—	—	—
Ecuador	2	41.0	20.5	—	—	—	—	97.1	—	37.3	—	134.4
Egypt	19	4,510.0	2,133.0	—	—	—	—	1,379.6	—	—	1,671.3	3,050.9
Equatorial Guinea	1	870.0	170.0	—	—	—	—	102.8	—	—	36.7	139.5
France	1	570.0	563.0	—	139.0	—	132.0	—	—	270.0	—	541.0
Hungary	8	1,137.4	461.0	—	71.0	38.8	40.7	139.8	—	71.3	228.3	589.9
India	11	3,691.9	2,945.1	—	227.8	—	—	3,939.7	768.2	714.3	884.5	6,534.5
Indonesia	13	7,972.3	7,089.7	—	625.1	—	304.4	305.3	1,521.9	—	1,965.1	4,721.8
Iran	22	17,142.0	10,509.0	—	—	—	—	—	3,726.9	—	9,190.6	12,917.5
Iraq	4	2,081.0	1,550.0	—	—	—	—	7.3	—	2.2	—	9.5
Italy	20	5,175.0	1,495.0	—	—	—	—	—	—	25.8	—	25.8
Kazakhstan	4	155.0	10.0	—	—	—	—	296.0	35.9	—	0.6	332.5
Kuwait	4	1,752.2	1,033.0	2,355.6	3,684.1	—	2,627.3	8,595.8	—	1,422.0	—	18,684.8
Libya	9	4,897.0	2,567.0	—	273.0	294.0	126.0	37.8	1,749.0	567.0	551.0	3,597.8
Malaysia	5	4,250.0	3,400.0	—	23.2	—	28.2	—	—	57.0	—	108.4
Mexico	8	4,879.0	2,755.0	2,416.0	—	—	—	4,238.6	12,752.4	—	2,242.0	21,649.0
Mozambique	1	—	—	—	—	—	—	—	—	—	—	—
Myanmar	1	24.0	—	—	17.0	26.2	—	—	—	4.7	—	47.9
Netherlands	2	725.0	315.0	—	—	—	—	—	—	—	230.5	230.5
New Zealand	3	944.5	489.0	—	4.7	—	5.2	270.9	—	16.0	805.8	1,102.6
Nigeria	4	1,268.0	228.0	—	—	—	—	—	3,415.1	—	84.0	3,499.1
Norway	4	3,150.0	530.8	—	2,596.7	586.7	1,452.7	—	175.4	1,389.7	—	6,201.2
Oman	8	826.0	309.4	—	—	—	—	—	202.0	43.0	—	245.0
Pakistan	12	1,195.0	858.7	—	—	—	—	53.8	64.9	—	9.1	127.8
Peru	4	545.7	298.2	—	—	—	—	14.9	1,399.0	—	12.8	1,426.7
Poland	1	55.0	—	—	—	—	—	33.6	—	—	16.8	50.4
Qatar	2	1,010.0	220.0	1,397.0	1,681.0	—	1,103.0	—	1,618.7	122.0	—	5,921.7
Russia	24	1,405.6	925.5	563.7	—	—	709.7	6,559.9	—	1,056.8	237.8	9,127.9
Saudi Arabia	10	10,040.0	8,496.0	—	—	—	—	—	24,234.0	—	12,810.0	37,044.0
Serbia and Montenegro	1	43.0	30.0	—	11.3	6.0	8.4	—	—	16.0	—	41.7
Syria	1	450.0	—	—	—	—	—	507.0	—	—	—	507.0
Thailand	5	1,070.0	1,030.0	1.6	—	—	—	557.0	49.1	84.0	—	691.7
Trinidad & Tobago	3	1,394.0	1,101.0	—	290.3	88.6	99.3	—	—	195.0	—	673.2
Tunisia	1	174.0	139.2	—	—	—	—	—	—	—	209.0	209.0
Ukraine	1	—	—	—	—	—	—	—	—	—	—	—
United Arab Emirates	9	3,923.0	3,295.6	—	792.5	—	612.0	—	374.9	—	7,199.2	8,978.6
UK	11	13,856.0	5,836.9	—	—	—	—	—	948.0	1,572.5	36.0	2,556.5
US	572	71,062.7	45,501.7	10,722.1	9,079.8	1,600.3	3,469.8	182.8	43,618.9	5,035.1	2,518.9	76,227.6
Uzbekistan	2	—	—	—	—	—	—	—	—	—	—	—
Venezuela	14	3,927.0	3,555.0	—	—	—	—	—	7,312.9	—	—	7,312.9
Vietnam	1	150.0	120.0	—	281.0	—	188.0	495.0	—	—	167.9	1,131.9
Yemen	4	1,760.0	1,645.0	—	—	—	—	903.0	676.2	—	—	1,579.2
Total, excl. US	**1,299**	**180,227.8**	**110,552.8**	**17,614.8**	**13,456.6**	**1,165.7**	**9,862.6**	**30,902.6**	**75,431.8**	**12,565.2**	**56,183.8**	**217,183.1**
World total	**1,871**	**251,290.5**	**156,054.5**	**28,336.9**	**22,536.3**	**2,766.0**	**13,332.5**	**31,085.4**	**119,050.6**	**17,600.3**	**58,702.7**	**293,410.7**
Canada												
Alberta	903	46,333.7	25,035.5	7,153.6	978.3	—	584.6	126.4	10,850.4	2,616.1	7,222.0	29,531.3
British Columbia	34	5,681.4	4,322.7	295.0	112.7	—	302.6	565.0	66.0	537.8	—	1,879.1
Northwest Territories	2	219.9	28.3	—	—	—	—	—	—	—	—	—
Nova Scotia	2	600.0	420.0	—	—	—	—	—	765.0	—	—	765.0
Ontario	1	—	—	—	—	—	—	—	—	—	—	—
Saskatchewan	25	175.0	140.1	91.7	58.1	—	12.3	113.9	37.3	30.4	2.7	346.4
Total Canada	**967**	**53,010.0**	**29,946.6**	**7,540.3**	**1,149.1**	**—**	**899.5**	**805.3**	**11,718.7**	**3,184.3**	**7,224.7**	**32,521.8**
US												
Alabama	14	1,358.0	475.3	—	124.2	—	76.1	—	247.5	54.5	132.7	635.0
Alaska	5	9,525.0	9,298.0	—	1.2	—	—	—	168.4	—	0.6	170.2
Arkansas	5	873.8	507.4	—	—	—	—	—	27.1	—	—	27.1
California	31	1,117.2	838.9	—	382.6	3.8	167.5	50.4	71.5	307.9	98.8	1,082.5
Colorado	42	2,382.7	1,651.7	417.2	431.3	57.3	177.1	8.7	903.5	166.7	170.2	2,332.0
Florida	1	32.0	4.0	—	—	—	—	—	41.0	—	—	41.0
Illinois	1	2,200.0	1,426.0	1,440.0	655.0	127.0	159.0	—	2,940.0	75.0	—	5,396.0
Kansas	12	2,828.5	902.1	—	279.3	37.9	87.4	—	1,777.1	84.6	260.3	2,526.6
Kentucky	4	120.0	106.1	—	—	—	—	—	153.5	—	—	153.5
Louisiana	70	18,120.3	8,775.3	1,144.2	829.4	266.1	294.9	—	6,679.1	1,555.2	333.8	11,102.7
Michigan	22	1,549.4	625.7	—	5.6	—	3.0	2.6	476.5	1.5	9.8	499.0
Mississippi	4	1,603.4	900.1	—	—	—	—	—	1,000.2	—	—	1,000.2
Montana	4	15.4	9.5	—	42.4	—	30.9	—	4.5	19.4	—	97.2
Nebraska	1	10.0	8.0	—	—	—	—	—	2.0	—	—	2.0
New Mexico	26	3,194.0	2,383.9	2,020.1	1,139.1	171.7	406.1	—	2,160.6	454.9	118.0	6,470.5
North Dakota	7	202.5	166.8	—	277.2	20.1	149.4	—	55.2	129.3	—	631.2
Ohio	4	25.0	10.0	0.1	2.8	0.8	1.9	—	8.2	—	2.3	16.1
Oklahoma	55	3,359.0	2,272.7	388.8	367.0	53.1	157.9	56.9	5,846.6	165.8	285.6	7,321.7
Pennsylvania	8	43.0	32.5	—	26.0	—	14.8	—	4.1	7.8	6.5	59.2
Tennessee	2	8.0	1.5	—	—	—	—	—	—	—	—	—
Texas	193	15,734.3	11,130.2	4,496.7	3,422.7	718.8	1,205.9	64.2	18,712.0	1,526.1	627.7	30,774.0
Utah	14	531.0	243.2	—	21.6	—	24.0	—	253.0	12.1	9.8	320.5
West Virginia	8	585.0	304.0	250.9	176.0	30.3	86.2	—	378.0	65.5	—	986.9
Wisconsin	1	—	—	—	—	—	—	—	—	—	—	—
Wyoming	38	5,645.2	3,428.8	564.1	896.4	113.4	427.7	—	1,709.3	408.7	462.8	4,582.4
Total US	**572**	**71,062.7**	**45,501.7**	**10,722.1**	**9,079.8**	**1,600.3**	**3,469.8**	**182.8**	**43,618.9**	**5,035.1**	**2,518.9**	**76,227.6**

Source of Alberta data: Alberta Energy and Utilities Board, data series ST50, ST13A. Source of British Columbia data: Government of British Columbia, Ministry of Energy and Mines, www.em.gov.ba.ca. Source for Saskatchewan data: Saskatchewan Industry and Resources, tel. (306) 787-2596.



Global LPG markets react to high oil prices

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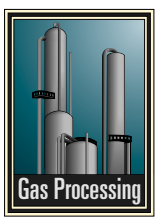


High global oil prices, regional supply disruptions, project delays, regional demand increases, and slowing economies in many regions have all affected global LPG markets and trade.

LPG production has been rising in nearly every region of the world. In 2007, global supply was about 229 million tonnes (7.3 million b/d), up 2.4% from 2006. This increase compares to an average supply growth of about 2.0%/year 2000-06. LPG production and exports have ramped up, associated with higher crude oil and LNG production rates. Because the LPG is a by-product of oil and gas production, LPG production is unlikely to be reduced despite a surge in supply and a probable reduction in LPG prices relative to crude.

Meanwhile, LPG demand has also increased around the globe. About half of total LPG demand comes from the residential-commercial market for heating and cooking. Within limits, base demand that consists of residential-commercial demand and a significant fraction of other LPG demand is relatively insensitive to price. Consequently, any LPG supply that exceeds this base demand will need to be consumed by the more elastic demand coming mainly from petrochemical plants—or possibly stored for later consumption when the market adjusts.

The global LPG supply surplus is building even while crude oil and petroleum product prices are strong. As a result, LPG price relationships have been affected. Global LPG markets are experiencing high absolute LPG price levels, which are supported by high crude oil and natural gas prices, but recent LPG prices have also been relatively weak compared to crude.

Markets for LPG substitutes such as ethane, light naphtha, and certain fuels are also affected by changes in LPG supply and pricing. For example, in Japan, Fuel Oil A has traditionally been a more economical industrial fuel than LPG. In recent years, however, LPG has been the more economical industrial fuel except during peak seasonal LPG demand.

Global supply

Global supplies of LPG rose to about 229 million tonnes in 2007 from 199 million tonnes in 2000. Thus, supplies increased by about 2.0%/year. Purvin & Gertz expects supplies will reach about 258 million tonnes by 2010 (Fig. 2).

Changes in sources

Natural gas processing continues to be the largest supply source of LPG supply, accounting for nearly 60% of total worldwide production during the last 10 years. Refineries accounted for nearly all of the remaining production. Other sources account for less than 0.5% of worldwide LPG production.

A fundamental change in the market will occur during the next few years as LPG is recovered from LNG. Most propane and butane available in the raw gas streams for LNG production will be separated from the LNG upon liquefaction. The growth in LNG facilities around the world will increase LPG production accordingly.

Smaller amounts of LPG and significant amounts of ethane, however, will be left in the LNG stream when there is no local demand. Some markets can utilize sources of LNG that contain higher levels of ethane and LPG. With many projects, extraction of the LPG components will be necessary before liquefaction of the gas stream.

On the regasification end, the ethane present in some LNG will prevent the gas from meeting natural gas pipelines' specifications. In these cases, the LNG will need to be diluted or have the eth-

ane extracted prior to sendout into the natural gas grid.

Regional supply comparisons

Regional LPG production has shown some notable shifts during the last decade.

In 1990, LPG produced in regions east of the Suez Canal ("East of Suez") totaled slightly less than 30% of the world total. By 2000, the East of Suez's share of total production had risen to about 35%, and Purvin & Gertz estimates that more than 40% of the world's LPG supplies will come from East of Suez by 2010.

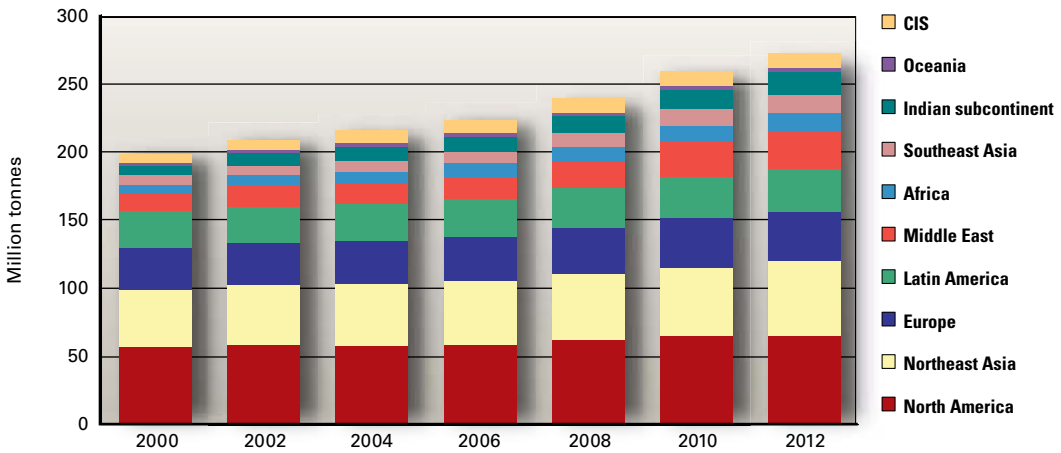
On a percentage basis, production increases have been particularly high in the CIS region, where supply nearly doubled to about 13.4 million tonnes in 2007 from 6.8 million tonnes in 2000. Other regions that grew quickly in the same period include the Indian subcontinent, the Far East, and Oceania, each of which saw growth greater than 4%/year so far this decade.

Since 2000, total global LPG production has increased by nearly 30 million tonnes. On an absolute production basis, the largest supply increase came from the Middle East, which increased by 8.8 million tonnes to about 43.3 million tonnes in 2007 from a relatively large base of 34.5 million tonnes in 2000. Thus, the Middle East accounted for about 30% of the world increase in LPG production so far in this decade.

Other regions with large absolute increases included the CIS region, with an increase of about 6.6 million tonnes, and the Far East at 6.3 million tonnes. Although the Indian subcontinent and Oceania had large increases on a percentage basis, their contributions on an absolute basis were smaller because they started from a smaller production base in 2000.

World LPG demand

Fig. 1



Middle East

The Middle East region has experienced the highest growth in LPG production since 2000 despite consecutive production decreases in the region in 2001 and 2002. Iraq had a dramatic LPG production decrease in 2003 due to the war, but the overall impact on the region was relatively small since Iraq's production was less than 5% of the total Middle East region.

The Middle East has historically provided much of the LPG that is consumed in Asia, and we expect that this trade pattern will continue for the foreseeable future.

Increased crude oil production in the Middle East during the last few years has caused an increase in associated-gas production in the region. The corresponding increase in LPG production has freed up some supplies for export. The largest increase in production, however, came from gas processing in the Middle East. Refineries produce only 12% of the region's total LPG supplies.

Saudi Arabia remains the largest LPG producer with nearly half of the Middle East's production. Saudi Arabia's production decreased, however, by about 0.5 million tonnes in 2007. The UAE also had a significant decrease at 0.7 million tonnes. Production increased by 1.0 million tonnes in Qatar, and by 1.1 million tonnes in Iran.

Over the next few years, we expect that LPG production will increase in each of these four countries as they continue to develop existing and new gas reserves. The continued growth in worldwide demand for LNG will also drive expansion of gas processing in the Middle East. By 2010, LPG production in the region will likely reach more than 59 million tonnes.

North America

North America remained the largest regional producer of LPG in 2007. North America's annual LPG production declined, however, by 4.3 million tonnes 2000-07 despite consecutive production increases in 2006 and 2007. We expect the Middle East to surpass North America's LPG production by 2010.

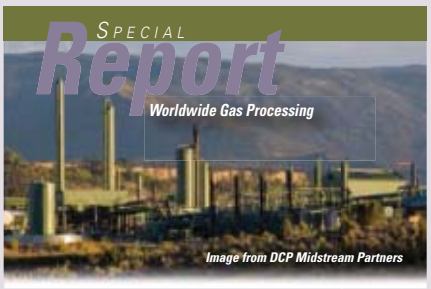
A large amount of production in the prolific Gulf of Mexico region was knocked off line for several months during 2005 by two major hurricanes, but that does not account for the overall decline since 2000. Production in North America had peaked in 2000 at more than 59 million tonnes but then declined to less than 55 million tonnes by 2003. Since 2003, production has increased except for 2005.

High energy prices: good or bad for NGLs?

Monthly average prices for crude oil have increased by a factor of five in less than 5 years since the end of 2003 and have nearly tripled in only the last 18 months. Global prices for propane and butane have also increased during this period, but at a noticeably slower pace. Thus, LPG has become relatively cheap during this rapid run-up in energy prices.

In the US, prices for propane and normal butane have risen by a factor of "only" 3.5 since late 2003. Likewise, spot prices for propane and butane in Northwest Europe have increased by a factor of roughly 3.6 and 3.9 in 5 years. In Japan, the relative increase in LPG spot prices has been somewhat more modest at about 3.3 and 3.5 times during the same period.

This relatively slow increase has shifted demand for LPG throughout the world as both a fuel and as an ethylene plant feedstock. For example, until 2005 LPG in Japan was a more expensive industrial fuel than kerosene throughout the year. From 2005 to 2007, LPG became a cheaper fuel than kerosene during many months each year. Starting in 2008, LPG has been a much cheaper fuel than kerosene during every month. Thus, demand for LPG has likely risen.



Similarly, LPG was never a competitively priced ethylene plant feedstock in Asia before the beginning of 2007. During the last 18 months, however, costs of producing ethylene from both propane and butane have been lower than for naphtha except during the peak winter heating season. Ethylene producers throughout Asia have been adding or restarting facilities that allow them to crack more LPG.

In Northwest Europe before 2006, propane was virtually never a competitively priced cracker feedstock, and butane was only attractive compared with naphtha during 4 or 5 months in the summer.

In 2008, Purvin & Gertz estimates that both propane and butane will be cheaper feedstocks than naphtha for 9 or 10 months out of the year.

Lastly, because of the large amount of feedstock flexibility among crackers in the US, cash production costs for all feedstocks have historically been fairly close to one another. In 2008 ethane, propane, and normal butane should all be much cheaper feedstocks than naphtha throughout the year.

Thus, LPG has become an attractive ethylene plant feedstock in all regions of the world. Demand for LPG as a cracker feedstock has increased accordingly.

The good news for LPG demand is that relatively weaker prices have resulted in stronger demand as both a fuel and as a cracker feedstock. The bad news is that absolute prices for LPG have soared to record highs. Demand by residential consumers, the world's largest end-use sector, is stagnating or falling in essentially all regions.

Many consumers have resorted to conservation measures such as turning down thermostats in their homes or cooking food that requires less LPG (pasta rather than beans). Other consumers have reverted to other forms of cooking fuel such as coal, wood, and even dung.

So, are high prices good or bad for LPG demand? The answer is a likely a resounding..."both." We expect that residential-commercial demand for LPG will grow by only 4%/year in 2008 and 2009 but that chemical demand will increase by more than 10%.

Purvin & Gertz expects that LPG production in North America will grow to about 56 million tonnes by the end of the decade. Gas processing provides slightly more than 60% of the LPG production in the region.

Far East

The 6.3-million-tonne increase in Far East production of LPG 2000-07 was dominated by increased production from refineries in China. Production in Korea and Taiwan also increased, but these increases were dwarfed by the increases in China. Japan's production decreased by 6.4 million tonnes during the period. All of the production in the region comes from refineries, as there is no appreciable gas processing.

In the future, Purvin & Gertz expects that refinery production of LPG will continue to increase significantly in China, where new refineries and refinery expansions are planned to accommodate the growing Chinese economy and growing demand for transportation fuels.

Africa

In Africa, LPG production rose to 17.8 million tonnes in 2007 from 14.5 million tonnes in 2000, resulting in growth of 2.9%/year. The net increase in production 2000-07 was driven by increases in Nigeria and Angola, which had a combined increase of 1.8 million tonnes/year. Algeria, Egypt, and Libya each had increases of 0.3 to 0.4 million tonnes/year.

Purvin & Gertz expects that LPG production will continue to expand in Africa. We expect particularly large absolute production increases from Nigeria and Algeria by the end of the decade, with significant contributions from Egypt, Libya, and Equatorial Guinea as well.

On Africa's west coast, Nigeria's LPG production has increased by about 1

million tonnes since 2000 due to an increase in crude oil production and a large increase in gas processing capacity. In the past, Nigeria flared a large portion of its natural gas production, along with the entrained LPG. This practice has been decreasing, and the gas is now being processed to recover the LPG.

Additions to natural gas liquefaction capacity have also increased the overall recovery of LPG from the produced gas in Nigeria. We expect that LPG production in Nigeria to increase to about 3.8 million tonnes by 2010. Civil unrest in the country continues to impede increased production. Other countries in West Africa that produce and export LPG include Angola, the Congo, and Equatorial Guinea.

On the north coast of Africa, Algeria, Egypt, and Libya are significant LPG producers. Algeria is still the world's second largest LPG exporter after Saudi Arabia. Algeria produced more than half of the total for Africa in 2007. Egypt produced 11% of African supply in 2007 but remains a net importer of LPG due to high domestic demand. Libya is also a large producer of LPG; its production should reach about 1.4 million tonnes by 2010.

Latin America

LPG production in the Caribbean and Latin America was about 25 million tonnes in 2007. This production was far less than in the Middle East and North America but comparable to production in the Far East and in Western Europe.

Within the region, Mexico is the largest producer of LPG, followed by Brazil, Venezuela, and Argentina. Together, these four countries accounted for more than 80% of the 2007 LPG production in the region. Gas processing in the region accounts for more than 60% of LPG production; this percentage will grow in the future.

Several countries in Latin America have plans for new and expanded gas liquefaction that will add to the regional LPG supply. Purvin & Gertz expects total LPG production in the region will rise to about 28 million tonnes by 2010. Brazil had the largest supply growth since 2000, at about 1.3 million tonnes/year. At 0.8 million tonnes/year, Venezuela is likely to have the largest supply growth through 2010 as several new projects are brought online. Peru, which began production from the Camisea field in 2004, should grow by almost 0.7 million tonnes and register the largest percentage increase in the region.

Indian subcontinent

On the Indian subcontinent, production rose to 9.0 million tonnes in 2007 from only 6.3 million tonnes in 2000. India dominates the region's LPG supply, with around 95% of production. Much of the growth has been due to additional crude oil refining capacity added in the late 1990s.

More than two-thirds of the regional LPG production comes from refineries, which is a wide departure from the world average. By 2010, we expect that regional production will increase to about 9.7 million tonnes, reflecting increased production from the new Jamnagar refinery.

Southeast Asia; Oceania

In Southeast Asia, gas processing produces about 56% of LPG, and the balance comes from refineries. The largest sources of supply in the region are Thailand, Malaysia, and Indonesia, with Thailand being the largest producer at around 37% of regional production.

Indonesia's LPG production has generally declined since 2001, due mainly to declining LNG gas production. Civil unrest in the area shut down the Arun LNG plant, and gas volumes at Bontang continue to decline. Additional natural gas production projects are under way, which should turn the trend.

Purvin & Gertz expects that regional LPG production in Southeast Asia will increase by about 2.4 million tonnes 2007-10. The largest volume increases should come from Indonesia and Thailand.

In Oceania, LPG production increased to 4.5 million tonnes in 2007 from 3.4 million tonnes in 2000. Oceania experienced growth of about 4.1%/year during this period, but the absolute volumes are small in comparison with overall worldwide supply. We look for regional production to continue to expand gradually.

Europe; the CIS

Northern Europe is a large but mature producing region. LPG supplies have grown by about 0.7%/year since 2000, but supplies peaked in 2003 at 18.8 million tonnes and have declined each year since. In 2007, production dropped by 0.5 million tonnes due to operating problems; therefore we forecast a rebound in 2008.

Production from the North Sea represents a large portion of regional production, but refineries in the region provide nearly half of the region's total LPG supplies. We expect that regional supplies will be flat to slightly reduced through the end of the decade. Increased refinery supplies of LPG should help offset declining North Sea supplies.

In contrast, the neighboring CIS region is experiencing a strong increase in supply. In 2007, the CIS countries produced 13.4 million tonnes of LPG, which represents nearly a 10% /year increase since 2000. This growth occurred mainly because of additional gas processing in several countries.

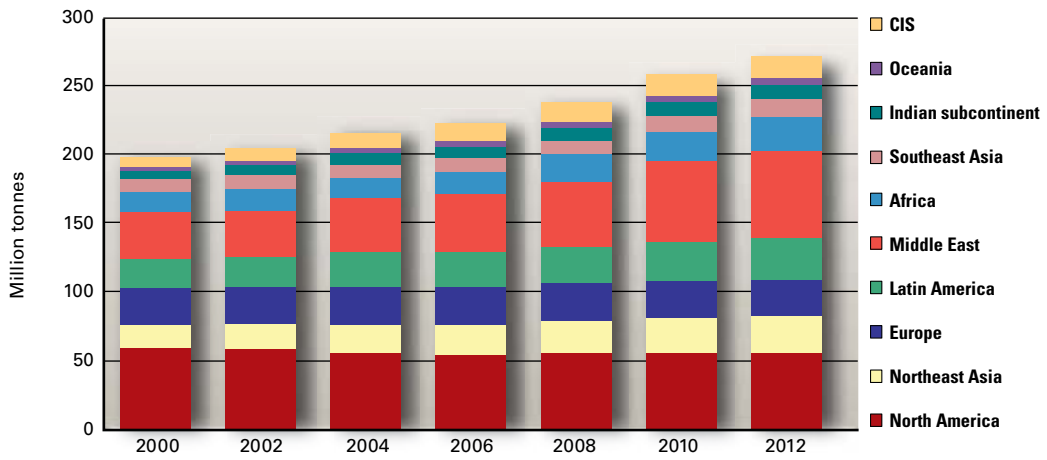
LPG demand growth

Total global demand for LPG was nearly 229 million tonnes in 2007. Purvin & Gertz estimates that the market will grow to about 258 million tonnes by 2010. Thus, demand will likely grow by about 31% compared with demand of 198 million tonnes in 2000 (Fig. 1).

Although total global growth for LPG since 2000 averaged 2.1%/year, growth rates in individual geographic regions have varied widely. The highest growth in base demand (i.e., outside the price-sensitive petrochemical industry) has occurred in developing regions of the world, driven by residential-commercial consumption (Fig. 3). In the more mature economies of Western Europe

WORLD LPG SUPPLY

Fig. 2



and North America, LPG base demand increased much more slowly than the global average.

LPG demand growth in 2007 continued to be high in the Middle East, Africa, Southeast Asia, and especially the Indian subcontinent. Much of this demand growth resulted from rising consumption by the residential-commercial sector. Demand growth in the Middle East primarily, however, resulted from the region's expansion of its petrochemical sector.

Asia, Oceania

The total Asian market—the Far East, Southeast Asia, and Indian subcontinent—overtook North America in 2001 as the largest LPG consuming market in the world. LPG demand in Asia totaled about 68 million tonnes in 2007. For comparison, the North American market was about 60 million tonnes in 2007.

LPG demand in Asia has increased by an average of about 3.2%/year since 2000. Nearly 70% of total demand in the region is for use in the residential-commercial sector. It is interesting to note that South Korea is the world's largest consumer of LPG for automobile fuel; however, at a 2007 consumption of about 4.3 million tonnes of LPG, this application still represents a relatively small contribution to the total Asian market demand.

Almost all demand growth for LPG in Asia is in the residential-commercial sector. This region includes more than 3.5 billion people, or almost 56% of the world's total population. We expect economic growth in this region to continue and result in additional consumption of LPG, although more slowly than during the last 10 years. Per-capita consumption of LPG in this region will likely increase sharply in the future.

Within the region, Japan and China are the largest consumers of LPG. China's total demand surpassed that of Japan in 2004, but Japanese demand was higher again in 2007. Chinese demand was reduced by high prices relative to alternatives for cooking and heating, while Japanese demand increased due to LPG's preference as a petrochemical feedstock.

In 2007, demand in China totaled about 18.4 million tonnes, while Japan's total was 18.8 million tonnes. Growth in Chinese demand for LPG was very strong at about 20%/year throughout the 1990s but has slowed to 4.5%/year since 2000, with 2007 growth of only about 0.4%.

In future, Purvin & Gertz expects Chinese demand to continue to grow but not at rates seen in the 1990s. In contrast, Japanese demand growth was 0.4%/year during the 1990s and has been flat on average since 2000. Japan's market is mature and only modest demand growth is expected.

The LPG market in Southeast Asia is much smaller than the Far East, but it is generally growing faster. The Far East market was about 6.2 times the size of the Southeast Asian market in 2000, but the ratio has since narrowed to about 5.2. Some of the Southeast Asian markets have exhibited strong growth rates and are becoming more important regional players in the LPG trade.

The region has experienced total LPG demand growth near 5%/year since 2000. Total LPG demand in the region grew to about 9.0 million tonnes in 2007 from 6.6 million tonnes in 2000.

Almost 60% of the 2007 demand in the Southeast Asia region was concentrated in Malaysia and Thailand, both of which have mature LPG markets with high penetration in the residential-commercial markets. Indonesia and the Philippines combined for 2.3 million tonnes of LPG demand in 2007.

Most countries in Southeast Asia, with the notable exceptions of Singapore and the Philippines, have experienced reasonably high growth rates during the last 10 years. More than 70% of the regional consumption is in the residential-commercial sector. Purvin & Gertz expects that growth in this sector will continue through the rest of the decade at more than 5%/year. With growth of more than 20%/year of growth over 3 years expected, Indonesia, Thailand, and Vietnam will likely exhibit the highest growth rate of any country in the region through 2010.

The LPG markets in the Indian

subcontinent continue to exhibit strong potential growth. In 2007, total demand rose to about 12.1 million tonnes from only 7.2 million tonnes in 2000. This increase represents growth of nearly 8%/year. Almost all of this demand is concentrated in India, which accounts for more than 90% of the total LPG consumption on the subcontinent.

Compared with Asia, LPG demand in Oceania is very low at only 2.2 million tonnes in 2007. Australia dominates the regional market with total consumption of 2.0 million tonnes. One unique aspect of the Australian market is the very high use of LPG as auto fuel, an end-use sector that accounts for about 63% of the total use in the country.

Middle East

In the Middle East, LPG demand represents a notable exception to most regions that consume large amounts of LPG in the residential-commercial sectors. Conversely, demand in the Middle East has increasingly been heavily influenced by the petrochemical sector's use of LPG as a feedstock. Before 1994, the chemicals sector consumed less than 10% of total LPG demand in the region. In 2007 chemicals comprised more than 45% of total demand, and by 2010 we expect that figure to rise to about 60% of total LPG demand as new projects come on stream.

Saudi Arabia has been a major contributor to the use of the LPG for chemicals production and currently accounts for about 43% of total LPG consumption in the Middle East. In 2007, regional demand for LPG totaled about 17.0 million tonnes, and Saudi Arabia accounted for about 7.3 million tonnes. Petrochemical feedstock demand currently accounts for almost 80% of the total demand in Saudi Arabia.

We expect that demand for LPG in Saudi Arabia will likely jump sharply in 2008 through 2010, as the next series of chemical manufacturing facilities come into production. Demand growth in the residential-commercial sector should remain relatively steady, with moderate growth during the next few years.

Iran is the next largest consumer of LPG in the Middle East, accounting for more than 22% of regional demand. Demand growth in Iran has averaged nearly 8%/year since 2000. Petrochemical use of LPG in the country will increase dramatically after 2010, pushed by expanded production from the South Pars field.

Europe

LPG demand has increased rapidly in some countries of Eastern Europe. Due to the collapse of the former Soviet Union, many of the newly formed republics experienced severe economic downturns during 1990-95. Since 1995, many of these countries have enjoyed strong economic growth, and LPG demand has increased accordingly.

From 1995 to 2005, demand in many of the countries of Eastern Europe increased at more than 7%/year. Although this demand growth is strong in percentage terms, the absolute increases in LPG volumes were less impressive, mainly because these countries were starting from low consumption bases.

In Northern Europe, there is no single, dominant LPG-consuming country. The UK and Ireland comprise the largest consumer of LPG and currently account for 3.8 million tonnes of the regional consumption, which totaled about 17.0 million tonnes in 2007. Scandinavia consumed about 3.1 million tonnes of LPG in 2007, and Germany used about 2.8 million tonnes. Poland consumed 2.7 million tonnes of LPG, and the Netherlands used 2.2 million tonnes.

Total base demand in Northern Europe has grown only slowly to 13.2 million tonnes in 2007 from 12.0 million tonnes in 2000. Price-sensitive consumption for ethylene production, however, has increased to 3.8 million tonnes in 2007 from 2.0 million tonnes in 2000. Purvin & Gertz expects price-sensitive demand to grow rapidly for the next few years to about 5.6 million tonnes in 2010 as global production of LPG rises faster than base demand.

Within Northern Europe, auto-fuel use in Poland has exhibited extremely strong growth during the past 10 years and accounted for the bulk of the growth in the country's LPG market. As in many other countries where autogas represents a significant component of LPG demand, Poland's 2007 autogas consumption of about 1.9 million tonnes/year is driven by the fuel tax structure. In the absence of increased incentives, autogas growth in Poland will slow.

In southern or Mediterranean Europe, growth patterns for LPG have been quite different than in the north. The countries that make up this region include Spain, Italy, France, Turkey, Bulgaria, Romania, and the Balkan states. Most of these markets are very mature, and the petrochemical sector does not make up a large component of demand. Consequently, the region is not likely to show strong growth.

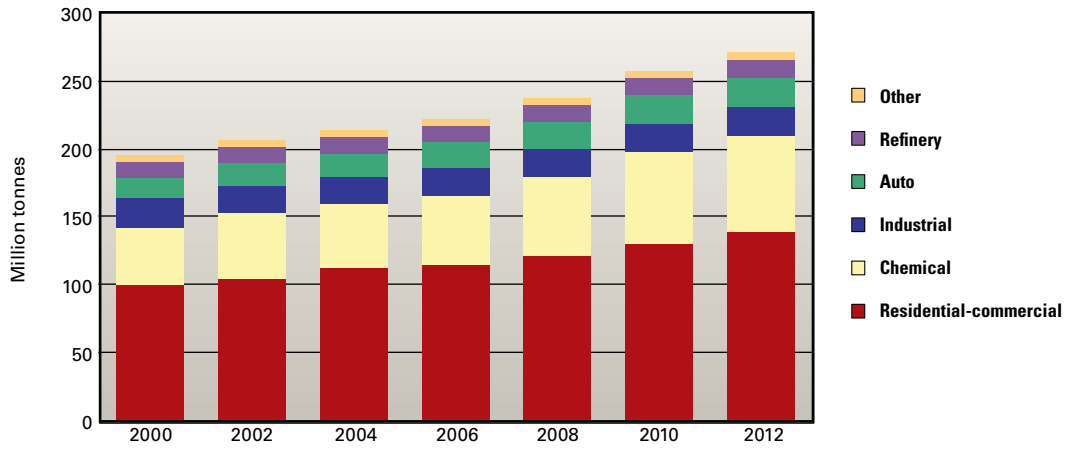
Demand in Southern Europe peaked at 17.2 million tonnes in 2000 and declined to 15.3 million tonnes in 2003. Demand rebounded to about 16.2 million tonnes in 2007 but will not surpass the 2000 levels by the end of the decade.

The CIS region (Commonwealth of Independent States) includes Russia and all the republics of the former Soviet Union, except the Baltic States. Between 1990 and 1998, demand in the region steadily declined due to weak economic conditions. In recent years, however, growth has returned to these markets. LPG demand in the CIS has grown at average rates exceeding 7%/year since 2000.

In 2007, demand in the CIS totaled about 9.9 million tonnes. Russia accounts for the largest portion of the regional demand, consuming more than 80% of the LPG. Within Russia, the residential-commercial sector uses slightly less than one-half of the total, and petrochemical consumption of LPG accounts for almost 40%. We expect LPG demand in the CIS to rise to about 10.6 million tonnes in 2010.

WORLD LPG DEMAND BY SECTOR

Fig. 3



Africa

In Africa, LPG markets have grown rapidly. Demand in the entire region has grown at 5.7%/year since 2000. In 2007, total LPG demand rose to 10.3 million tonnes. Almost all the consumption in Africa is in the residential-commercial sector.

Egypt is the largest consuming country, accounting for about one-third of regional consumption. Algeria and Morocco are also large regional consumers of LPG. We look for regional demand to increase to 11.8 million tonnes by 2010.

Latin America

Latin America is a large market for LPG. Within the region, about 80% of LPG feeds residential-commercial demand. Mexico and Brazil account for almost 60% of LPG consumption. LPG demand in Latin America declined starting in 2000 to a low of about 25.7 million tonnes in 2003.

Much of the contraction in demand occurred in Brazil and Mexico due to a combination of economic factors and penetration into the market by natural gas. Latin American demand has since rebounded to about 28.3 million tonnes in 2007. Purvin & Gertz expects that demand will grow to nearly 30 million tonnes by 2010.

Mexico continues to have the highest per-capita use of LPG in the residential market of any country in the world. Four out of five households in the country use LPG as cooking fuel. Mexico consumed about 9.7 million tonnes of LPG in 2007—almost 45% more than in Brazil.

North America

The North American market (excluding Mexico, counted with Latin America) is one of the largest in the world and is mature. North American base demand for LPG grew at less than the world average in 2007. The US petrochemical industry, however, relies heavily on LPG as a primary feedstock, and petrochemicals' LPG demand was robust in 2007. Total North America LPG demand—including price-sensitive demand—grew at about 1.6%.

One unique aspect of the North American market is its ability to accommodate a large amount of price-sensitive demand. The US Gulf Coast has a large amount of underground storage, ample marine terminal facilities, and a large petrochemical industry that has unparalleled feedstock flexibility.

These attributes allow the US Gulf Coast to consume large amounts of LPG when the price is right. Consequently, when global supply of LPG exceeds base demand, the US Gulf Coast is often the superior outlet for the excess supply because the LPG can be cracked as feedstock or stored until prices improve.

Base demand in North America has grown at only 0.3%/year since 2000. Even with the price-sensitive demand included, the growth rate was only 0.5%/year. This small growth rate, however, masks the absolute demand increase due to the large size of the market.

Total LPG consumption in the North American market increased by 2.0 million tonnes 2000-07. For comparison, this increase by itself is nearly the same size as the total LPG consumption in Oceania in 2007.

Because North America is a mature market, Purvin & Gertz does not expect base demand to grow appreciably in the region. Base demand growth should average only about 1.1%/year through 2010. Demand by the price-sensitive market, however, should expand rapidly 2008-09. After the peak of the surplus, price-sensitive demand will decline, but should remain relatively high for several years as the petrochemical industry takes advantage of low-cost global supplies.

We look for total LPG demand in North America, including price-sensitive demand, to reach nearly 65 million tonnes by 2010.

Global LPG trade

With increased global LPG production and demand, one might have expected increased waterborne trade in 2007. Large-cargo waterborne trade volume actually dropped, however, to about 51.5 million tonnes in 2007 from 53.0 million tonnes in 2006. Among the many contributors to this

decline, many are likely to be temporary.

On the source side, South American exports dropped by nearly 1 million tonnes. This drop was due mostly to an abnormally harsh winter that caused Argentina and others to retain their LPG rather than sell it on the global market.

The Middle East, Australia, and the North Sea each dropped LPG exports by more than 0.4 million tonnes. OPEC cuts, delayed projects, and increased domestic demand contributed to the Middle East's drop. North Sea exports were hampered by declining production and significant maintenance work on terminals.

The largest increase in exports was about 0.6 million tonnes from Africa, particularly from Algeria and Nigeria.

On the destination side, import demand for propane continued to be soft in China as consumers balked at the high international prices and domestic refineries were able to meet internal demand. Waterborne imports into China dropped by 0.8 million tonnes in 2007.

Premium demand increased in South America to cope with the cold winter. The drop in exports coupled with the South American winter took a cut out of price-sensitive demand. Because LPG was frequently favored over naphtha, LPG still flowed to crackers in Asia and the Mediterranean. The traditional "market of last resort," however, the US Gulf Coast, found itself without significant incoming supplies of off-season LPG. Imports to the US Gulf Coast dropped by 1.9 million tonnes in 2007. ✦

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Volatile VLCC rates lead tanker rebound

Christopher E. Smith
Pipeline Editor

Tanker market earnings for the half-year ended March 2008 firmed by 14.1%, from the previous 6 months. Temporary increases in demand (driven by market trading) and decreases in supply (conversions) drove the increase in earnings. Clarkson Research Services Ltd. detailed the reasons behind these market movements and forecast future market directions in its Spring 2008 "Shipping Review and Outlook: A Half-Yearly Review of the Shipping Market."

According to Clarkson data, the tanker market, consisting of both modern and early-1990s very large crude carriers (VLCCs), modern Suezmax, modern Aframax, and both dirty and clean products carriers, averaged $34,771/day in earnings from September 2007 to March 2008, a 14.1% increase from the $30,477/day seen March-September 2007.

A 93.3% increase in VLCC earnings, to $86,009/day, led the upward momentum, with clean-product tankers being the only segment experiencing more than a marginal drop in earnings from the previous 6 months, falling 16.1% to $22,529/day (Table 1).

TANKER EARNINGS Table 1

Vessel type	March-September 2007	September 2007-March 2008	Change, %
	$/day		
VLCC (modern)	44,494	86,009	93.3
VLCC (early 1990s)	42,398	80,384	89.6
Suezmax (modern)	36,833	53,038	44.0
Aframax (modern)	31,190	37,556	17.7
Products (dirty)	28,785	28,241	–1.9
Products (clean)	26,866	22,529	–16.1
Weighted average	30,477	34,771	14.1

Perhaps the most striking feature, according to Clarkson, was the speed with which VLCC rates increased in October-December 2007, peaking at more than $230,000/day for modern vessels, as compared to $25,000/day for spot VLCCs in October 2007 (OGJ, Feb. 4, 2008, p. 64).

Even with the easing in rates off those highs, Clarkson said, high scrap prices and phaseout requirements, combined with continued trade growth, offer the possibility of earning strength continuing, at least in the short term.

The oil tanker fleet grew to reach 385.9 million dwt by yearend 2007, an increase of 6.2%, with another 4.4% increase forecast for 2008. The active tanker fleet for vessels of more than 10,000 dwt increased by 147 ships over the 6 months ending Mar. 1, 2008; 187 vessels delivered against 21 vessels scrapped. With the current order book standing at 41% of the fleet (in deadweight), Clarkson sees a possibility that the fleet could become oversupplied.

This article details some of the other findings in a few of the numerous vessel categories covered twice each year by Clarkson in its Shipping Market Outlooks.

Market outlook

A combination of the usual seasonal surge in oil lifting—later than usual in 2007—and the sudden exodus of single-hull tankers for conversion fueled strength in the tanker market, according to Clarkson. Clarkson said that spot earnings improved across all the major sectors, the average Suezmax spot rate increasing 269%.

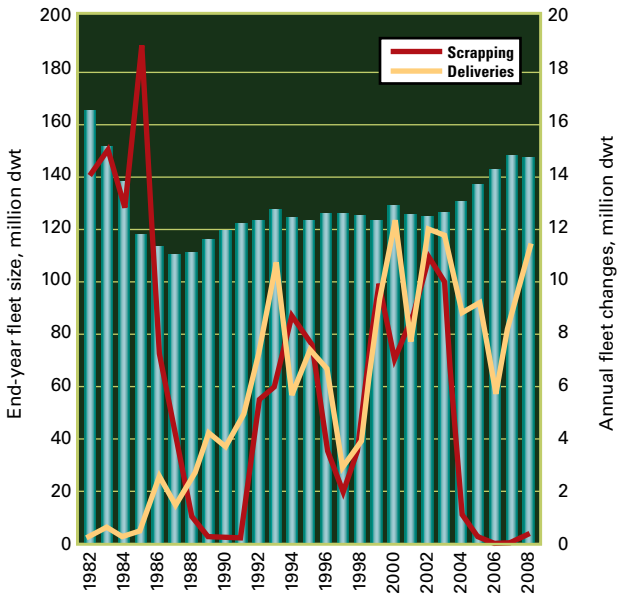
Crude tankers of all categories gained ground against 10-year average spot rates over the 6 months. The spot rate for 30,000-dwt clean product tankers also increased to $22,520/day from $17,765/day in the preceding 6 months. Rates for a 1-year time-charter of the same vessel type, however, slipped 4%, to $22,000/day, according to Clarkson.

Ship values continued to increase, with the value of 5-year old VLCCs reaching $140 million from $130 million in September 2007.

Clarkson notes that conversions of single-hull tankers have helped offset deliveries of new vessels, at least in the larger sizes, but that underlying demand

VLCC FLEET DEVELOPMENT

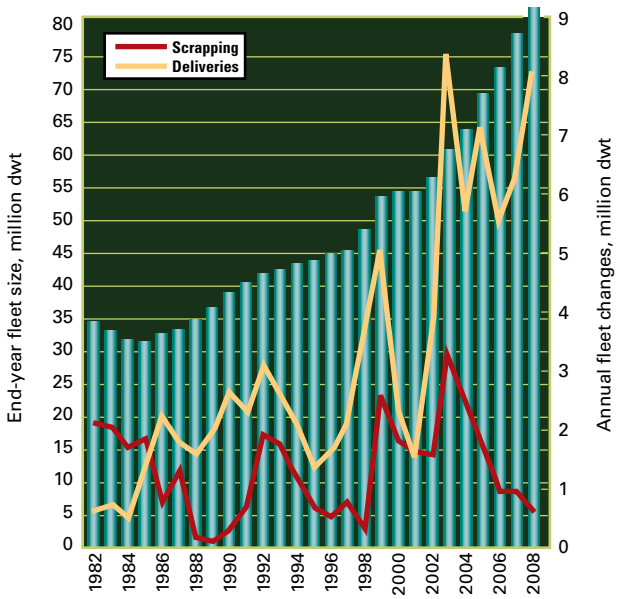
Fig. 1



Source: Clarkson Research Services

AFRAMAX FLEET DEVELOPMENT

Fig. 2



Source: Clarkson Research Services

remains sluggish, predicting the fleet will grow by 4.4% during 2008. This growth could add to supply pressures if conversions falter, according to Clarkson.

VLCC

By Mar. 1, 2008, the VLCC fleet totaled 146.8 million dwt, down from 148.4 million dwt 6 months earlier due to conversion of single-hulled tankers to floating, production, storage, and offloading vessels and very large ore carriers. The fleet will total 147.1 million dwt by yearend 2008, as conversions continue to keep pace with deliveries, even as scrapping remains low (Fig. 1). Increased deliveries in 2009 will expand it to 158.7 million dwt.

Clarkson described the VLCC sector as volatile for the 6 months ending Mar. 1, 2008, with spot earnings for a 1990s-build vessel starting at a 4-year low before reaching record highs in December. For the entire 6 months, spot earnings averaged $77,713/day, compared with $50,126/day for the same period 1 year earlier. This coincided with relatively flat fleet growth and a continued increase in asset values (Table 2).

By contrast, weakness continued in the time charter market, with 1-year rates for modern tonnage dropping to $43,317/day between September 2007 and March 2008 compared with $49,563/day for the same period a year earlier. Clarkson notes, however, that rates picked up as the spot market improved, ascribing the fall instead to the strength of 2006-07 market.

Clarkson sees upwards support for spot prices remaining in place for the balance of 2008, as the lack of fleet growth faces continued demand.

VLCC MARKET SUMMARY

Table 2

Worldscale rates	End 2007	March 2008	Change, %
AG-West	180	83	–54.2
AG-Far East	275	115	–58.2
Med-UK	205	133	–35.4
Revenue, $/day			
Average spot earnings, 1990s built	185,635	77,358	–58.3
1-year time-charter rate, 1990s built	52,500	45,000	–14.3
Asset values, $ million			
Newbuild price, 300,000 dwt	146	148.5	1.7
5-year old, 300,000 dwt	135	140	3.7
Tonnage supply, million dwt			
Fleet	148.3	146,8	–1.0
Order book	54.9	57.8	5.3

Suezmax

On Mar. 1, 2008, the Suezmax fleet totaled 54.8 million dwt, flat for the 6 months as conversions matched 1.3 million dwt of deliveries. A heavy delivery schedule, particularly in 2009, will see the fleet reach 62.4 million dwt by yearend, according to Clarkson.

Spot earnings for the 6 months ending Mar. 1, 2007, averaged $46,322/day, down only slightly from a year before despite reaching highs of more than $112,000 day at year-end 2007. Time-charter rates for 1 year on a modern vessel dropped 9.7% from the end of 2007, while 3-year rates fell 4.3% to $22,000/day.

Clarkson expects spot rates in the Suezmax sector to remain steady in the short term, bolstered by robust demand. In the medium term, however, rates may come under pressure as potential vessel oversupply emerges. The

2010 single-hull phase-out, however, could reduce the risk of oversupply, according to Clarkson.

Aframax

On Mar. 1, 2008, the Aframax fleet had increased to 76.9 million dwt. A heavy delivery schedule, only partially offset by demolitions and conversions, will grow the fleet to 83.1 million dwt by the end of 2008, according to Clarkson (Fig. 2).

Aframax earnings rose to $35,420/day during the 6 months ending Mar. 1, 2008, but were still down 17% from the year-earlier period. Time charter rates also slipped 12% from a year earlier, reaching $21,833/day for a 1-year term.

Clarkson sees the 40%-of-fleet order book in the Aframax sector as leading to the same potential medium-term oversupply of vessels expected in VLCC and Suezmax vessels, but notes that the 2010 phaseout of single-hulled vessels could provide some counteracting upward pressure in the future.

Products

Clarkson reports softer earnings in the products market during the 6 months ending Mar. 1, 2008. Spot earnings for clean-product tankers averaged $22,189/day, down from $27,961/day for the previous 6 months and $24,979/day for the year-earlier period. Clarkson ascribed the fall in earnings to a combination of charterers holding their positions and large product inventories, particularly of US gasoline, limiting immediate demand.

On Mar. 1, 2008, the 10,000-60,000 dwt product tanker market stood at 84.6 million dwt. With more than 10 million dwt/year expected to be delivered during the next 2 years and limited scrapping and conversions, Clarkson expects the fleet to reach 105.7 million dwt by the end of 2009.

Over the longer term, Clarkson expects tonne-mile growth to be stronger than in 2008, as both expansion of refinery capacity in the Far East and fleet expansion slow.

Chemical

Mar. 1, 2008, saw mixed spot freight rate movement from end-2007, according to Clarkson. Rates for 5,000 tonnes Rotterdam-Houston fell 7.3%, with Houston to Rotterdam for 5,000 tonnes rising 7.8%.

Persian Gulf-Mediterranean rates showed the sharpest increase, rising 25% (15,000 tonnes). Despite strength along some routes, however, Clarkson saw the entire segment as weakened by a softer dollar and elevated operating costs, particularly for crewing and bunkers.

As with the other tanker segments, Clarkson sees future fleet development in chemicals as hinging on the market's ability to absorb a large orderbook (15.6 million dwt as of Mar. 2008), tempering this somewhat with expectation of a buoyant biofuels markets and expanded Middle East production.

LNG

Clarkson described the LNG segment as ready to accelerate, citing a number of final approvals in both liquefaction plants and receiving terminals expected over the next 12 months. In the first 2 months of 2008, six vessels totaling 1.15 million cu m were delivered to the fleet, the smallest measuring 147,200 cu m, creating a short-term capacity overhang and depressing charter rates accordingly. In total, 56 vessels are scheduled for delivery in the last 10 months of 2008, 44 in 2009, and 19 in 2010.

Prospects for major growth longer term, according to Clarkson, continue to depend on the success of Russian and Iranian development plans. Output at Shtokman could increase from an initial 2013 capacity of 23.7 billion cu m/year to 71 billion cu m/year in 2020, says Clarkson, also citing three large-scale projects in Iran.

A combination of project delays and on-schedule vessel delivery could, however, extend the current rate softness forward, according to Clarkson. ✦

Imports of crude and products

	Districts 1-4 6-6 2008	Districts 1-4 5-30 2008	District 5 6-6 2008	District 5 5-30 2008	Total US 6-6 2008	Total US 5-30 2008	Total US [1]6-8 2007
	1,000 b/d						
Total motor gasoline	1,195	1,257	—	53	1,195	1,310	1,157
Mo. gas. blending comp.	644	873	—	43	644	916	618
Distillate	127	162	—	49	127	211	180
Residual	403	216	—	—	403	216	315
Jet fuel-kerosine	78	52	31	110	109	162	312
Propane-propylene[2]	106	111	4	15	110	126	135
Other	743	278	84	56	827	334	947
Total products	**3,296**	**2,949**	**119**	**326**	**3,415**	**3,275**	**3,664**
Total crude	**8,490**	**8,377**	**1,198**	**1,409**	**9,688**	**9,786**	**10,141**
Total imports	**11,786**	**11,326**	**1,317**	**1,735**	**13,103**	**13,061**	**13,805**

[1]Revised. [2]Data available only for PADDs 1-3.
Source: US Energy Information Administration
Data available in OGJ Online Research Center.

Purvin & Gertz LNG netbacks—June 13, 2008

Receiving terminal	Liquefaction plant: Algeria	Malaysia	Nigeria	Austr. NW Shelf	Qatar	Trinidad
	$/MMbtu					
Barcelona	8.77	6.76	8.26	6.62	7.50	8.16
Everett	10.53	7.83	10.04	7.90	8.58	10.92
Isle of Grain	11.34	8.85	10.50	8.75	9.43	10.53
Lake Charles	8.55	6.67	8.24	6.82	7.07	9.37
Sodegaura	7.05	9.76	7.30	9.38	8.51	6.17
Zeebrugge	9.27	6.99	8.46	6.89	7.52	8.47

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

Crude and product stocks

District	Crude oil	Motor gasoline: Total	Motor gasoline: Blending comp.[1]	Jet fuel, kerosine	Fuel oils: Distillate	Fuel oils: Residual	Propane-propylene
	1,000 bbl						
PADD 1	16,513	57,086	31.358	9,630	35,381	16,205	4,150
PADD 2	65,500	49,792	17,627	7,891	30,074	1,360	15,337
PADD 3	149,525	70,150	33,257	12,509	31,889	16,563	17,973
PADD 4	13,975	5,786	1,699	594	3,344	282	[1]1,087
PADD 5	56,684	27,274	20,587	9,239	13,293	5,095	—
June 6, 2008	**302,197**	**210,088**	**104,528**	**39,863**	**113,981**	**39,505**	**38,547**
May 30, 2008	**306,757**	**209,090**	**103,474**	**39,751**	**111,704**	**38,166**	**38,002**
June 8, 2007[2]	**342,427**	**201,540**	**89,569**	**42,029**	**122,566**	**35,353**	**36,941**

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

Refinery report—June 6, 2008

District	Refinery operations: Gross inputs	Refinery operations: Crude oil inputs	Refinery output: Total motor gasoline	Refinery output: Jet fuel, kerosine	Refinery output: Fuel oils: Distillate	Refinery output: Fuel oils: Residual	Refinery output: Propane-propylene
	1,000 b/d						
PADD 1	1,284	1,281	1,955	100	422	131	56
PADD 2	3,367	3,327	2,380	219	1,079	42	222
PADD 3	7,684	7,536	3,013	678	2,222	375	684
PADD 4	511	510	249	23	169	17	[1]170
PADD 5	2,747	2,665	1,377	473	583	178	—
June 6, 2008	**15,593**	**15,319**	**8,974**	**1,493**	**4,475**	**743**	**1,132**
May 30, 2008	**15,785**	**15,480**	**9,113**	**1,566**	**4,506**	**710**	**1,126**
June 8, 2007[2]	**15,582**	**15,371**	**9,326**	**1,459**	**4,078**	**678**	**1,149**
	17,594 operable capacity		**88.6% utilization rate**				

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

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

OIL&GAS JOURNAL online research center

OGJ crack spread

	*6-13-08	*6-15-07	Change $/bbl	Change, %
SPOT PRICES				
Product value	148.94	87.09	61.85	71.0
Brent crude	135.09	55.41	79.68	143.8
Crack spread	13.85	31.69	–17.84	–56.3
FUTURES MARKET PRICES				
One month				
Product value	151.86	88.10	63.75	72.4
Light sweet crude	134.73	66.65	68.08	102.1
Crack spread	17.13	21.46	–4.33	–20.2
Six month				
Product value	149.06	82.86	66.20	79.9
Light sweet crude	135.58	69.76	65.82	94.4
Crack spread	13.48	13.11	0.38	2.9

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

Statistics

OGJ GASOLINE PRICES

	Price ex tax 6-11-08	Pump price* 6-11-08	Pump price 6-13-07
	¢/gal		
(Approx. prices for self-service unleaded gasoline)			
Atlanta	373.1	412.8	309.3
Baltimore	358.7	400.6	307.3
Boston	361.1	403.0	297.1
Buffalo	358.5	418.6	309.3
Miami	370.9	421.2	313.7
Newark	361.5	394.4	291.3
New York	350.2	410.3	308.6
Norfolk	355.9	393.5	298.2
Philadelphia	361.3	412.0	313.3
Pittsburgh	350.5	401.2	300.3
Wash., DC	374.4	412.8	308.3
PAD I avg.	361.5	407.3	305.1
Chicago	389.4	440.3	345.8
Cleveland	348.3	394.7	295.4
Des Moines	354.7	395.1	314.7
Detroit	357.2	406.4	326.7
Indianapolis	351.4	396.4	319.7
Kansas City	356.1	392.1	314.7
Louisville	364.3	401.2	317.8
Memphis	345.7	385.5	304.3
Milwaukee	358.4	409.7	321.9
Minn.-St. Paul	357.2	397.6	297.7
Oklahoma City	347.1	382.5	301.3
Omaha	345.9	392.3	302.7
St. Louis	354.9	390.9	311.6
Tulsa	344.8	380.2	300.6
Wichita	330.9	374.3	308.0
PAD II avg.	353.7	395.9	312.2
Albuquerque	349.2	385.6	324.3
Birmingham	354.4	393.1	300.1
Dallas-Fort Worth	359.4	397.8	292.6
Houston	351.7	390.1	289.5
Little Rock	351.0	391.2	299.7
New Orleans	356.4	394.8	305.3
San Antonio	349.8	388.2	294.1
PAD III avg.	353.1	391.5	300.8
Cheyenne	350.5	382.9	298.1
Denver	350.2	390.6	321.0
Salt Lake City	350.0	392.9	320.2
PAD IV avg.	350.2	388.8	313.1
Los Angeles	385.0	443.5	326.4
Phoenix	371.5	408.9	308.2
Portland	377.0	420.3	320.0
San Diego	393.9	452.4	340.7
San Francisco	390.1	448.6	345.0
Seattle	376.8	429.2	317.4
PAD V avg.	382.4	433.8	326.3
Week's avg.	**359.5**	**403.1**	**310.5**
May avg.	**329.3**	**372.9**	**307.6**
Apr. avg.	**296.4**	**339.3**	**278.3**
2008 to date	**290.0**	**333.6**	—
2007 to date	**220.3**	**263.8**	—

*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

	6-6-08 ¢/gal		6-6-08 ¢/gal
Spot market product prices			
Motor gasoline (Conventional-regular)		Heating oil No. 2	
New York Harbor	340.10	New York Harbor	394.36
Gulf Coast	339.10	Gulf Coast	393.48
Los Angeles	382.51	Gas oil	
Amsterdam-Rotterdam-Antwerp (ARA)	305.23	ARA	407.39
Singapore	326.07	Singapore	386.74
Motor gasoline (Reformulated-regular)		Residual fuel oil	
New York Harbor	357.60	New York Harbor	250.90
Gulf Coast	358.10	Gulf Coast	247.69
Los Angeles	389.60	Los Angeles	248.76
		ARA	250.47
		Singapore	227.66

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

BAKER HUGHES RIG COUNT

	6-13-08	6-15-07
Alabama	3	6
Alaska	7	8
Arkansas	49	45
California	42	32
Land	42	31
Offshore	0	1
Colorado	100	111
Florida	0	1
Illinois	0	0
Indiana	2	2
Kansas	8	14
Kentucky	11	8
Louisiana	162	171
N. Land	57	54
S. Inland waters	23	22
S. Land	25	31
Offshore	57	64
Maryland	1	0
Michigan	1	1
Mississippi	12	13
Montana	13	16
Nebraska	0	0
New Mexico	79	78
New York	7	5
North Dakota	71	36
Ohio	13	13
Oklahoma	213	197
Pennsylvania	20	13
South Dakota	2	4
Texas	929	837
Offshore	11	10
Inland waters	2	0
Dist. 1	24	18
Dist. 2	31	31
Dist. 3	69	60
Dist. 4	96	89
Dist. 5	182	177
Dist. 6	122	124
Dist. 7B	29	37
Dist. 7C	72	53
Dist. 8	138	113
Dist. 8A	28	28
Dist. 9	43	35
Dist. 10	82	62
Utah	41	40
West Virginia	26	35
Wyoming	74	77
Others—NV-2; OR-1; TN-5; VA-5; WA-2	15	10
Total US	**1,901**	**1,773**
Total Canada	**230**	**251**
Grand total	**2,131**	**2,024**
Oil rigs	389	285
Gas rigs	1,504	1,484
Total offshore	68	76
Total cum. avg. YTD	**1,809**	**1,743**

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	6-13-08 Rig count	6-13-08 Percent footage*	6-15-07 Rig count	6-15-07 Percent footage*
0-2,500	78	5.1	69	5.7
2,501-5,000	134	53.7	111	53.1
5,001-7,500	257	14.3	238	22.6
7,501-10,000	445	3.8	411	2.9
10,001-12,500	472	2.5	449	2.0
12,501-15,000	318	0.3	269	—
15,001-17,500	125	—	113	0.8
17,501-20,000	70	—	70	—
20,001-over	37	—	38	—
Total	**1,936**	**7.3**	**1,768**	**7.8**
INLAND	28		46	
LAND	1,852		1,659	
OFFSHORE	56		63	

*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]6-13-08	[2]6-15-07
	1,000 b/d	
(Crude oil and lease condensate)		
Alabama	15	19
Alaska	725	734
California	655	668
Colorado	44	39
Florida	5	5
Illinois	25	26
Kansas	94	101
Louisiana	1,360	1,318
Michigan	15	16
Mississippi	51	55
Montana	93	95
New Mexico	165	163
North Dakota	116	118
Oklahoma	173	170
Texas	1,349	1,356
Utah	46	50
Wyoming	146	147
All others	61	75
Total	**5,137**	**5,155**

[1]OGJ estimate. [2]Revised.

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

US CRUDE PRICES

$/bbl*	6-13-08
Alaska-North Slope 27°	106.81
South Louisiana Sweet	137.75
California-Kern River 13°	120.55
Lost Hills 30°	128.55
Wyoming Sweet	126.36
East Texas Sweet	130.75
West Texas Sour 34°	123.75
West Texas Intermediate	131.25
Oklahoma Sweet	131.25
Texas Upper Gulf Coast	127.75
Michigan Sour	124.25
Kansas Common	130.25
North Dakota Sweet	124.50

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

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

WORLD CRUDE PRICES

$/bbl[1]	6-6-08
United Kingdom-Brent 38°	125.47
Russia-Urals 32°	119.69
Saudi Light 34°	120.79
Dubai Fateh 32°	119.96
Algeria Saharan 44°	126.32
Nigeria-Bonny Light 37°	129.82
Indonesia-Minas 34°	127.97
Venezuela-Tia Juana Light 31°	122.26
Mexico-Isthmus 33°	122.15
OPEC basket	124.18
Total OPEC[2]	121.52
Total non-OPEC[2]	121.16
Total world[2]	121.36
US imports[3]	117.82

[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]

	6-6-08	5-30-08	6-6-07	Change, %
	bcf			
Producing region	660	650	810	–18.5
Consuming region east	959	905	1,080	–11.2
Consuming region west	267	251	339	–21.2
Total US	**1,886**	**1,806**	**2,229**	**–15.4**
	Mar. 08	**Mar. 07**	**Change, %**	
Total US[2]	**1,247**	**1,603**	**–22.2**	

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

World oil balance

	2007 4th qtr.	2007 3rd qtr.	2007 2nd qtr.	2007 1st qtr.	2006 4th qtr.	2006 3rd qtr.
	Million b/d					
DEMAND						
OECD						
US & Territories	21.00	21.03	20.97	21.07	21.09	21.25
Canada	2.37	2.38	2.28	2.34	2.29	2.31
Mexico	2.08	1.98	2.07	2.05	2.00	1.96
Japan	5.22	4.67	4.61	5.39	5.29	4.75
South Korea	2.31	2.06	2.12	2.35	2.32	2.04
France	2.00	1.93	1.85	1.97	1.95	1.93
Italy	1.72	1.63	1.67	1.69	1.71	1.68
United Kingdom	1.73	1.75	1.78	1.80	1.81	1.78
Germany	2.55	2.56	2.38	2.38	2.71	2.75
Other OECD Europe	7.60	7.52	7.25	7.35	7.55	7.46
Australia & New Zealand	1.12	1.09	1.07	1.09	1.10	1.07
Total OECD	**49.70**	**48.60**	**48.05**	**49.48**	**49.82**	**48.98**
NON-OECD						
China	7.87	7.59	7.52	7.33	7.45	7.17
FSU	4.32	4.22	4.32	4.25	4.36	4.27
Non-OECD Europe	0.79	0.73	0.78	0.85	0.78	0.72
Other Asia	8.93	8.64	8.83	8.74	8.80	8.52
Other non-OECD	15.02	15.30	14.99	14.71	14.47	14.71
Total non-OECD	**36.93**	**36.48**	**36.44**	**35.88**	**35.86**	**35.39**
TOTAL DEMAND	**86.63**	**85.08**	**84.49**	**85.36**	**85.68**	**84.37**
SUPPLY						
OECD						
US	8.56	8.40	8.53	8.43	8.40	8.38
Canada	3.32	3.35	3.33	3.42	3.39	3.31
Mexico	3.35	3.46	3.61	3.59	3.52	3.71
North Sea	4.57	4.28	4.49	4.80	4.76	4.51
Other OECD	1.57	1.56	1.54	1.50	1.55	1.55
Total OECD	**21.37**	**21.05**	**21.50**	**21.74**	**21.62**	**21.46**
NON-OECD						
FSU	12.66	12.55	12.60	12.61	12.48	12.26
China	3.86	3.87	3.96	3.92	3.81	3.85
Other non-OECD	11.38	11.40	11.20	10.88	11.22	11.37
Total non-OECD, non-OPEC	**27.90**	**27.82**	**27.76**	**27.41**	**27.51**	**27.48**
OPEC	**36.17**	**35.43**	**35.06**	**34.97**	**35.49**	**36.20**
TOTAL SUPPLY	**85.44**	**84.30**	**84.32**	**84.12**	**84.62**	**85.14**
Stock change	**–1.19**	**–0.78**	**–0.17**	**–1.24**	**–1.06**	**0.77**

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

OECD total net oil imports

	Feb. 2008	Jan. 2008	Dec. 2007	Feb. 2007	Chg. vs. previous year Volume	Chg. vs. previous year %
	Million b/d					
Canada	–1,334	–1,222	–1,277	–1,315	–19	1.4
US	10,531	1,869	11,484	10,795	–264	–2.4
Mexico	–1,160	–1,220	–1,258	–1,726	566	–32.8
France	1,681	2,081	1,941	1,960	–279	–14.2
Germany	2,079	2,392	2,310	2,361	–282	–11.9
Italy	1,328	1,509	1,701	1,714	–386	–22.5
Netherlands	912	1,033	1,215	1,014	–102	–10.1
Spain	1,558	1,677	1,627	1,670	–112	–6.7
Other importers	3,798	4,469	3,873	4,184	–386	–9.2
Norway	–2,206	–2,089	–2,297	–2,395	189	–7.9
United Kingdom	29	–129	–90	–165	194	–117.6
Total OECD Europe	**9,179**	**10,943**	**10,280**	**10,343**	**–1,164**	**–11.3**
Japan	5,426	5,444	5,727	5,382	44	0.8
South Korea	2,111	2,556	2,281	2,087	24	1.1
Other OECD	1,096	920	699	763	333	43.6
Total OECD	**25,849**	**29,290**	**27,936**	**26,329**	**–480**	**–1.8**

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

OECD* total gross imports from OPEC

	Feb. 2008	Jan. 2008	Dec. 2007	Feb. 2007	Chg. vs. previous year Volume	Chg. vs. previous year %
	Million b/d					
Canada	542	577	397	443	99	22.3
US	5,850	6,413	6,310	5,528	322	5.8
Mexico	30	31	40	30	—	—
France	616	868	925	821	–205	–25.0
Germany	409	467	484	352	57	16.2
Italy	1,100	1,318	1,306	1,316	–216	–16.4
Netherlands	391	774	774	556	–165	–29.7
Spain	671	654	691	797	–126	–15.8
Other importers	1,210	1,269	1,230	1,542	–332	–21.5
United Kingdom	316	183	273	251	65	25.9
Total OECD Europe	**4,713**	**5,533**	**5,683**	**5,635**	**–922**	**–16.4**
Japan	4,567	4,822	4,442	4,382	185	4.2
South Korea	2,280	2,472	2,490	2,080	200	9.6
Other OECD	762	603	740	701	61	8.7
Total OECD	**18,744**	**20,451**	**20,102**	**18,799**	**–55**	**–0.3**

*Organization for Economic Cooperation and Development.
Source: DOE International Petroleum Monthly
Data available in OGJ Online Research Center.

US petroleum imports from source country

	Feb. 2008	Jan. 2008	Average YTD 2008	Average YTD 2007	Chg. vs. previous year Volume	Chg. vs. previous year %
	1,000 b/d					
Algeria	384	636	514	672	–158	–23.5
Angola	350	578	468	522	–54	–10.3
Kuwait	266	239	252	170	82	48.2
Nigeria	1,025	1,191	1,110	1,120	–10	–0.9
Saudi Arabia	1,627	1,503	1,563	1,394	169	12.1
Venezuela	1,131	1,290	1,214	1,273	–59	–4.6
Other OPEC	1,067	976	1,020	586	434	74.1
Total OPEC	**5,850**	**6,413**	**6,111**	**5,737**	**404**	**7.0**
Canada	2,464	2,586	2,527	2,460	67	2.7
Mexico	1,327	1,307	1,317	1,538	–221	–14.4
Norway	100	86	93	117	–24	–20.5
United Kingdom	155	213	185	229	–44	–19.2
Virgin Islands	351	380	366	371	–5	–1.3
Other non-OPEC	2,356	2,507	2,434	2,481	–47	–1.9
Total non-OPEC	**6,753**	**7,079**	**6,922**	**7,196**	**–274**	**–3.8**
TOTAL IMPORTS	**12,603**	**13,492**	**13,063**	**12,933**	**130**	**1.0**

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

Oil stocks in OECD countries*

	Feb. 2008	Jan. 2008	Dec. 2007	Feb. 2007	Chg. vs. previous year Volume	Chg. vs. previous year %
	Million bbl					
France	176	182	180	178	–2	–1.1
Germany	273	278	275	292	–19	–6.5
Italy	129	136	133	135	–6	–4.4
United Kingdom	94	95	98	105	–11	–10.5
Other OECD Europe	683	692	674	676	7	1.0
Total OECD Europe	**1,355**	**1,383**	**1,360**	**1,386**	**–31**	**–2.2**
Canada	201	206	205	181	20	11.0
US	1,662	1,677	1,662	1,666	–4	–0.2
Japan	605	621	621	636	–31	–4.9
South Korea	149	155	143	147	2	1.4
Other OECD	111	108	106	103	8	7.8
Total OECD	**4,083**	**4,150**	**4,097**	**4,119**	**–36**	**–0.9**

*End of period.
Source: DOE International Petroleum Monthly Report
Data available in OGJ Online Research Center.

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Blame obsession won't change the price of gasoline

The US Constitution gives Congress plenty of work to perform. So why do lawmakers keep adding to their load?

In fact, the Constitution is notably specific in its expectations. In Section 8, it provides a long list of congressional powers and, by implication, responsibilities. The chores range from punishing pirates and maintaining a navy to passing laws.

The list's top item seems to be the favorite. It's the one about imposing taxes.

The Editor's Perspective

by Bob Tippee, Editor

Nowhere does the Constitution instruct representatives and senators to affix blame for the sour turns of events that occasionally befall the nation.

Yet lawmakers spend a lot of time on blame, especially when the sour turn of events involves the price of gasoline.

Since the landmark Gulf of Mexico hurricanes of 2005, lawmakers have been blaming oil companies for the gasoline price increases that so thoroughly anger so many of their constituents.

More recently, they have made "speculators" targets of high-price blame, along with regulators of commodities trading.

All this blame-fixing creates the illusion that Congress is doing something about gasoline prices. In reality, of course, there's little it can do that wouldn't make things worse.

Oil companies don't set the price of gasoline. Neither do speculators or trading regulators. Markets set oil prices. If blame must be assigned, economic arithmetic suggests it belongs to anyone who contributes extravagantly to demand or who in some way limits supply.

In the former category belong motorists who drive senselessly large vehicles, for example. The latter characterization applies chiefly to lawmakers who discourage oil and gas exploration with bans on federal leasing and other such folly.

But, of course, most people would rather bathe in hot oil than admit they're wrong. And complicity in national malaise represents no small offense.

So profligate consumers will probably stay angry at everyone else while their elected officials hold hearings, make pompous speeches, and point fingers. It's a self-reinforcing cycle of constitutionally protected delusion that excuses participants from the need to learn anything.

So they won't learn, no matter how deeply the policy mistakes they instigate hurt national interests. Who, after all, can blame them?

(Online June 13, 2008; author's e-mail: bobt@ogjonline.com)

Market Journal

by Sam Fletcher, Senior Writer

Angry officials mull market controls

Diplomatic and government policy responses appear to be coming to a head in a climate of accusations over high energy prices, said industry analysts.

"Some diplomatic, regulatory, or policy watershed is drawing near, or at least some venting of pent-up pressures is likely to manifest itself," said Paul Horsnell at Barclays Capital Inc., London. "At this moment, what is happening in Washington and elsewhere in terms of policy debates is as much a part of what [energy] traders need to be aware of as is supply and demand."

Horsnell noted "the provocative rhetoric" as UK Prime Minister Gordon Brown recently described the Organization of Petroleum Exporting Countries as a "scandal," while Australian Prime Minister Kevin Rudd spoke of applying "the blowtorch to the OPEC organization." Horsnell said, "It is fair to assume that so overt a stance does not facilitate constructive dialogue." Oil and gas producers have been "more discrete" in their language, but "it seems clear that they are beginning to lose some patience with the spread in the climate of rolling accusations," he said.

Meanwhile, analysts at Friedman, Billings, Ramsey & Co. Inc. (FBR), Arlington, Va., reported strong odds that the US Congress would pass a NOPEC bill (No Oil Producing and Exporting Cartels) for antitrust prosecution of OPEC members.

Horsnell cited "the continuing head of steam in Washington behind various potential market intervention measures. In particular, institutional investors seem ever closer to being placed in the regulatory crosshairs." However, he said, "We see institutional investment as a stabilizing and improving factor for commodities markets, and we believe that holding commodities has a valuable role to play within a balanced asset portfolio."

In addition, banning institutional holdings of commodities could lead to "some serious market distortions and volatility." Horsnell said, "A clumsy implementation could potentially create forced trading and generate chaotic conditions and very artificial prices in the short term. Such a development would in turn discourage what is already far too slow a rate of investment and delay demand reactions. Indeed, it is likely to lay the basis for another surge in prices once market conditions normalized, while leaving long-term investment lower than it would have been."

There is growing momentum in Congress to increase the authority of the Commodity Futures Trading Commission to allow interagency coordination, including working with the UK Financial Services Authority, said FBR analysts. There is growing support for requiring higher margins for crude oil trades and imposing position limits on noncommercial trades through swaps dealers. Strict limits or prohibitions on oil futures investment by sovereign wealth funds and their institutional investor partners are unlikely, FBR analysts said, but an investigation of potential conflicts of interest between research analysts who assess oil market conditions and institutional investors who buy oil futures is likely. There also is some support for barring further investment in oil by institutional investors, said FBR analysts.

Corn factor

In mid-June, Olivier Jakob at Petromatrix, Zug, Switzerland, discerned a possible "corn theme" in crude markets. "The US Midwest is currently suffering from historical flooding, and the corn crops are under threat. The prospect of lower corn supplies is pushing corn prices to record high levels, and expectations are growing for ethanol supplies to come under threat of falling margins (shares of ethanol producers are coming off the cliff)," he reported June 13.

Even before the mid-summer floods and the resulting run-up in corn prices, Jakob said, "Some states such as Texas were asking for a waiver on the ethanol mandate to alleviate the price pressure on corn. Following the floods, the pressure for an ethanol waiver could accelerate, and this could then be supportive for petroleum gasoline as the share of ethanol blending would be reduced."

Furthermore, Jakob said, "Crop damage and delays could be negative for diesel demand." As a result, the gasoline crack "was not only gaining vs. crude oil but was increasing while the heating oil crack was decreasing," he said. "The risk [of] buying gasoline on the flood trade is that an ethanol waiver would not be the only solution to attenuate any production shortage from the Midwest (94% of US ethanol production) as import of sugar-cane ethanol could also be substantially increased" via a waiver of the US import tariff on ethanol supplies from Brazil.

"The floods are also creating a potential risk on the safe operation of petroleum pipelines and refineries in the region, while barge traffic is being disrupted with portions of the Mississippi being closed," Jakob said.

(Online June 16, 2008; author's e-mail: samf@ogjonline.com)

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WELCOME

Welcome to the inaugural China Power Oil & Gas Conference & Exhibition held in the city of Guangzhou, Guangdong Province, at the economic centre of industrial south China.

This new and unique conference and accompanying trade show recognize the nexus that has formed at which growing Chinese demand for electric power meets its critical need to produce that power more cleanly. It will bring together Chinese and international expertize spanning the power, oil & gas and energy efficiency sectors through a twin track conference, co-located with an exhibition, showcasing the best in domestic and foreign technology and services.

China's burst of economic prosperity has prompted increased need for power generation. The result, in a land of massive coal reserves, has unfortunately been severe and extensive air pollution choking every large city. To clear its air, China must burn cleaner hydrocarbon fuels to produce power and boost renewable energy production. Although China's own efforts to produce cleaner fuels, especially natural gas for power generation, have increased rapidly, demand has outstripped supply. This has prompted proposals to bring in natural gas via pipeline from Central Asia and Siberia and via LNG.

The oil and gas elements of this conference focus on the general theme of oil and natural gas production, supply, transportation, and processing in the supply chain from supply source to power generation site. At the heart of this theme will be natural gas supplied to the country's power generation industries, even as China competes with other Asia-Pacific countries for fuel to generate power.

The conference will explore how China's market conditions themselves may evolve in ways that affect the supply of oil and natural gas for power generation and the impact of legal and regulatory conditions and will showcase particular Provinces' specific laws and regulations and how they encourage or discourage petroleum-based power development or demand.

Strategic sessions will examine China's policies to meet its growing need for electricity and to curb emissions as well as analyze the opportunities for investment in the sector and the legal framework under which investors must operate. The final day of the conference will be given over to the vital topic of energy efficiency in all its guises. This is a crucial component part of the machinery to tackle climate change and meet demand expectations. China has set itself challenging targets in the area of energy saving.

In terms of technology there is much interest in various environmental designs for LNG terminals to reduce their impact on air and water quality as well as on pipe-laying techniques and tools to limit damage to and enhance environmental recovery along a pipelines' rights-of-way (ROW). Leading industry experts will also present on the latest clean coal, boiler, gas turbine and environmental protection technologies.

In this Pre-Show Guide you will find all the information you need to plan your visit to China Power Oil & Gas including the preliminary conference programme, schedule of events, floor plan and exhibitor listing and registration form. Please refer to the event website www.chinapoweroilandgas.com for updates to the conference programme.

Speaking for the Advisory Board, we invite your participation in CPOG 2008 and hope you find the varied, high-level programme stimulating and practical.

We look forward to seeing you in Guangzhou.

Warren R. True, Ph.D.
Conference Director (Oil & Gas)
Chief Technology Editor- LNG/Gas Processing
Oil & Gas Journal

Nigel Blackaby
Conference Director (Power/ Energy Efficiency)
Associate Editor
Power Engineering International magazine
PennWell Corporation.

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WELCOME FROM CCCME

China Chamber of Commerce for Import & Export of Machinery and Electronic Products(CCCME) is the biggest association in foreign trade area in China (www.cccme.org.cn), and its main function is to bridge domestic and international industry include energy and power sector. At this important time for the Chinese power and energy industry, CCCME cordially invite you to attend a valuable industry exhibition:

China Power Oil & Gas Conference and Exhibition 2008 (CPOG) September 2nd - 4th, 2008

Pazhou Complex, Guangzhou, Guangdong Province, China

This important exhibition will be an in-depth and extensive presentation of products and services within the global power, energy and oil & gas industry, while demonstrating the rapid growth and endless potential of the Chinese markets.

Due to population growth and the development of numerous Chinese industries, China's demand has intensified drastically. Plans for new electricity and transmission plants have constantly been on the rise, creating countless business opportunities for investors, manufacturers and contractors. At the same time, it will grant numerous opportunities for private companies in the relevant field.

For anyone involved or wishing to be involved in the Chinese power, energy and oil & gas industry, CPOG 2008 is an indispensable opportunity. Through this event, industry business leaders will be able to present their current projects in addition to future needs, simultaneously displaying cutting-edge technologies and services. This exhibition is also a superb opportunity to meet relevant government officials, event organizers and possible business partners.

We urge and welcome your distinguished guests to visit this exhibition, and you can refer to www.chinapoweroilandgas.com for more information:

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Exhibition Director

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WHY THE NEED FOR CHINA POWER OIL & GAS?

The Zhujiang (Pearl) River Delta and its surrounding provinces are growing economically at a rate faster than any other region in the world. The region knows that without massive continued investment in its energy structure, energy shortages will act as a brake to continued growth. Consequently, there are estimated to be in excess of $100 billion of energy related projects on the table in this region right now seeking investment, equipment and technological expertize.

Driven both by edict from Central Government and the need to enhance the quality of life for all their citizens, the provincial governments of South China are serious about tackling the environmental impact of increased energy use. This will require huge investment in both environmentally friendly forms of generation as well as huge increases in energy efficiency on the demand side.

China's population increases year on year by 21 million people. Economic forecasts remain consistently strong for China. GDP growth is expected to be 11.4 per cent in 2007 and is forecast to be 10.1 per cent in 2008 and 9.2 per cent in 2009. Inflows of foreign direct investment into China totalled $86.1 billion in 2005, a new record and roughly double the level of 2001.

China has proven oil reserves of 2.2 billion tonnes (t), natural gas reserves of 2.3 trillion m^3 and coal reserves of more than 1 trillion tonnes. China is now the world's second largest importer of oil, after the US. Its demand for oil has doubled over the past decade to 6.75 million barrels/day and the US Energy Information Administration projects this will reach 10.9 million barrels/day by 2025. According to the government, during the 11th Five Year Plan (2006-2010) the country's oil production will increase from 900 million tonnes to 1 billion tonnes per annum.

At the end of 2005, China had an installed generating capacity of about 622 GW.

Coal remains the dominant source for power generation and will continue to be so for the foreseeable future although its share will fall to about 64 per cent (from the current 75 per cent) by 2020, due to environmental concerns.

China is also increasing its installed capacity of gas fired generation. In 2002, the installed capacity of gas turbines and combined cycle plants totalled about 5000 MW. By 2020 this figure is expected to reach 60 GW representing about six per cent of the total installed capacity.

As organizers of CHINA POWER OIL & GAS, PennWell Corporation's leading role and contacts in the energy related international exhibitions and conferences field including the POWER-GEN series of conferences and exhibitions, **Power Engineering International** magazine, the **Oil & Gas Journal** along with a large number of other events and publishing ventures, uniquely positions the company to bring the international energy sector directly to this exciting market.

WHY GUANGDONG/ WHY GUANGZOU?

More than 60,000 foreign enterprises have gone into business in the Guangdong province since 1979.

Guangdong is nationally number 1 in GDP, urban population income, retail sales, exports imports and ownership of motorcycles and air conditioners. Hong Kong accounts for 2/3 of firms investing in the province.

Rapid economic growth has resulted in an energy supply gap and serious environmental protection problems for Guangdong Province. Guangdong's energy consumption reached 110 million tonne of coal equivalents by the year 2005 and will reach 150 million tonne by 2010. The province is expected to gradually reduce its reliance on small coal fired power plants replacing them with large clean coal and gas fired power plants for the sake of environmental protection.

- The economies in South China have grown at an unprecedented rate. For example, the Guangdong economy alone has grown more than 60 times over since 1980.
- Nearly 40 per cent of all China's trade is now generated in Guangdong, Fujian and other southern provinces. Guangdong province now accounts for 40 per cent of China's import and exports.
- The seaports of the greater Pearl River Delta now handle one container, every second of every hour of every day - 365 days a year.

WHY GUANGZHOU?

China's third largest city, Guangzhou is the capital city of the province of Guangdong. Located at the north of the Zhujiang (Pearl) River Delta, Guangzhou has already become South China's centre of commerce, finance, communication, culture, science and technology.

From 1980 to 1993, Guangzhou's GDP increased by an average of 13.98 per cent annually, and its financial revenue increased by an average of 16.4 per cent annually. In recent years, Guangzhou's economic strength is growing steadily, ranking third in the nation. The steady and fast growth in economy has increased Guangzhou's development force and has enhanced its regional position, thus making it one of the China's major cities.

In September 2007, PennWell organized China's Energy Future, a two-day conference in Guangzhou, which set the scene for CHINA POWER OIL & GAS. The 300 delegates that gathered for the conference were addressed by municipal and state leaders particularly from China's southern provinces, who defined the scale of the task that the country faces and invited foreign investment and technical expertise to partner in future projects that would serve to meet the country's needs. China's Energy Future proved conclusively that there was a need for a major global forum to seriously address China's current and future energy needs.

There are no comparable events to CHINA POWER OIL & GAS that address such a broad range of energy technologies at a strategic and technical level and attract such a high level of senior management and decision makers from the Chinese and international business community.

With the active support of CCCME and other organizations based in China and the region, CHINA POWER OIL & GAS is set to become the pre-eminent energy forum for the international power, petroleum, oil and gas community to interact with their counterparts in China.




CHINA'S 11TH FIVE-YEAR PLAN

The 11th five year plan for national economy and social development is based on an all-around development strategy of economic growth, construction of a political civilization, cultural and social construction. Unlike previous five-year plans, it is no longer an instruction but a blueprint made by the government.

After three decades of rapid growth at 9.5 per cent on annual rate, China's GDP is the 4th largest and its international trade is the 3rd largest in the world. As a result, the demand for energy has dramatically increased and China's economy is still not efficient enough to maintain the high growth. Therefore China needs relatively more energy. In the first half of 2006 China's imports of crude coal, crude oil and refined oil increased by 51%, 15.6% and 16.1% respectively. Unfortunately China's high growth has been achieved at a cost to the environment. As a result the government has committed to build a conserving and environmentally friendly economy in its 11th five-year plan.

SCHEDULE OF EVENTS

MONDAY 1ST SEPTEMBER 2008

Registration	**12:00 - 17:00**

TUESDAY 2ND SEPTEMBER 2008

Registration	**08:30 - 18:00**
Opening Keynote Session	09:30 - 11.00
Ribbon Cutting Ceremony	11:00 - 11.15
Exhibition	11:15 - 18:00
Conference Session 1	13:30 – 15:00
Delegate Networking Break	15:00 – 15:30
Conference Session 2	15:30 – 17:00
Networking Reception	16:30 - 18.00

WEDNESDAY 3RD SEPTEMBER 2008

Registration	**08:00 - 18:00**
Conference Session 3	09:00 – 10:30
Exhibition	10:00 - 18:00
Delegate Networking Break	10:30 – 11:00
Conference Session 4	11:00 – 12:30
Delegate Lunch	12:30 – 14:00
Conference Session 5	14:00 – 15:30
Delegate Networking Break	15:30 – 16:00
Conference Session 6	16:00 – 17:30

THURSDAY 4TH SEPTEMBER 2008

Registration	**08:00 - 17:00**
Conference Session 7	09:00 – 10:30
Exhibition	10:00 - 17:00
Delegate Networking Break	10:30 – 11:00
Conference Session 8	11:00 – 12:30
Delegate Lunch	12:30 – 14:00
Conference Session 9	14:00 – 15:30

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CONFERENCE GRID OVERVIEW

09:30 - 11:00	Keynote & Session	
12:00 - 13:30	Delegate Lunch	
SESSION 1 13:30 - 15:00	Securing Energy Supply Sources	Clean Coal Power Generation Options
SESSION 2 15:30 - 17:00	Fuel Suppliers - Strategies & Case Studies	Boiler Technologies
SESSION 3 09:00 - 10:30	Chinese Energy Policy: Meeting the Needs of Power Provision	Offshore Oil & Gas Technology
SESSION 4 11:00 - 12:30	The Legal Framework for Chinese Energy Enterprises	Gas Turbine Technologies & Advanced Technology Transfer
SESSION 5 14:00 - 15:30	Financing & Investment - Encouraging FDI in Chinese Energy Projects	Environmental Protection Technologies
SESSION 6 16:00 - 17:30	Energy Strategies to Combat Climate Change	Renewable Energy Technology & Distributed Generation Options
SESSION 7 9:00 - 10:30	The Fifth Energy: Energy Efficiency - Opportunities & Challenges	
SESSION 8 11:00 - 12:30	Energy Efficiency - Case Studies	
SESSION 9 14:00 - 15:30	Investment & Project Financing for Energy Efficiency Projects - A Panel Discussion	

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President
American Chamber of Commerce
South China
P.R. China

Mr. Colin Tam
CEO
Ashmore Energy International Asia Ltd.
Hong Kong S.A.R.
P.R. China

Mr. Warren True
Chief Technology Editor
LNG/Gas Processing - Oil & Gas Journal
PennWell Corporation
USA

Mr. Dominic Yin
Chairman & CEO
Greater China Environmental Protection Ltd
EESCO P2E2 Hong Kong Ltd.
EPPA Enterprises Ltd.
Hong Kong S.A.R.
P.R China

Mr. Jie Zhang
CEO
China Energy Investment Net
P.R. China

Mr. Zi Hua Zhou
Director of Hi-Tech and Investment Department
People's Government of Hainan Province Hainan Industry and Information Technology Bureau
P.R. China

CONFERENCE PROGRAMME
TUESDAY 2ND SEPTEMBER

Keynote Session: 09:30 – 11:00
Co-Chair: Nigel Blackaby, Conference Director, PennWell Corporation, UK

Co-Chair: Warren R. True, Chief Technology Editor--LNG/ Gas Processing - Oil & Gas Journal, PennWell Corporation, USA

Harley Seyedin, President, American Chamber of Commerce, South Asia and CEO, First Washington Group, P.R. China
* Wolfgang Dehen, Member of the Managing Board & CEO of the Energy Sector, Siemens AG,Germany
* Colin Tam, CEO, Ashmore Energy International Asia Ltd, Hong Kong S.A.R, P. R China

Other keynote speakers to be confirmed

Session 1: 13:30 – 15:00
Strategic Track: Securing Energy Supply Sources
Chair: Warren R. True, Chief Technology Editor--LNG/Gas Processing - Oil & Gas Journal, PennWell Corporation, USA

Overview of the Chinese oil and gas picture with a focus on supply and demand for power generation
John H. Vautrain, Vice-President and Director, Purvin & Gertz Inc, Singapore

Tile to be confirmed
Dr. Kang Wu, Managing Director, USA, FACTS Global Energy, USA

Title to be confirmed
Warren R. True, Chief Technology Editor--LNG/Gas Processing - Oil & Gas Journal, PennWell Corporation, USA

Other presentations to be confirmed

Technical Track: Clean Coal Power Generation Options
Chair: Joel Laykin, Secretary General, IPPF, Hong Kong S.A.R., P.R. China

IGCC – More Efficient Power Generation for China from Cleaner Coal
B. Jason Crew, Product Line Manager, GE Energy, USA

Improved efficiency through new technologies meets the governmental goals
Dieter Launert, General Manager, Siemens Ltd. China, P.R. China

Emerging IGCC Strategies for Polygeneration and Carbon Capture
Alex Klein, Senior Analyst, Emerging Energy Research, USA

Session 2: 15:30 – 17:00
Strategic Track: Fuel Suppliers – Strategies & Case Studies
Chair: TBC

* Representative from BP Global
* Representative from Exxon Mobil
* Representative from Shell, Chevron or Total

Technical Track: Boiler Technologies
Chair: * Mike Emmerton, Managing Principal, PB Power , Hong Kong S.A.R., P.R. China

Development of ultra supercritical CFB technology to meet the challenge of climate change
Prof. Jianxiong Mao, Consultant, Foster Wheeler, P.R. China

Co-Author:
Arto Hotta, Foster Wheeler Energia Oy, Finland

Selecting Tubing Materials for Power Generation Heat Exchangers
Daniel Janikowski, Corporate Technical Sales Manager, Plymouth Tube Company, USA

Boiler air flow measurement technology
*David Dunn, Air Monitor, P.R. China

Also Invited
boxfish22* Representative from Alstom

* Representative from Foster Wheeler

* Invited/To be confirmed

CONFERENCE PROGRAMME
WEDNESDAY 3RD SEPTEMBER

Session 3: 09:00 – 10:30
Strategic Track: Chinese Energy Policy: Meeting the Needs of Power Provision

Chair: Nigel Blackaby, Conference Director, PennWell Corporation, UK

The speakers invited are:

* Shen Zhongmin, Managing Director - China, CLP, P.R. China
* Roger Goh, Executive Director, Golden Concord Holdings Limited, Singapore
* William H. Overholt, Director, RAND Center for Asia Pacific Policy; Center for Asia Pacific Policy Chair in Asia Policy Research, Rand Corporation, USA

Technical Track: Offshore Oil & Gas Technology

Chair: Warren R. True, Chief Technology Editor--LNG/Gas Processing - Oil & Gas Journal, PennWell Corporation, USA

Application of Mid Range LNG Process to Small Scale Liquefaction
Simon Newton, Managing Director Asia, Energy & Power Ltd, Hong Kong S.A.R., P.R. China

Co-Author:
Brian Songhurst, Energy & Power Consultants Ltd, UK

Utilization of Atmospheric Heat Exchangers in LNG Vaporization Systems
Tom Dendy, Global Market and Application Development, SPX Thermal Equipment, USA

Co-Author:
Rajeev Nanda, Technip, USA

Deepwater concepts for offshore development in South China Sea
Dr. Shukai Wu, President, Enertech Services Intl Inc, USA

Co-Author:
Dr. Charles Liu, ESI China, P.R. China

State of the Art Riser Solutions for Oil and Gas Production in Shallow and Ultradeepwater Environments
Dr. Zhimin Tan, Principal Technology Leader, Wellstream International, USA

* Invited/To be confirmed

Session 4: 11:00 – 12:30
Strategic Track: The Legal Framework for Chinese Energy Enterprises

Chair: David C. Buxbaum, Partner, Anderson & Anderson LLP, Macau S.A.R., P.R. China

Chinese Draft Energy Law: Policy Issues, Options and Directions
David Renton, Partner, Baker Botts, Hong Kong S.A.R., P.R. China

Technology Transfer in Hydro Power Plant
Mohammad Sadegh Eslamipour, Project Manager, Mapna Generator, Iran

Quangdong's Energy Conservation Policies & Regulations
* Ou Jun, Deputy Secretary-General of Guandong Association of Environmental Protective Industry, Deputy Director of Guangdong Cleaner Production Center, P.R. China

Policy & Regulations of Energy Economics
* Lin Boqiang, Director of China Energy Economics Research, Xiamen University, Fujian Province, P. R. China

Policies of Energy Efficiency in China
* Dai Yande, Deputy Director of Energy Research Institute of NDRC & Founder Chairman of Energy Efficiency Strategies Allience, P. R. China

Technical Track: Gas Turbine Technologies & Advanced Technology Transfer

Chair: TBC

Benefits of Gas Turbine Efficiency Water Wash Systems
Tom Wagner, Technical Director, GTE Inc., USA

Power Generating Technologies to meet
Lutz Kahlbau, General Manager, SIEMENS Ltd. China, P.R. China

Title to be confirmed
* Dennis J. Ryan, Associate Vice President & Director of Asia Sales and Business Development, Black & Veatch, Thailand

CONFERENCE PROGRAMME
WEDNESDAY 3RD SEPTEMBER

Session 5: 14:00 – 15:30
Strategic Track: Financing & Investment – Encouraging FDI in Chinese Energy Projects
Chair: *Colin Tam, CEO, Ashmore Energy International Asia Ltd., Hong Kong S.A.R., P.R. China

The speakers invited are:
* Mike Kershaw, Global Head of China International Business Development, HSBC, Hong Kong S.A.R., P.R. China
* Hisaka Kimura, Investment Specialist (Infrastructure), ADB, P.R. China
* Harley Seyedin, President , American Chamber of Commerce, South Asia and CEO, First Washington Group, P.R. China
* Representative from China Light & Power
* Justin Yifu Lin, Director, China Center for Economic Research, P.R. China
* Representative from J. Power

Technical Track: Environmental Protection Technologies
Chair: TBC

Assessing the impact of adding pollution control equipment
Greg Kosowski, Vice President, TRAX, LLC, USA

Micro-Algae from Coal Fired Plants CO_2 Emissions
Thomas Byrne, CEO, Byrne & Company Limited, USA

Trace Level Mercury Removal by a New Biological and Chemical Process
Yanguo Ma, Technologist, GE Water and Process Technology, USA

Co-Authors:
Tim Pickett, GE Water and Process Technology, USA
Jill Sonstegard, GE Water and Process Technology, USA

Water recovery and generation in power plant cooling systems Tom Dendy, Global Market and Application Development, SPX Thermal Equipment, USA

Co-Author:
Dr. Bing Ting, SPX Cooling Technologies, USA

Session 6: 16:00 – 17:30
Strategic Track: Energy Strategies to Combat Climate Change
Chair: TBC

Overview of the renewable industry within the Chinese power sector
*Li Junfeng, Dep. Director General, Energy Research Institute of NDRC & General Secretary of Chinese Renewable Energy industries Association
* Representatives from Aggreko
* Representatives from Caterpillar

Other invited speakers:
* Hubert Wang Tose, Senior Vice President, International Environmental Trading Group, Hong Kong S.A.R., P.R. China
* James McGuire, Managing Director - Infrastructure, Marsh, Hong Kong S.A.R., P.R. China

Technical Track: Renewable Energy Technology & Distributed Generation Options
Chair: *Jeffrey J. Greene, Partner, DLA Piper, P.R. China

Title to be confirmed
*Jorg Mahler, Managing Director, TÜV Rheinland Hong Kong Ltd., Hong Kong S.A.R., P.R. China

Wind technology options available from Goldwind and their suitability and application in China and overseas
* Wu Gang, CEO, Golwind, P.R. China

Title to be confirmed
* Thorbjørn N. Rasmussen, President, Vestas Asia Pacific A/S, Singapore

Wind Maping
*Steven T. Cashen - Director, International Market Development, 3TIER Group, USA
* Invited/To be confirmed

ENERGY EFFICIENCY
MORE URGENT THAN EVER

The final day of the conference has been dedicated to the vital topic of energy efficiency in all its guises. This is a crucial component part of the machinery to tackle climate change and meet demand expectations. China has set itself challenging targets in the area of energy saving.

Under the pressure of climate change, sustainable development and energy security, energy efficiency - the fifth energy besides coal, petroleum, natural gas and renewable energy - is now more urgent than ever, especially in China.

Despite its limited energy reserves per capita, China has experienced increased energy consumption and intensified environmental pollution leading to evidence of climate change, such as desertification. China's leaders have recognized the urgent need for the country to take immediate actions to shape its clean energy future in which energy efficiency is the focus.

The Chinese government has given priority to energy efficiency in China's National Energy Plan 2020 and "The 11th Five-Year Economic Plan". It has also published Energy Conservation Law and established the National Energy Bureau. China has set a unit energy consumption reduction target of 20 per cent for the five-year period from 2006 to 2010 - but the country is already well behind schedule.

Some national or local NGOs are actively involved in China's energy conservation efforts as well. These include the Energy Conservation Service Industry Committee of China Energy Conservation Association (EMCA) and the Energy Saving Cooperation Alliance (ESCA), along with the newly established Hong Kong Association of Energy Service Companies (HAESCO).

The Chinese government has launched an energy saving drive and is promoting energy efficiency in society. Just this year, provincial governments will be required to install 50 million energy efficient light bulbs. Energy efficiency business opportunities in China will be significant both in terms of investment and equipment. China Power Oil & Gas recognizes this important aspect of China's energy strategy and devotes the third day of the conference to the topic of energy efficiency. This will be a unique opportunity to better understand the challenges and opportunities facing this vital sector.

Key China Facts

- Coal, oil, and natural gas reserves per capita in China are 1/2, 1/10, and 1/20 of the global average.
- China faces a shortage of oil and natural gas supply in the long term.
- Energy consumption is responsible for 80 per cent of the total discharge of SO_2 and particulates
- Acid rain affects more than one third of the country's total area.
- More than 90 per cent of the coal fired power plants have not installed desulphurization unit.

CONFERENCE PROGRAMME
THURSDAY 4TH SEPTEMBER

Session 7: 09:00 – 10:30
The Fifth Energy: Energy Efficiency – Opportunities & Challenges

Chair: Dominic Yin, Chairman & CEO, Greater China Environment Protection Ltd., EESCO P2E2 Hong Kong Ltd., EPPA Enterprises Ltd., Hong Kong S.A.R., P.R. China

Kyoto Protocol & China
* Vladimir Kozharnovich, Project Manager, UNIDO, Austria

Title to be confirmed
Representative from McKinsey & Co

China's Energy Efficiency Market & Investment Opportunities
* Jie Zhang, CEO, China Energy investment Net, P.R. China

Session 8: 11:00 – 12:30
Energy Efficiency – Case Studies

Chair: Dominic Yin, Chairman & CEO, Greater China Environment Protection Ltd., EESCO P2E2 Hong Kong Ltd., EPPA Enterprises Ltd., Hong Kong S.A.R., P.R. China

An innovative program in cooperation with local government authorities to support EE projects
* Shumao Wang, Director, ESCA, P.R. China

Title to be confirmed
* Raymond Fong, Senior Consultant, HKPC, Hong Kong S.A.R., P.R. China

Successful case studies by using the financial grants of World Bank
* Li Gang, Chairman, Liaoning Nengfa Wei Ye Group, P.R. China

The successful cases of EE projects in Taiwan
* Dr. Dennis Wong, TAESCO & Energy Conservation Center of Taiwan Green Foundation, Taiwan

Energy Efficiency Project case in China
Speaker to be confirmed

Fuel Demand Model for Saudi Aramco's 3rd Party Cogeneration Plants
Ahmed Al-Harbi, Sr. Process Engineer, Saudi Aramco, Saudi Arabia

Co-Author:
Walyoddin Asaad, Saudi Aramco, Saudi Arabia

Session 9: 14:00 – 15:30
Investment & Project Financing for Energy Efficiency Projects – A Panel Discussion

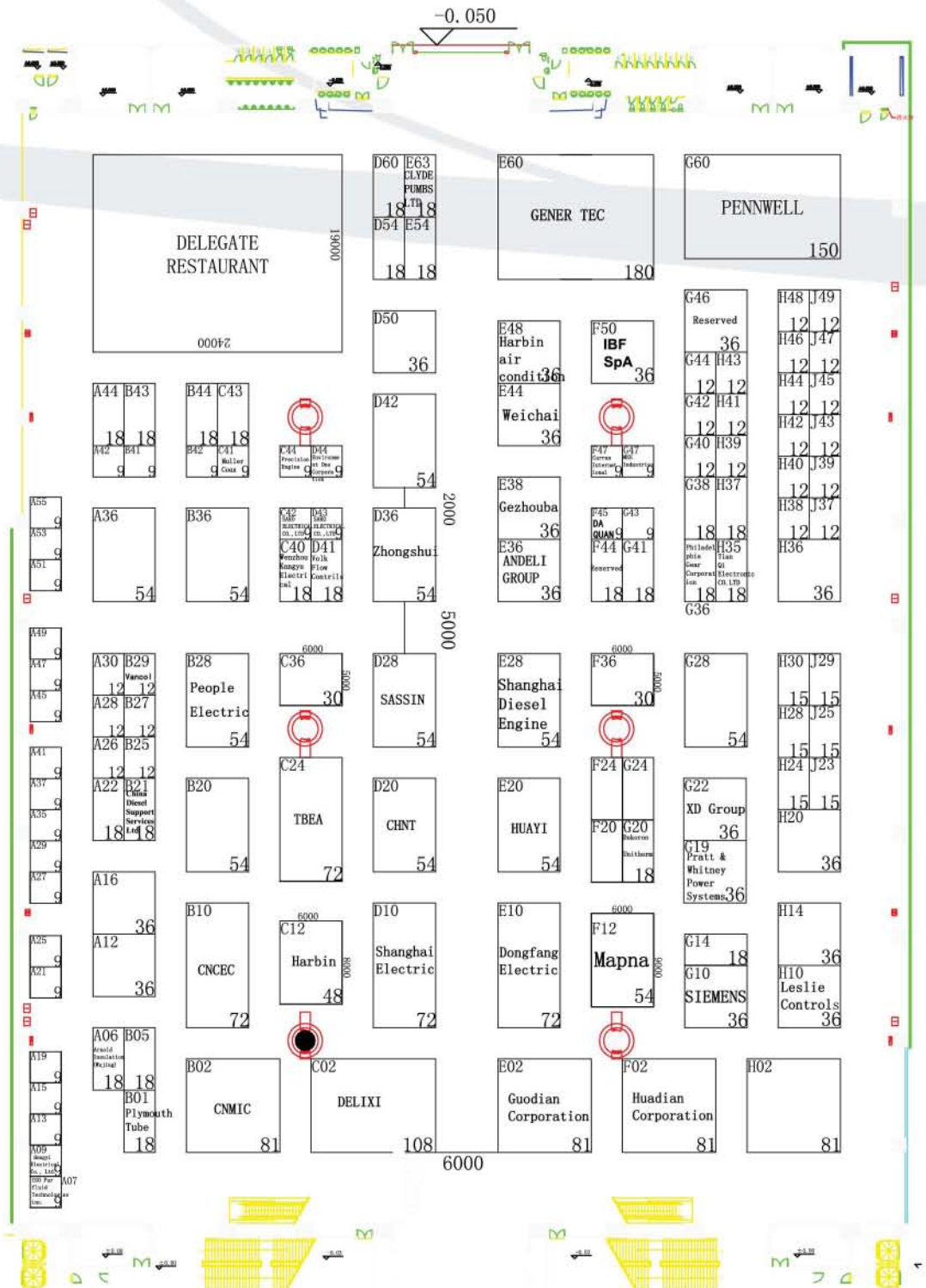
Chair: Jie Zhang, CEO, China Energy Investment Net, P.R. China

* Calvin Xu, Senior Operations Officer &. CHUEE Program Manager, IFC, P.R. China
* Zhu Li Yong, Corporate Manager Corporate Banking Department, Industrial Bank, P.R. China
* Kenichiro Seto, Chief Representative, JBIC, Hong Kong S.A.R., P.R. China
* Sun Hong, Chairwoman of the Board, Shandong Rongshihua Leasing Co Ltd, P.R. China
* Water Chen Yang, Energy Efficiency Manager, Schneider Electric (China) Investment Co.Ltd., P.R. China
* Representative from HSBC
* Invited / To be confirmed

EXHIBITOR LIST As of 19-05-08

COMPANY	STAND
Andeli Group	E36
Arnold Insulation (Wujing)Co.,Ltd.	A06
Cable USA	G20
China Diesel Support Service Ltd.	B21
China Hengyi Electrical Co., Ltd.	A09
CHNT	D20
Clyde Pumps Technology (Beijing) Co., Ltd	E63
CNCEC	B10
CNMIC	B02
Curran International	F47
DaQuan Electric Co., Ltd	F45
Dekoron - UniTherm	G20
Dekoron Wire & Cable Asia	G20
Delixi	C02
Dongfang Electric	E10
Environment One Corporation	D44
Gener Tec	E60
Gezhouba	E38
Guodian Corporation	E02
Harbin	C12
Harbin Aircondition	E48
Huadian Corporation	F02
HUAYI	E20
IBF SpA	F50
ISOPur Fluid Technologies	A07
Leslie Controls	H10
MAPNA Group	F12
MEE Industries	G47
Muller Coax Shanghai	C41
PennWell Booth	G60
People Electric	B28
Philadelphia Gear Corporation	G36
Pitco	F20
Plymouth Tube Company	B01
Pratt & Whitney Power Systems	G19
Precision Engine	C44
Sako Electrical Co.,Ltd	C42 & D43
SASSIN	D28
Shanghai Diesel Engine Co., Ltd	E28
Shanghai Electric	D10
Siemens AG	G10
TBEA	C24
Volk Flow Controls Inc	D41
Weichai Power Co.,Ltd	E44
Wenzhou Kangyu Electrical	C40
XD Group	G22
YUEQING VANCOL IMP&EXP CO.,LTD.	B29
ZheJiang TianQi Electric CO.LTD	H35
Zhongshui	D36

EXHIBITION FLOORPLAN



THE VENUE

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Traffic Guide to Pazhou Complex

Taxi

Depart from Guangzhou Railway Station/Chinese Export Commodities Fair (Pazhou) Complex, fare: approx RMB 60

Depart from New Baiyun Airport, fare: approx RMB 200

Depart from Guangzhou East Railway Station, fare: approx RMB 40

Metro Line1: Guangzhou East Railway Station-Xilang

Route: Guangzhou East Railway Station, Tianhe Sports Center, Tiyu Xi Road, Yangji, Dongshan Kou, Lieshi Lingyuan (Guangzhou Martyrs' Cemetery), Nong Jiang Suo (Peasants' Movement Institute), Gongyuan Qian (People's Park), Xi Menkou (West Gate), Chenjia Ci (Chen Clan Academy), Choushou Road, Huangsha, Fangcun, Huadi Wan, Kengkou, Xilang (Xilang Metro Station: 6:00-22:30; Guangzhou East Railway Station Metro Station: 6:18-23:00)

Metro Line 2: Sanyuan Li-Pazhou

Route: Sanyuan Li, Guangzhou Railway Station, Yuexiu Park, Jinian Tang (Memorial Hall), Gongyuan Qian (People's Park), Haizhu Square, Shi Er Gong (2nd Worker's Palaze), Jiangnan Xi, Xiao Gang, Sun Yan-Sen University, Lujiang, Chigang, Modiesha, Xingang Dong, Pazhou (Xiaogang Metro Station: 6:00-22:28; Sanyuan Li Metro Station: 6:16-23:03)

CHINA POWER OIL&GAS

REGISTRATION FORM

2- 4 September 2008
Pazhou Complex
Guangzhou, China

CODE: CPOG08PRESHOW

PLEASE COMPLETE IN BLOCK LETTERS

First Name:..... Last Name:.....

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1. Please indicate your primary job function (check one only)

- ☐ 02 Company Management (CEO, Pres, VP. Partner, Director, Manager, etc.)
- ☐ 03 Manager/Supervisor
- ☐ 04 Engineer (Design, Planning & Specify, Consulting)
- ☐ 05 Engineering / Technical / Geoscience
- ☐ 06 Operations & Maintenance
- ☐ 14 Sales/Marketing
- ☐ 16 Consultant
- ☐ 98 Other (please describe)

_____

2. Please indicate your firm's primary business activity (check one only)

- ☐ 05 Electric Utility or Power Generation Company
- ☐ 09 IPP Industrial/Cogeneration
- ☐ 10 Oil/Gas Company - Integrated, State-Owned, Independent
- ☐ 18 Original Equipment Manufacturer Specifier
- ☐ 20 Consulting Company engaged in projects or providing services for an oil and/or gas company
- ☐ 30 Contractor
- ☐ 40 Engineering/Construction
- ☐ 43 Government Energy Department
- ☐ 50 Financial
- ☐ 60 Service/Supply
- ☐ 65 Government/Library/Education
- ☐ 89 Consulting Engineer or Constructor Firm
- ☐ 60 Equipment Supplier
- ☐ 61 Energy Association
- ☐ 62 Energy Trader
- ☐ 63 Equipment Operation & Maintenance
- ☐ 64 University/Research Centre
- ☐ 98 Other (please describe)

_____

3. Please indicate all your areas of interest

- ☐ 00 Production
- ☐ 01 Thermal Plants
- ☐ 02 Hydro Plants
- ☐ 03 Renewable Energy
- ☐ 04 Nuclear
- ☐ 05 Waste to Energy
- ☐ 06 Drilling
- ☐ 07 Transmission & Distribution
- ☐ 10 Exploration
- ☐ 12 Information Technology
- ☐ 29 Gas Processing
- ☐ 23 Pipeline/ Transportation
- ☐ 15 Refining
- ☐ 19 Petrochem
- ☐ 39 Financial/ Business Issues
- ☐ 98 Other

_____

4. Purchasing Role: ☐ Specify ☐ Recommend ☐ Approve ☐ None

For Information on corporate packages, contact
Linda Adams
Phone: +1 918 832 9294
Email: lindad@pennwell.com

3 ways to register:

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2
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3
Mail:
PennWell C&E Registration (CPOG) P.O. Box 973059
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· Conference Proceedings

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Advances in technology are enabling coiled tubing drilling to gain wider acceptance in the Lower 48 after being mainly relegated to Alaska's North Slope and Canada for years. *Photos courtesy of Baker Hughes INTEQ.*

Oil & Gas Journal's Technology Forum series, produced by the OGJ Group Publisher, supplements the magazine with topical features on cutting-edge technology, services, and equipment, all expertly written from the technology provider's perspective. Inquiries should be directed to Bill Wageneck, Group Publisher, at billw@pennwell.com.

Safety, staff top drilling concerns

Advanced technologies continue to make an impact on the global oil and natural gas drilling sector.

But in the end, the top issues for drilling contractors and the service and supply companies that support them remain the same as they have in recent years: safety performance and the lack of qualified personnel.

Skills shortages

John W. Lindsay, 2008 chairman of the International Association of Drilling Contractors (IADC) and executive vice-president, US and international operations, Helmerich & Payne International Drilling Co., is focused on the attraction and retention of quality personnel as a critical issue facing the industry today.

"There is more experience retiring from the industry than we are replacing with new employees, and, of course, the new employees don't have the same knowledge base," he says. "There are some advantages inherent in the new employees because they have different skill sets, new ideas, and don't carry some of the old habits that have resisted new and improved practices in the past. Our challenge is to incorporate these new personnel and skills into collaborative organizations that will lead our industry onto the paths forward."

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— John Lindsey, Helmerich & Payne, 2008 IADC chairman

The ability to place qualified personnel is the biggest challenge faced by the industry today, claims George Sutherland, Southern Region US manager for Halliburton's Sperry Drilling & RST Global Operations Business.

"Growth in demand for drilling rigs and services is outpacing our ability to place qualified personnel within the workforce," he points out. "The industry pays a high price due to rig inefficiencies, nonproductive time, and poor safety performance. Hiring and training efforts are constantly being upgraded to meet the challenge. The industry is also taking evaluation of personnel much more seriously through core competency testing programs."

Personnel development has always enjoyed a priority at H&P, Lindsey says.

"Since 1998, we have raised the level of efforts and results by building new rigs with the latest technology and safety-by-design to attract the best personnel," he says. "In addition to the new rigs, we have also designed a training facility, known as the Personnel Development Center, in Houston that shares a common location with our new FlexRig assembly facility. Both new and experienced rig personnel spend several weeks learning about safety, leadership, team building, and rig equipment. This initial training is a long-term investment in our personnel with the objectives of working safely and efficiently for our customers."

Drilling safety

There is some debate about whether or not the drilling industry is improving its safety record. In the Feb. 26, 2007, *Oil & Gas Journal Technology Forum: Drilling Technology,* several industry experts interviewed noted that IADC statistics showed that drilling safety performance had been flat in recent years.

"I think the fact that [accident levels] have remained flat in the face of reducing experience levels is probably a good testimony to the efforts that contractors are putting into safety programs," says Mark Thomas, Halliburton fixed-cutter product manager. "Certainly rig automation will also help to improve safety records in the future."

In Atwood Oceanics' experience, technology has not been a good indicator for safety performance, contends Alan Quintero, vice-president, engineering: "Safety performance is driven more by 'soft' factors such as culture and simple, effective management systems."

He adds, "I believe a return to basics in safety such as behavior-based programs, good supervision and training, etc., will have a bigger impact on safety performance than technological innovations."

Sutherland contends that "a global standard and culture

change is required from an increasingly mobile, global workforce" to bolster the industry's drilling safety performance.

But Lindsey disagrees that safety performance has flattened in recent years, noting that man-hours worked in the US land drilling sector have doubled in the past 5 years.

The IADC total recordable rate has gone from 5.83 to 4.31 in the US land sector from 2003 to 2008 year-to-date—down 25% since 2003—even with man-hours increasing from 50 million in 2003 to 100 million in 2007, he says.

"I believe new rig technology and improved training are the catalysts for this performance improvement," he explains. "With the addition of 300 new rigs and 400 refurbished rigs, a large portion of the fleet has safety designed into the rigs that didn't exist previously.

"In addition to better rigs, industry training has improved, creating an expectation for many contractors that 'incident-free' operations are possible. A reality of today's workforce is that 22-year-olds are not willing to work in an industry where the expectation is that he or she has a high probability of being injured in the first 12 months of work. The industry is getting better at safety, and along with that reputation, a cycle of success will continue to encourage better results into the future."

Lindsey has made the safety challenge the top priority for his vision for IADC.

"Improving industry safety is a cornerstone of [IADC's] mission," he notes. "The decision to operate safely is the most important decision companies make. Everything else is secondary; because if we can't do it safely, we shouldn't do it at all."

"I believe a return to basics in safety such as behavior-based programs, good supervision and training, etc., will have a bigger impact on safety performance than technological innovations."

— Alan Quintero, Atwood Oceanics

Lindsey believes that safety success is accomplished by the collaboration of all segments of IADC—E&P companies, drilling contractors, and oil field service firms—working to drive industry recordable rates down.

"Finally, we all are faced with environmental challenges as more wells are drilled in environmentally sensitive areas and environmental standards are raised. IADC is taking a leadership position in this effort by organizing a new Environmental Policy Advisory Panel, but it needs our assistance.

"Unfortunately, there aren't many leading-edge performance metrics related to environmental performance. However, the negative publicity from an environmental incident within the industry becomes a CNN event that is communicated as if our industry doesn't care.

"I don't have the answer for how we improve, but improve we must. I suspect the solution is similar to the commitment our industry has made in its safety effort, whereby all IADC members—drilling contractors, E&P companies, and service providers—work in a collaborative way toward a common goal of enhancing environmental responsibility. After all, we owe it to ourselves, our communities, and our individual companies."

Rig supply

The least of the drilling sector's worries these days seems to be any concerns over another rig glut developing.

"I don't believe there will develop an oversupply of rigs in the next 3 years, due to operator demands for new rigs, attrition of old rigs, and the supply chain for new rigs," Lindsey says. "Operators today have a demand for more-efficient rigs due to the difficulty of wells being drilled. There will continue to be rigs sidelined by operators because the rig does not have the ability to drill wells in a safe and efficient manner.

"The lingering question is what contractors do with the old rigs. One common response is that the old rigs can be sent overseas. I don't think that will be a successful strategy because the international fleet is very old, and operators in international locations have desires to improve efficiency and safety.

"Attrition of land rigs has been artificially low for the last 4 years due to the rig count demands placed on the fleet, so many of the rigs that are stacked today will probably be written off. In addition to operator demand and attrition slowing rig oversupply, I don't believe the supply chain for new rigs has the ability to oversupply quality rigs during the next 3 years. If the past 3 years is a predictor of future rig production, the industry will have a hard time producing more than 100 to 120 newbuilds/year; therefore, a real oversupply of the quality rigs E&P companies demand will not take place in the near term."

With many land rigs 20–40 years old and the US drilling focus shifting to more difficult wells—particularly in the unconventional natural gas plays—refurbishment activity keeps pace with newbuild action.

Noting that the US land rig business has added more than 700 rigs during the past 3 years, Lindsey estimates that 300 of those were new rigs and 400 were refurbished.

"With a rig count of approximately 1,800 rigs today, it is estimated that 1,100 of those rigs are over 30 years old and, in many cases, unable to drill the type of wells E&P companies desire to drill today because of the degree of difficulty."

As an example, Lindsey notes that nearly 50% of all wells drilled in the US today are horizontal, directional, or both (HDorB), compared with only 20% in 2003.

"The addition of 700 rigs corresponds to the net growth in

HDorB in the US, which translates to retooling continuing as long as operators have demanding well profiles and the desire to deliver wells more efficiently," he concludes.

Sutherland says he thinks that "much of the available 'good' iron is already in action, thus newbuilds are the logical option."

Thomas, however, contends that "a lot of the land fleet is being retooled already, with more and more focus on rig automation to offset the lowered experience levels seen in the industry."

Drilling activity drivers

Drilling for unconventional gas has changed the business for drilling contractors, Lindsey contends.

"Because of the nature of the well cycles and decline rates on unconventional wells and the need to drill literally thousands of wells in these plays, this reality has given contractors the opportunity to apply new ideas and innovation on how to enhance productivity and safety, reinvest in their fleets, and have some certainty of work to pay for their investments," he points out. "I heard the term 'gas factory' drilling in 2004, and I think that term describes very well how the game has changed. We are manufacturing wellbores with mobile manufacturing units, and we must figure out ways to improve the manufacturing process annually. Those companies that have the best ideas and rig performance will be in the best position to grow as unconventional resource plays are exploited in the US and expand globally."

Unconventional oil and gas reserves are having a huge impact on drilling markets, Sutherland concurs.

"The ability to economically extract hydrocarbons from previously thought 'nonproductive' rocks, through horizontal drilling and completion techniques, is truly a testament to a technology-driven industry," he says. "Unlocking these unconventional reserves now while commodity prices are high, using advanced drilling and completion techniques, will help sustain the industry when commodity prices are not as robust. The techniques being refined now to unlock these reserves will be translated to similar basins around the world as they mature."

At the same time, the challenge of developing unconventional gas is helping to drive technology improvements at a quicker rate, Thomas points out.

Similarly, "High commodity prices are making the high-risk deepwater plays very attractive," Sutherland notes. "We are pushing the limits of water depth, well depth, pressure, and temperature every day. Our ability to deliver drilling tools for these environments is key for our success in deepwater."

Sally Charpiot, Halliburton marketing manager for production enhancement, reckons that offshore rig-building activity "is more active than it has been for nearly 25 years.

"The backlog for ultradeepwater rigs is 5 to 6 years. Additionally, the old rig fleets are coming into shipyards for upgrades. Optimizing rig time with scalable, on-time solutions is extremely valuable."

Quintero points to the industry legacy of cyclicality: "As we all know, this industry is cyclical. The only thing we know for sure is that rising cycles will eventually come down. The question is when. That said, I believe the macroeconomic fundamentals are still good, and units, especially in deep water, are generally contracted for several years to come, pointing to at least a few more years of high demand."

The deepwater boom is already having an impact on the types of offshore rig being built today, adds Quintero: "Out of 40-plus semisubmersibles currently under construction, only two are not dynamically positioned (DP), and only eight are not ultradeepwater. With the aging of the existing fleet, when

existing rigs begin to be retired we will see the percent of the total semisubmersible fleet that is DP and ultradeepwater increase."

Costs

While escalating drilling costs have been a concern for operators, Trico Marine Chairman and CEO Joe Compofelice contends that it is all too easy to look at the fluctuation in costs over a short horizon and worry about escalating outlays.

"There is no way around the effect of market forces over the short term," he explains. "But market forces work over the long term even better.

"The major advances in E&P over the last couple of decades (seismic data acquisition and data enhancement, MWD, formation evaluation WD, lateral drilling, coiled tubing stimulation, subsea completions technology) have all had huge positive effects on lowering costs to our customers.

"This is the far more important trend. I expect that trend to continue—possibly accelerate—and at Trico Marine, that principle of investing to provide customers the capacity and performance they need is how we make capital allocation decisions."

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Technology advances

Advances in rotary steerable systems (RSS) and measurement- and logging-while-drilling top the lists of several experts as the technologies making the biggest impacts in drilling today.

Development of RSS and MWD/LWD tools for high-pressure/high-temperature (HPHT) downhole conditions is helping to open up new deepwater horizons.

"Rotary steerable systems coupled with near-bit and deep-reading petrophysical measurements are allowing for longer, more accurately placed laterals," Sutherland points out, adding that such deployments have been an enabler for extreme deepwater drilling.

"The ability to log and evaluate reservoirs, immediately and completely, using drilling tools, can result in huge savings and reduced risk for deepwater wells," he says. "Near-bit, deep-reading, and 'look ahead/around' petrophysical sensors and near-bit and drillstring-distributed drilling mechanics sensors, coupled with faster telemetry methods—such as wired pipe—will greatly expand our ability to explore the deep water."

Sutherland also speculates that casing/liner drilling and managed-pressure technology could emerge as routine deepwater drilling cost reducers in the near future.

The most significant technical challenges in the realm of drilling fluids are related to efforts to minimize downtime and reduce overall well cost, says Newpark Drilling Fluids Pres. Bruce Smith.

"To accomplish those goals, we certainly place great emphasis upon developing effective, environmentally sound products and systems. Equally important, however, is the evolving role of drilling fluid project planning, management, and execution.

"Modern drilling activities feature ever more complex well geometry and employ an expanding array of drillstring tools and specialized disciplines—from tool specialists to directional drillers, and so forth. Each requires a seat at the planning table, and their needs in the drilling process sometimes conflict.

"Hydraulics planning is a primary example. Our drilling fluids programmers and project managers must consider the requirements each of these specialists and their equipment demands. The truly effective drilling fluids program must reconcile these needs to optimize drilling fluids performance and drilling efficiency, and each project requires constant oversight. Effectively managing these and other such operational factors is a hallmark of our company's technical staff capabilities."]

Transocean's GSF Rig 127 jack up set a world record for the longest extended-reach well ever drilled at 40,320 ft MD with a 35,770-ft horizontal section. The well was drilled off Qatar in 36 days and incident-free. Photo courtesy of Transocean.

CTD expansion seen in US, Russia

Proponents of coiled tubing drilling (CTD) are pressing efforts to expand the growing practice in the US onshore drilling theater.

Until recently, CTD was commonplace in Canada but almost nonexistent in the US Lower 48. Coiled tubing applications in the US to date have mostly involved well interventions, cleanouts, and the like, but using CT for drilling has been rare. An exception is Alaska, where CTD has been an accepted practice for over a decade.

Changing market

But the market is changing in favor of CTD, according to Steve Carey, Baker Hughes INTEQ product line manager, slimhole re-entry.

"At present, CTD is looking healthier than at any other time during its long and checkered history," he contends. "With the right degree of commitment on the part of the operators and CTD service providers, the practice is set to grow significantly."

That's especially true in the US, Carey points out, which has 50% of the CT services fleet; there, he expects to see big gains in CTD for both re-entry and grassroots drilling.

"At present, CTD is looking healthier than at any other time during its long and checkered history."

— Steve Carey, Baker Hughes INTEQ

The main drivers for expanding CTD in the Lower 48 are high oil and gas prices spurring an interest in re-entries and enhanced oil recovery (EOR) in mature fields and a continuing surge in development of unconventional gas resources.

Russia is also set for a rapid increase in CTD, according to Carey: "Several large projects are being considered where re-entry and infill drilling using CT will be introduced to giant, mature fields. These mature fields typically have a large number of existing wells with impairment. The producing reservoir was damaged or completed suboptimally when originally drilled. CTD allows for sidetracking deeper and closer to the producing interval (placing ESPs deeper) to bypass disturbed or damaged zones and precisely repositioning the wellbore."

Holistic approached needed

Wider acceptance of CTD leading to its increased adoption greatly depends on merging several key technologies and services to form a complete, seamless, and multidisciplined offering capable of successfully executing the full range of CT drilling applications, says Carey.

"A holistic approach to practical field development using CTD would encompass surface and subsurface disciplines, feasibility study, reservoir modeling and simulation, enhanced reservoir access and oil recovery techniques, drilling and evaluation, well completion and production, facilities downstream of choke, HS&E, and commercial aspects," he adds. "Of equal importance is the early recognition of when developments are subeconomic or too risky to attempt. This approach provides a thorough understanding of the key technical challenges and their discrete and collective impacts to the project."

CTD fleet

Greater availability of fit-for-purpose CTD equipment that can be more easily mobilized to cover a range of CTD applications is paramount to expanding the practice of CTD, Carey contends.

"The emergence of fully automated hybrid CT rigs, combined with equally important advances in subsurface technologies—e.g., advanced closed-loop drilling and evaluation systems—has caused a significant increased interest in applying CTD," he says. "Whether accessing bypassed or unswept pools from mature fields, or tapping as yet undeveloped unconventional reservoirs, CTD is emerging as a highly desirable, economically viable option."

Carey notes that the growing emphasis on redevelopment and EOR is having a positive impact on efforts to expand the availability of hybrid CTD rigs, "especially those with enhanced mobility and automation features, capable of operating in a variety of applications, e.g., underbalanced drilling (UBD), managed-pressure drilling (MPD), or overbalanced drilling scenarios.

"Several companies have made significant investment to develop CT rig technology and have built a new generation of CT rigs that address current and future market needs, especially in the US and Russia.

"Older, less capable, inflexible CTD rigs will become obsolete, their utilization restricted more and more to basic interven-

tion operations. Their inherent inefficiencies of operation coupled with their labor intensiveness will lead to their demise."

Personnel issues

A continuous effort and commitment to increase the pool of CTD personnel through training is also required, Carey points out.

"Right now, a shortage of experienced personnel is an even greater barrier to CTD growth than equipment or technology," he says. "Typically we can react quickly and provide more hardware at short notice; however, we do not keep pace when developing and training a competent labor force. Today we suffer from a 'shortage of experience' which may well be the result of previous industry downturns. This shortage must be addressed to redress the balance and keep pace with increased activity."

Carey believes that a focused effort on training new recruits and on developing existing human resources via cross-training would have a positive impact on the CTD labor force in the short term.

"Increased recruitment of engineers and their development specifically for CTD is needed in the longer term," he adds. "It's preferable that personnel possess a breadth of experience covering conventional drilling in addition to CTD practices, e.g., competent CT directional drillers are still a rarity."

CTD technology issues

Recent advances in technology, along with a growing "knowledge database" for the application of CTD, have brought the industry to a tipping point where the practice of CTD is set to increase greatly, according to Carey. He notes efforts by several service companies to develop hybrid CTD units; advanced CTD transport systems; advanced CTD bottomhole assemblies; smaller, automated-integrated CTD units; advanced formation evaluation for smaller hole sizes (2⅞–4¾ in.); improved completions and frac systems; improved window milling and exiting systems; improved coil specifications and manufacturing processes; and advanced monitoring systems (surface and downhole).

Integrated packages/services

Carey insists that the further integration of a range of services and technologies is required to enable the provision of a CTD package to operators who have limited experience in the application of CTD.

"Effectively integrating surface and subsurface products and services into a complete CTD package will make the application more available to a wider customer base," he says. "The lack of experience in planning and executing CTD—and a perception of CTD as 'high-risk'—generates a degree of discomfort (out-of-comfort-zone) from the conventional drilling community. UBD and MPD are still widely unaccepted and are often thought to be too dangerous and not worth the added hassle."

Because CTD is generally more complex than conventional drilling, its success depends greatly on the seamless integration of many distinct services and disciplines to form one coherent, focused team, according to Carey.

"In UB CTD, the drilled lateral is often produced while drilling," he notes. "Geosteering, ECD control, hole-cleaning, logging, optimizing drilling and coil parameters to avoid dysfunctions, monitoring production-while-drilling, and reinjection are carried out in real time, with everyone working in concert to optimize the operation."

CTD is much less forgiving than conventional drilling, Carey adds: "Its smaller scale often leads to higher pressures, smaller annular clearances, and differential sticking in highly depleted zones. Also, less robust hardware and the inability to rotate complicate the situation further."

Coiltrak

INTEQ began its development of CTD systems in 1990, and continuous investment and refinement led to the launch of the CoilTrak system in 2002, according to Carey. "CoilTrak is a sophisticated directional drilling system capable of precisely positioning the wellbore within the productive reservoir using CT," he says. "CoilTrak's unique downhole sensors provide real-time measurement and interpretation of the drilling environment and allow for subsequent actions on drilling and formation events that optimize the drilling process.

"CoilTrak's directional drilling BHA contains automated closed-loop steering functionality complete with downlinking from surface to precisely steer slimhole wells. An electric hydraulic orienter controls the tool face while drilling in the desired direction. The ability to automate direction-holding within an exceptionally small tolerance ensures the optimal exit from the predrilled well and unmatched precision when placing the well bore in the productive reservoir.

"CoilTrak's formation evaluation capabilities combine to allow for accurate geosteering by joystick control in underbalanced and often hostile drilling environments. The system reliability is evidenced from its world record of over 12 days continuous drilling multilaterals to expose more than 14,000 ft of reservoir from one single motherbore. CoilTrak went on to drill more than 340,000 ft from 40 reentered wells and completely reversed production decline, revitalizing an otherwise uneconomic depleted gas field."

INTEQ continues to develop CoilTrak's capabilities through the addition of advanced formation evaluation and completion services, Carey points out.

"CoilTrak's Rib Steering Motor (RSM) applies the same principles as AutoTrak, INTEQ's rotary steerable system, to drill a smoother, extended lateral with coil tubing, whereas a bent-motor plus orienter configuration creates a continuous dogleg while slide drilling and increases tortuosity," he says. "The RSM creates a smooth well path using ribs to direct and control the direction of the bit in 3D."

CoilTrak's formation evaluation modules also allow for geosteering and navigating the wellbore to intersect the producing horizon in complex faulted and compartmentalized reservoirs, Carey notes: "By steering a smooth wellbore within the productive zone and avoiding exiting through roof or floor, the

well's productivity is maximized and risk minimized."

Additional CoilTrak completion systems are being tested to allow for running, setting, and cementing liners and for a variety of other completion applications using e-line coil and without the need for swapping reels, he adds.

"CoilTrak's intelligent downhole sensors are utilized in our Smart Well Intervention systems to provide for delicate downhole operations such as fishing or milling, and not otherwise possible using conventional CT," Carey says. "CoilTrak's sensors are capable of sensing minute changes downhole and in real time that confirm whether or not an operation has been successful."

Composite materials

Advances in composite materials technology are helping composites make inroads in the CTD market, according to Martin van Onna, general manager, Airborne Composite Tubulars BV, The Hague.

Thermoplastic composites will enable composite materials to make real inroads in the CTD market.

— Martin van Onna, Airborne Composite Tubulars

He sees the application of thermoplastic composites, rather than thermoset composites, making a big impact in CTD.

"First of all when comparing composites, we see that thermoplastic composites have much higher ductility, yielding higher toughness and residual strength. This will make thermoplastic composites stand a chance where thermoset did not," van Onna says. "Secondly, the composite coiled tubing does not have any fatigue or corrosion issues. Thirdly, the composite coiled tubing offers the possibility to integrate power conductors and optical fibers into the wall of the coil, which results in the following benefits:

- The power conductors provide up to three times the amount of power compared with wireline cable. Also, the optical fibers can be integrated, providing unprecedented data communication capability, the ability to monitor temperature across the complete well trajectory, and strain monitoring capability.
- The data communication capability provides the possibility for continuous acquisition of petrophysical and drilling dynamics data during drilling operations, resulting in logging passes for each bit trip.
- In addition to the petrophysical data, borehole stability data can be assessed through combining downhole data with surface weight information. This can help identify, prevent, and cure fractures and permeable sands that are responsible for poor borehole stability.
- The real-time information availability of the drilling, pressures, temperatures, forces, and vibration conditions downhole allows for a step-change in real-time tool-face change, leading to higher rates of penetration.
- The tool-face control can be automated, resulting in automated drilling, predictability, controllability, and ultimately elimination of waste."

In addition, says van Onna, the absence of a cable inside the coil simplifies coil operation, eliminating slack wire management, the risk of "bird nesting," and reversed pumping to move slack up the coil. Also, the absence of a cable makes it possible to proceed with cementing operations without first having to remove the cable or change coil—an advantage offshore. The absence of a cable inside, in conjunction with the lower friction of the composite, increases circulation rate, reducing the required number of wiper trips, van Onna adds. And the pressure requirements at surface are lower, as the pressure losses are reduced.

"An important misconception with regards to composite coiled tubing is that the internal diameter and hence circulation rate would not allow for the composite coiled tubing to be used for drilling applications," he points out. "Due to the integration of the power conductors and optical fibers in the wall of the tubing, combined with lower friction of the plastic liner, pressure loss across the tubing is much lower than with steel coiled tubing, and circulation rates are sufficient."

Van Onna contends that the challenge for wider use of composites in CTD isn't limited to proving its technical and economic feasibility: "The supply chain—its capacity and stability of quality—is an issue that needs to be addressed too. Airborne has recognized this and attacked it by entering into strategic alliances with companies in the supply chain. In this way the supply chain is prepared upfront for increasing output at the required quality levels."]

The focus on unconventional and mature resources is bolstering the market for coiled tubing drilling in the US. Photo courtesy of Baker Hughes INTEQ.

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