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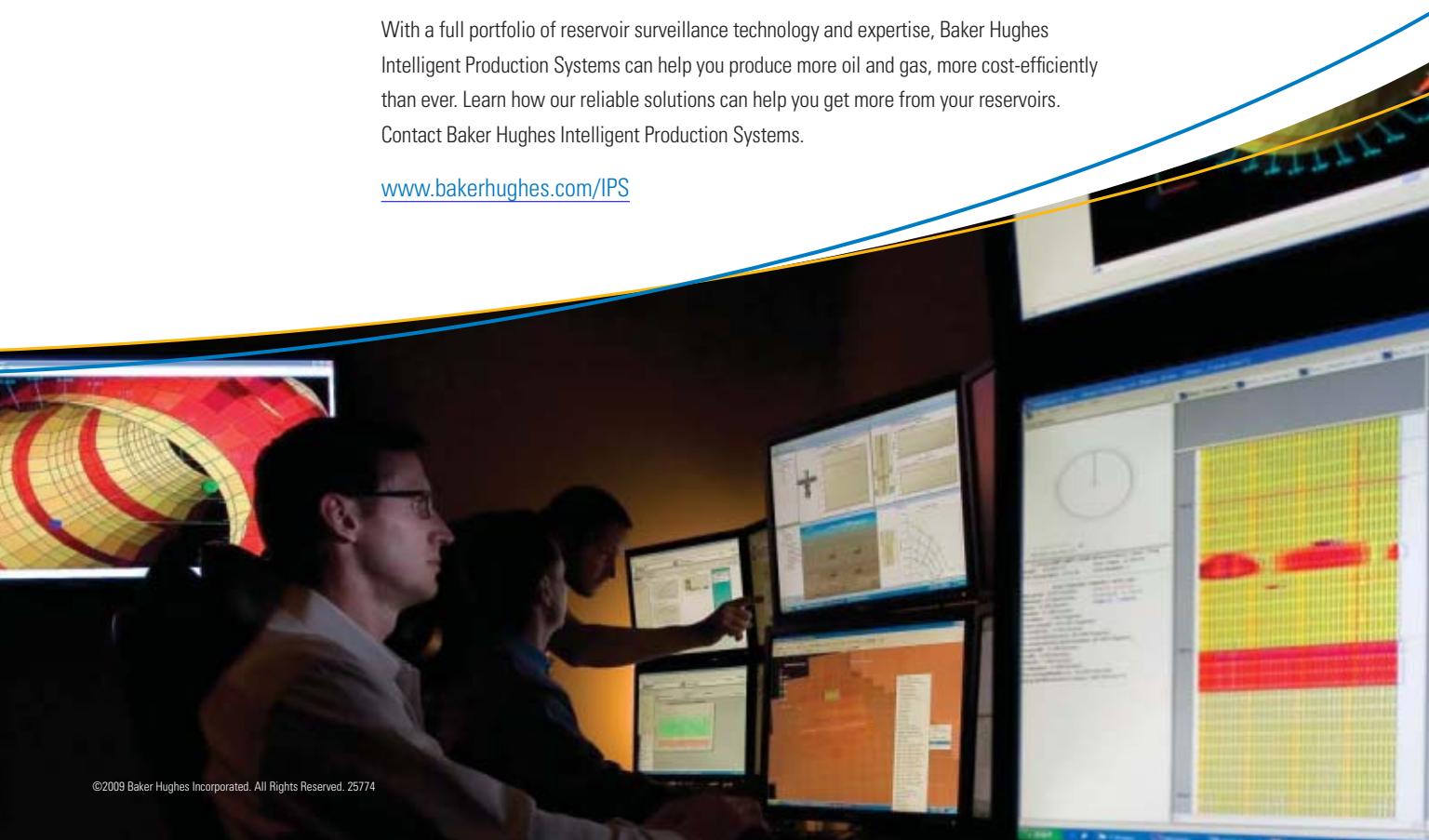

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DW6

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The World Floating Production Report provides the industry executive with an overview of future prospects within the floating production sector. It analyses historic and future FPS installations over the period 2012 by region, operator, water depth, and vessel type.
DW8

The World Offshore Oil & Gas Production & Spend Forecast
Presents an analysis of production capacity for every existing and potential offshore producing area in the world for each year through to 2012. Production, capital expenditure and operational expenditure levels are charted & tabulated by region, including all potential spend sectors.
DW7

The AUV Gamechanger Report
Describes how AUVs fit into the family tree of unmanned underwater vehicles (UUVs), outlines the development of the industry and gives many examples of the various types of AUVs and the technologies involved.
DW2

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DW10

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Ethylene Report

US exaggerating hope for renewable energy
Indonesia opens 24 oil, gas blocks for bidding
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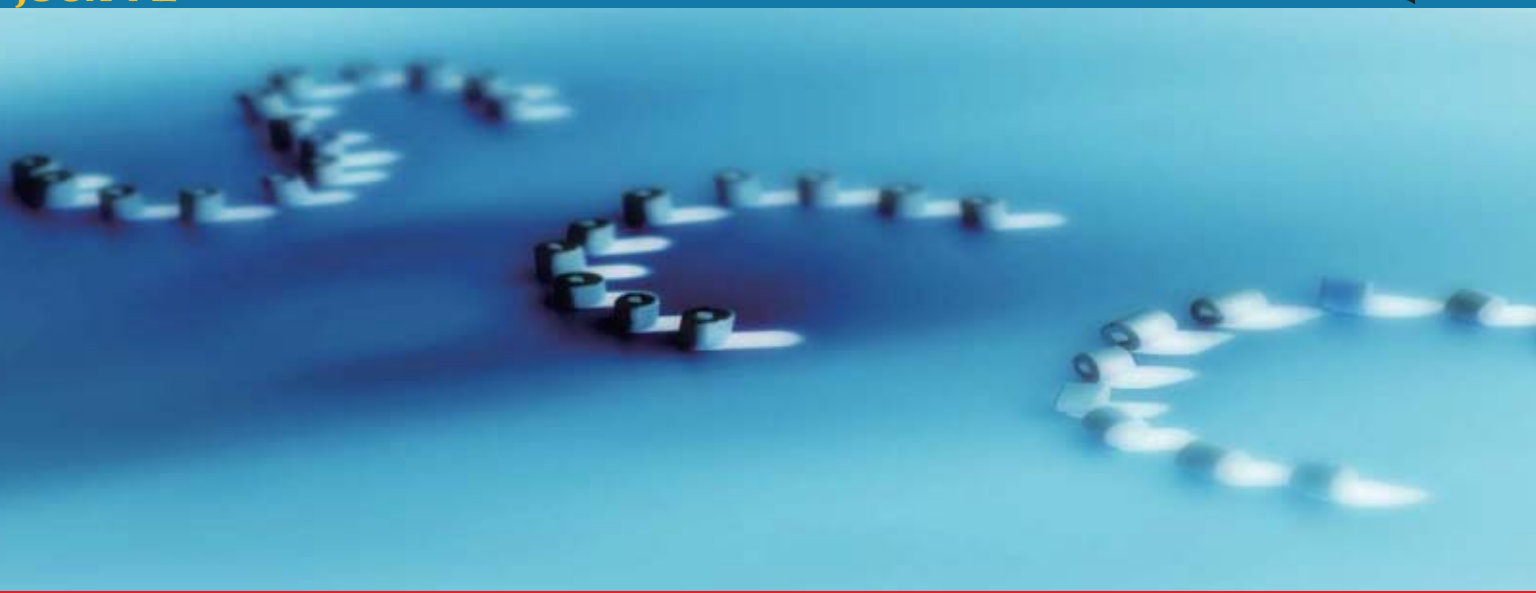

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OIL&GAS JOURNAL®

July 27, 2009
Volume 107.28

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COVER

Yanbu Petrochemical Co.'s ethylene plant, Yanbu, Saudi Arabia, can produce 1.7 million tonnes/year of ethylene. Saudi Basic Industries Corp., a 50% owner of the Yanbu plant, started up another 1.3-million-tpy plant in Yanbu in 2008. The Middle East started up nearly 7 million tpy of ethylene production capacity in 2008, an increase of more than 56% compared with last year's OGJ Ethylene Survey. The region saw start-up of five major ethylene plants in 2008, three in Iran and two in Saudi Arabia. The 7 million tpy of new capacity is a record of annual additions. Photo from Sabic.

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v.
Diamond Offshore Company and Diamond Offshore (Trinidad) L.L.C.

Civil Action No. 05-0224,
United States District Court for the Eastern District of Louisiana,
Hon. Daniel E. Knowles III presiding

Two week bench trial

Damages sought by Plaintiffs: $100 million

No liability found for alleged allision between
Diamond's MODU *Ocean America*
and Plaintiffs' Canyon Express Pipeline System
during Hurricane Ivan.

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July 27, 2009

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General Interest — Quick Takes

IHS: Global upstream M&A activity rebounded in 2Q

Global upstream mergers and acquisitions (M&A) deals nearly doubled in the second quarter, up from a 10-year low in the first quarter, spurred by a resurgence in oil prices and a thaw in equity and credit markets, according to IHS Herold Inc., an IHS company.

"Both US onshore and international deal counts increased significantly, although North American activity remained well below historical averages," said Chris Sheehan, IHS Herold director of M&A research. "International pricing for proved plus probable reserves held firm on stronger crude oil prices, but falling gas prices plunged North American asset deal prices to the lowest level since 2005."

Sheehan said, "The upsurge in activity in the second quarter is encouraging, but the market is still extremely volatile."

IHS Herold reported that second quarter total transaction value increased fourfold outside North America, driven by strong activity in the Africa-Middle East region and upturns in Europe and Asia-Pacific.

Total worldwide transaction value was flat at $28.4 billion, as first quarter figures were buttressed by the $20 billion merger of Suncor Inc. and Petro-Canada. National oil companies represented nearly 40% of global deal value, including Sinopec's $8.8 billion agreement to acquire Addax Petroleum—the largest overseas upstream transaction by a Chinese company.

Saskatchewan reports growing energy momentum

Saskatchewan offers a wealth of oil and natural gas assets, and officials believe the province's resource potential will continue to grow through anticipated technological innovations.

Of the Canadian provinces, Saskatchewn is Canada's second-largest oil producer and third-largest natural gas producer.

One promising play under production is Saskatchewan's portion of the Bakken oil play. Saskatchewan's Bakken oil production reached 57,000 b/d in December 2008 compared with 950 b/d in October 2004.

Ed Dancsok, assistant deputy minister of the Saskatchewan Ministry of Energy and Resources, attributes escalating production figures to advances in horizontal drilling and hydraulic fracturing. The province has not yet established a Bakken reserve estimate.

In 2008, Saskatchewan reported 4,045 oil and gas wells were drilled, making it the province's second-best year in terms of total wells drilled. In 2007, officials reported 3,451 wells were drilled.

Initial oil in place for conventional crude reserves across the province is estimated at 41.2 billion bbl. Currently, more than 35.5 billion bbl remain beyond reach, but Danscok said intensive research efforts are under way to find ways to economically unlock that oil.

Latest estimates put Saskatchewan's remaining recoverable reserves of conventional crude oil at 1.18 billion bbl. This includes 611 million bbl of heavy oil, with the rest being medium and light crude.

These figures do not include oil sands or oil shale, and the province is working toward developing its unconventional crude oil. Saskatchewan has a 2.7 million hectare area with some degree of oil sands potential.

Dancsok said enhanced oil recovery holds great potential for Saskatchewan's conventional reserves. Current EOR projects include both steam and carbon dioxide injection. Researchers are studying vaporized solvent injection methods for heavy oil.

EOR production levels increased steadily from 2,735 b/d in 1982 to 50,788 b/d in 2008. Canada's largest CO_2 project is the Weyburn project operated by EnCana Oil & Gas Partnership. In 2005, Apache Canada began CO_2 injection in Midale field.

Brazil interested in Russian expertise

Brazil's Deputy Foreign Minister Samuel Pinheiro Guimaraes, on a visit to Moscow, said his country is interested in using Russian technology to develop oil and gas fields as well as nuclear power.

"We're interested in Russia's technologies of oil and gas output at sea platforms and their transportation," said Guimares, who added that Brazil could share its deepwater oil production technology in exchange for Russian technology.

"The fields have been discovered at a depth of 7 km and some 200 km off the coast, so we'll have to convert the gas into a liquid with Russian technology on offshore platforms," Guimaraes said.

Guimares also discussed the potentials for cooperation between the two countries regarding nuclear technology, saying that "Brazil ranks fifth in the world for uranium stocks" while "Russia has big experience on nuclear technologies."

"We're planning to build eight new nuclear power electric power plants," Guimares said, adding, "We praise Russia's participation in carrying out this program."

He said, "Brazil is planning to carry out an infrastructure program within the next 6 months that amounts to $150 billion. The program includes the construction of new electric power plants, ports and railways. In each field Russia has indisputable experience that we seek to use." ✦

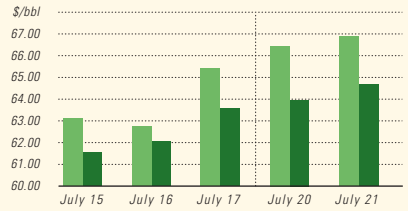
Exploration & Development — Quick Takes

Oxy adds giant gas, oil field in California

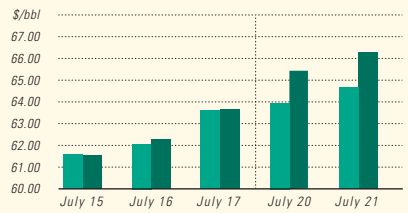
Occidental Petroleum Corp. has drilled six wells in an apparent giant gas and oil field in California's San Joaquin basin and has estimated 150-250 million boe recoverable.

Industry Scoreboard

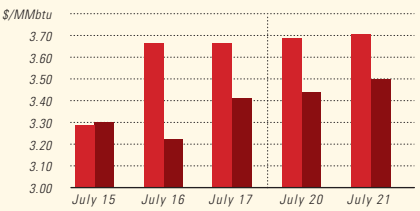
IPE BRENT / NYMEX LIGHT SWEET CRUDE



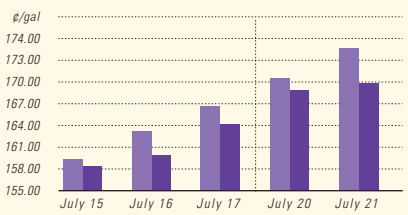
WTI CUSHING / BRENT SPOT



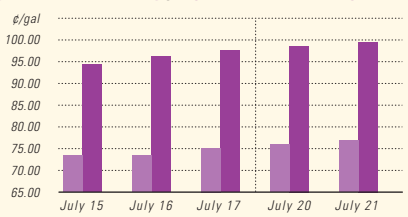
NYMEX NATURAL GAS / SPOT GAS - HENRY HUB



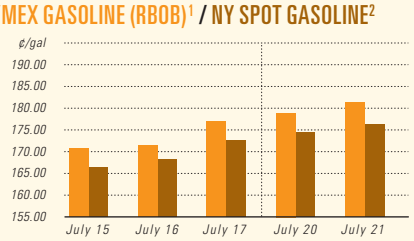
IPE GAS OIL / NYMEX HEATING OIL



PROPANE - MT. BELVIEU / BUTANE - MT. BELVIEU



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



[1]Reformulated gasoline blendstock for oxygen blending.
[2]Nonoxygenated regular unleaded.

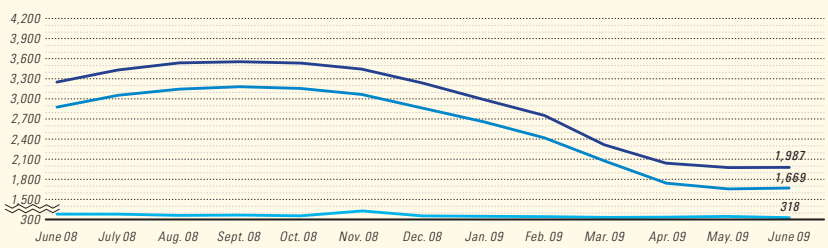
US INDUSTRY SCOREBOARD — 7/27

Latest week 7/10	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	9,144	9,091	0.6	8,957	9,042	–0.9
Distillate	3,280	3,714	–11.7	3,666	4,053	–9.5
Jet fuel	1,387	1,582	–12.3	1,386	1,586	–12.6
Residual	628	687	–8.6	609	648	–6.0
Other products	3,917	4,470	–12.4	3,998	4,555	–12.2
TOTAL DEMAND	18,356	19,544	–6.1	18,616	19,884	–6.4
Supply, 1,000 b/d						
Crude production	5,191	5,115	1.5	5,251	5,116	2.6
NGL production[2]	1,928	2,282	–15.5	1,883	2,132	–11.7
Crude imports	9,355	10,030	–6.7	9,298	9,816	–5.3
Product imports	2,580	3,249	–20.6	2,878	3,230	–10.9
Other supply[3]	1,821	1,403	29.8	1,689	1,552	8.8
TOTAL SUPPLY	20,875	22,079	–5.5	20,999	21,846	–3.9
Refining, 1,000 b/d						
Crude runs to stills	14,438	15,221	–5.1	14,438	14,934	–3.3
Input to crude stills	14,793	15,721	–5.9	14,793	15,266	–3.1
% utilization	83.8	89.3	—	83.8	86.8	—

Latest week 7/10	Latest week	Previous week[1]	Change	Same week year ago[1]	Change	Change, %
Stocks, 1,000 bbl						
Crude oil	344,484	347,297	–2,813	296,888	47,596	16.0
Motor gasoline	214,578	213,140	1,438	214,238	340	0.2
Distillate	159,291	158,738	553	125,690	33,601	26.7
Jet fuel–kerosine	43,314	42,839	475	38,954	4,360	11.2
Residual	35,740	36,582	–842	39,084	–3,344	–8.6
Stock cover (days)[4]			Change, %		Change, %	
Crude	22.9	23.3	–1.7	19.3	18.7	
Motor gasoline	23.5	23.2	1.3	22.9	2.6	
Distillate	48.6	48.6	0.0	30.1	61.5	
Propane	83.9	77.5	8.3	48.8	71.9	
Futures prices[5] **7/17**			Change		Change	%
Light sweet crude ($/bbl)	61.27	61.48	–0.21	140.04	–78.77	–56.2
Natural gas, $/MMbtu	3.46	3.41	0.05	12.31	–8.85	–71.9

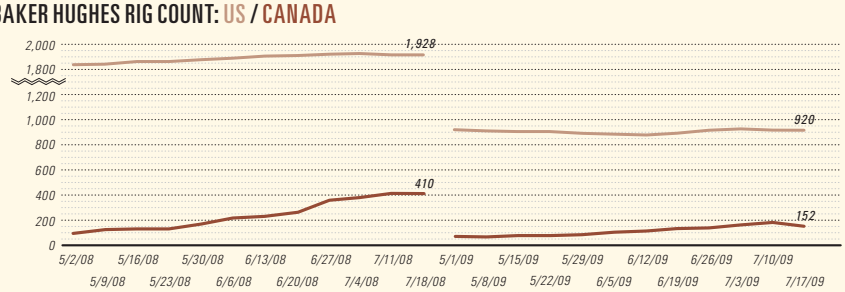
[1]Based on revised figures. [2]Includes adjustments for fuel ethanol and motor gasoline blending components. [3]Includes other hydrocarbons and alcohol, refinery processing gain, and unaccounted for crude oil. [4]Stocks divided by average daily product supplied for the prior 4 weeks. [5]Weekly average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

Geological extent of the multizone, mostly conventional discovery in Kern County is still undefined. Oxy didn't locate the find in sprawling Kern County by OGJ presstime but said the hydrocarbons are two-thirds gas. Oxy's interest is 80%.

The discovery could be California's largest in more than 35 years, Oxy said. The company said it is probable that more reserves exist outside the area so far defined and that similar structures lie outside its 1.1 million net acre position in California. Oxy plans to drill wells to exploit the other opportunities in the next 5-10 years.

Oxy, as California's largest gas producer, third-largest oil producer, and largest acreage holder, operates more than 7,500 active wells in 90 fields in the state. The company's proved reserves in California at the end of 2008 were 708 million boe, about 24% of its worldwide reserves.

BLM selects team to evaluate deferred Utah leases

The US Bureau of Land Management named a 12-member multidisciplinary team from three federal agencies to evaluate 77 deferred oil and gas lease parcels in southeastern Utah. The group does not include anyone involved in any previous decisions concerning the tracts, BLM said.

It includes James Haerter, BLM's program lead for oil, gas, and energy, and eight other employees of the US Department of the Interior agency, along with two specialists from the National Park Service and one from the US Forest Service. The team's findings are expected by late September, according to BLM.

Its Utah office originally auctioned the 77 parcels at a Dec. 19, 2008, lease sale. A federal district court enjoined their sale on Jan. 17 and US Interior Secretary Ken Salazar ordered that they not be issued on Feb. 6.

"It's essential that any future decisions on these parcels be based on solid science and a comprehensive evaluation process," BLM Acting Director Mike Pool said. "No one wants to strengthen the integrity of BLM's oil and gas lease sales more than BLM and this team's role is integral in achieving that."

BLM said the team will be asked to produce recommendations on whether the deferred parcels should be reoffered under the same conditions, reoffered under different terms, or be withdrawn. It added that the team also will review protests ledged against each of the parcels during the original lease sale's protest period and will address those protests in its final recommendations.

CNOOC, Sinopec sign deal for Angola block

Marathon Oil Corp. subsidiary Marathon International Petroleum Angola Block 32 Ltd. signed a $1.3 billion definitive agreement with CNOOC International Ltd. and Sinopec International Petroleum Exploration & Production Corp. under which CNOOC and Sinopec will acquire the Marathon unit's undivided 20% participating interest in the production-sharing contract and joint-operating agreement in Block 32 off Angola.

The transaction total excluded any purchase price adjustments at closing and has an effective date of Jan. 1, 2009. Marathon will retain a 10% working interest in the block.

The companies expect to close the transaction by yearend, subject to government and regulatory approvals. For transfer of working interests in Angola, the concessionaire and the other Block 32 partners have rights of first refusal.

"With the divestiture of a portion of our Angola interest, we are able to bring better balance to our overall portfolio by capturing the sizable amount of value we have created and redeploying capital into other growth regions for the company," said David E. Roberts Jr., Marathon executive vice-president, upstream. "At the same time, maintaining a 10% interest in both Blocks 31 and 32 provides Marathon with exposure to this important resource base," Roberts said.

Angola state-owned oil firm Sonangol serves as concessionaire of Block 32. Block operator Total E&P Angola (Block 32) Ltd. holds 30% interest. Other partners are Sonangol P&P 20%, Esso E&P Angola (Block 32) 15%, and Petrogal 5%.

Murphy makes oil find off Congo (Brazzaville)

Murphy Oil Corp. reported an oil discovery at the Turquoise Marine-1 prospect on the Mer Profonde Sud (MPS) block off Congo (Brazzaville).

The Turquoise Marine-1 discovery well, which was drilled to a total measured depth of 12,060 ft in 5,285 ft of water, found more than 136 ft of net oil pay. The well lies 17 miles from Murphy-operated Azurite field.

The discovery marks the second for Murphy on the MPS block, said David M. Wood, president and chief executive officer. The rig now moves to the Diamant Marine-1 prospect, which lies even closer to Azurite field, Wood said.

Murphy will be "looking at appraisal and development options for Turquoise Marine-1 in the coming months and seeking to optimize the existing Azurite field infrastructure," Wood added.

Murphy is operator with 50% working interest in Turquoise, Marine-1 and MPS block. Partners are PA Resources, 35%, and Societe Nationale des Petroles du Congo, 15%.

BP reports success of Mad Dog South well in gulf

BP PLC drilled a successful appraisal well in a previously untested southern segment of Mad Dog field in the Gulf of Mexico. The 826-5 well was drilled on Green Canyon Block 826 about 100 miles south of Grand Isle, La., in 5,100 ft of water.

The well found 280 net ft of hydrocarbons in the objective Miocene hydrocarbon-bearing sands and also found an oil column of more than 2,200 ft.

In 2008, BP drilled the A-7 well in the western part of the field, which found a hydrocarbon column of more than 2,500 ft and 275 ft of net pay.

"With these additional hydrocarbon resources in the west and south of the field, Mad Dog has been firmly established as the third giant field in BP's Gulf of Mexico portfolio, joining Thunder Horse and Atlantis," said Andy Inglis, BP chief executive officer, exploration and production.

BP is currently reviewing development options to increase production from Mad Dog either through debottlenecking the existing facility or by adding another production facility, the company said.

Mad Dog field, which started production in 2005, utilizes a truss-spar platform that is equipped with facilities for simultane-

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ous production and drilling operations. The facility is designed to process 80,000 b/d of oil and 60 MMscfd of gas.

BP holds a 60.5% working interest in Mad Dog. Other partners are BHP Billiton 23.9% and Chevron Corp. 15.6%. ✦

Drilling & Production — *Quick Takes*

Anadarko lets Caesar Tonga field contracts

Anadarko Petroleum Corp. has let two lump-sum contracts to Technip SA to design equipment to bring deepwater Caesar Tonga field on stream by 2011 in the Gulf of Mexico.

Caesar Tonga is a subsea tie-back to Anadarko's Constitution Spa development. It lies 190 miles off New Orleans in 1,500 m of water.

Technip will design and supply the components for four pipe-in-pipe flowlines and install 43 km of flowlines. It also includes the design, fabrication, and installation of eight pipeline end terminations.

This development will use the pipe-in-pipe technology, which provides insulation and flow assurance for effective production in deep and ultradeep water. Offshore installation will be carried out with the Deep Blue, Technip's deepwater pipelay vessel.

The second contract covers the project management, engineering, and fabrication of two control umbilicals and their termination hardware. This contract, which is scheduled to be completed in third quarter 2010, will be executed by Duco, Technip's wholly owned subsidiary in Houston.

Cabgoc starts oil production from Mafumeira Norte

Chevron Corp. subsidiary Cabinda Gulf Oil Co. Ltd. (Cabgoc) brought the Mafumeira Norte oil project off Angola on stream ahead of schedule.

Cabgoc developed the field with 14 wells to the existing Kungulo water-injection platform and will deliver a maximum of 30,000 b/d and 30 MMcfd of natural gas in 2011.

This project is in 160 ft of water 15 miles off Angola. This is the first phase development of Mafumeira field in Area A of Block 0.

Sonamet (Lobito), a joint venture of Sonangol and Acergy, won the engineering, procurement, construction, and installation contract for the Mafumeira Norte platform. This was the first time Sonamet was awarded such a contract and the platform was fabricated at its Lobito yard in southern Angola.

Chevron, through Cabgoc, has a 39.2% interest and is operator of the Block 0 contractor group, which also includes Sonangol P&P, 41%. Total SA, 10%, and Eni SPA, 9.8%. ✦

Processing — *Quick Takes*

Kurdistan inaugurates refinery at Arbil

Iraq's Kurdistan region, eyeing a broader plan of industrialization, has inaugurated a new refinery near the capital city of Arbil, one of several planned for the area that will jointly process as much as 200,000 b/d.

Refinery director Baz Karim said the new facility is operated by private Kurdish investors Kar Group, and will process crude from the Khurmala Dome oil field, which will initially provide 50,000 b/d of oil before rising to 100,000 b/d after 6 months.

The new refinery has an initial capacity of 20,000 b/d but is expected to increase to 40,000 b/d by yearend, with eventual plans calling for an increase to 75,000 b/d.

The Arbil facility will produce gasoline, kerosine, heavy fuel oil, diesel, paraffin, and airplane fuel, said Karim, who added that the KRG will pay Kar Group for what the refinery produces.

The new facility will enable the Kurdish region to reduce its dependence on Iraq and Turkey for its refined products, according to KRG Prime Minister Nechirvan Barzani.

"We cannot rely on foreign fuel and electricity to help us cope with the heat of summer and the cold of winter," said Barzani. "We will fulfill our promise that our people must live like citizens of the developed world in terms of living standards and prosperity."

Ashti Hawrami, minister of natural resources for the Kurdistan regional government (KRG), underlined that view, saying that the Arbil refinery is one of several planned for the region which will have the capacity of producing 200,000 b/d within 2-3 years.

The launch of the new refinery also coincided with remarks by KRG President Massud Barzani, who told an election campaign rally that he will not "compromise" on longstanding Kurdish claims to the oil-rich province of Kirkuk.

"We are committed to the application of Article 140 (of the Iraqi constitution) and we promise that we will absolutely not compromise on this issue or on the rights of the people of Kurdistan," Barzani said ahead of Kurdish regional elections, scheduled for July 25.

He was referring to the article of the Iraqi constitution which calls for a referendum to decide the fate of Kirkuk, which the Kurds wish to make the capital of their autonomous region.

In June, Kurdistan began exporting crude for the first time, sending 100,000 b/d from the Taq Taq and Tawke oil fields via the Iraq-Turkey pipeline to the Turkish port of Ceyhan. Initial exports include 40,000 b/d from Taq Taq and 60,000 b/d from Tawke (OGJ Online, June 1, 2009).

China approves Tianjin petrochemicals complex

Construction of the $3 billion petrochemicals complex in Tianjin, China, owned by Sinopec and Saudi Basic Industries Corp. is slated for completion in September.

The complex will have a production capacity of 3.2 million tonnes/year, including a 1 million tpy ethylene cracker and will produce other products, including polyethylenes, ethylene glycol, polypropylene, butadiene, phenol, and butene-1 (OGJ Online, Dec. 15, 2008).

In June 2008, the project's costs were expected to surpass $2.5 billion, but have since risen due to the expanded scope of the plant.

The Chinese National Development and Reform Commission (NDRC) has approved both companies forming a 50:50 joint venture for the complex. It follows a strategic cooperation agreement signed by both parties on June 21, 2008, in Jeddah, Saudi Arabia.

The companies will also assess adding polycarbonates at the fa-

Four 58-MW Rolls-Royce Trent GTGs Available for Immediate Delivery

The Rolls-Royce Trent 60 is an advanced aeroderivative gas turbine that delivers up to 58 MW of electric power in simple cycle service. At 42% efficiency, the Trent 60 is highly fuel efficient. It offers operators fast delivery and installation times, and beneficial environmental performance. All or part of the following is available for immediate sale:

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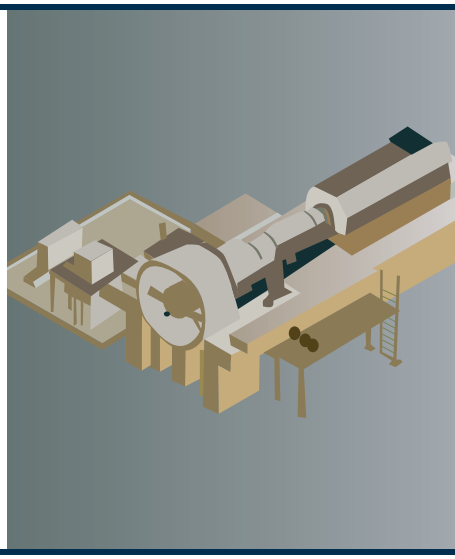
Two New Alstom 50-Hz Combined Cycle 140-MW Steam Turbine Generators Available for Immediate Shipment

These steam turbine generators (STGs) are new, 140-MW Alstom two-cylinder (HP and IP/LP) reheat condensing steam turbine generator sets suitable for combined cycle outdoor operation with axial exhaust and air-cooled (TEWAC) generator. Initial steam conditions 1900 psia/1050°F/1050°F reheat. Units include manufacturer's performance guarantees and warranties. Units may be shipped directly to your site from Alstom's European manufacturing facility.

- Units come complete with all normally supplied auxiliaries and include factory warranties covering manufacturing defects and performance guarantees.
- Configured as a two-cylinder machine with an HP turbine and a combined IP/LP turbine with an axial exhaust.
- Steam inlet conditions are 1900 psia (nominal)/1050°F/1050°F.
- Air-cooled TEWAC generator rated 165 MVA, 15.75 kV, 3 phase, 50 Hz, 3000 rpm.



Unused GE D11 HP/IP Turbine Assembly Available for Immediate Sale

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Solar Centaur 40 T4701S Turbine Generator Package with approximately 60,000 accumulated hours at 50% load. Package was in service from 1999 until August 2007. Engine is BACT compliant with OEM 25 ppm Nox/50 ppm CO guarantee. Operates off SAB-type Ideal generator rated at 3500 kW, 4375 kVA and 13,800 volts at 60 Hz. Miscellaneous equipment includes inlet air filtration and simple exhaust systems, and auxiliary control console with start/stop/sync/control.

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cility using Sabic technology.

China is the world's largest petrochemical market based on high growth rates realized by the Chinese economy, said Sabic. NDRC's approval means that it will ensure that the company will be able to reach its customers with local products and services.

Sasol to establish GTL plant in Uzbekistan

Sasol has formed a partnership with Petronas and Uzbekistan state oil and gas company Uzbekneftegaz to establish a 1.3 million tonne/year GTL plant in Uzbekistan.

The companies signed a joint venture agreement in the capital of Tashkent on July 15 and will begin a feasibility study on the $2.5-billion project. No start up date was provided nor were details on which gas fields could produce the feed to produce the diesel, kerosine, naphtha, and LPG.

Sasol said the GTL facility will use its proprietary Slurry Phase Distillate process, which produces a clean-burning, high-performance diesel fuel.

Each company will have an equal equity share in the JV. The plant would have a capacity of 36,000-40,000 b/d.

This deal builds upon a heads of agreement signed in April by Sasol Chief Executive Pat Davies and Petronas Pres. and Chief Executive Officer Tan Sri Mohd Hassan Marican.

Total reports steamcracker explosion at Carling

An explosion that occurred in the early afternoon of July 15 at Total Petrochemicals France's steamcracker unit at the Saint-Avold-Carling site in eastern France killed two people and wounded six others. The injured were subsequently discharged from the hospital, a Total spokesman told OGJ.

The accident occurred as the steamcracker was being restarted after a shutdown due to recent heavy storms in the area. The plant has been made safe and there is no risk of pollution, Total said.

A superheater was thought to have caused the explosion although no reasons have been given thus far for a cause. Total speculates that an accumlulation of gas occurred during the unit's operation and caused the blast.

The 250,000 tonne/year steamcracker was one of two crackers on the site. The second unit was shut down in 2008 and is in the process of being dismantled following a decision to restructure the Carling site. The remaining steamcracker had been thoroughly revamped during an October 2007 shutdown and its capacity increased.

Total SA Chief Executive Officer Christophe de Margerie, after visiting the site shortly after the incident, reassured workers that "the accident does not jeopardize the survival of the site."

In view of the current difficulties of the petrochemicals market in France, the Carling trade unions were worried that the site, which is in the process of being restructured, might be shut down, thinking that the cost of reconstruction of the damaged steamcracker might be too high to take on in a period of economic uncertainty. ✦

Transportation — *Quick Takes*

CPC inaugurates Taiwan's second LNG terminal

Taiwan's CPC Corp. officially inaugurated on July 16 the country's second LNG terminal, this one at Taichung in the north, according to press reports. Start-up of the nearly $955 terminal was more than a year behind schedule.

CPC's web site, however, was not updated on the event. Other press reports have stated delays in the pipeline have delayed completion of the terminal.

For 2009, the Taichung LNG terminal will supply 1.68 million tonnes of vaporized LNG via a subsea pipeline to the state-run 4.4-Gw Tatan electric power plant in Taoyuan County, northern Taiwan, according to statements attributed to CPC Chairman Shih Yen-shiang. The remaining gas will meet industrial and residential demand in northern and central Taiwan.

Shih said combined output from the new Taichung terminal and the existing Yungan terminal in southern Taiwan will enable CPC to move as much as 10.5 million tpy of LNG.

Start-up of the Taichung terminal will allow CPC to import nearly 1.6 million tonnes of LNG from Qatar this year, rising to 2.5 million tonnes in 2010 and to 3 million tonnes in 2011, the terminal's design capacity.

Shell, Vopak to build LNG terminal in France

Royal Dutch Shell PLC and Koninklijke Vopak NV have announced the formation of a joint venture aimed at developing an LNG terminal at Fos-sur-Mer, France.

Vopak LNG Holding BV will become the main shareholder with a 90% share in the JV, the Fos Faster LNG Terminal SAS, while Societe des Petroles Shell will hold the remaining 10%.

The firms said Fos Faster LNG will be developed as part of the expansion strategy of the Grand Port Maritime de Marseille and in close cooperation with the Port Authority.

"The joint venture combines the experience of Vopak in tank terminal development and operations with Shell's position as the largest equity shareholder of LNG capacity among international oil companies," they said.

The Fos Faster LNG terminal has an initial planned capacity of around 8 billion cu m/year of gas, more than 15% of the current annual gas consumption of France.

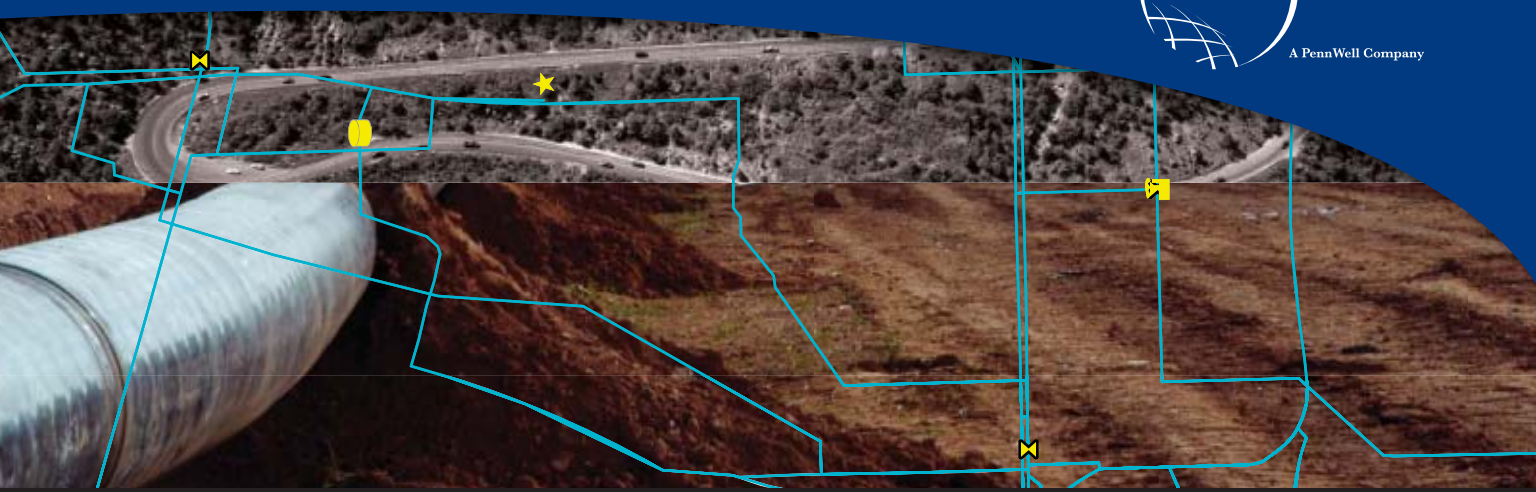
"Subject to market demand, permitting, and approval processes the terminal could commence operations around the middle of the next decade," the two firms said.

The proposed terminal would further enhance gas supply diversification by providing France and Europe access to new sources of gas.

Fos Faster LNG terminal will be positioned as an independent multicustomer terminal. The business model of the terminal will be similar to the Gate terminal currently under construction in Rotterdam.

Earlier this year, Koninklijke Vopak NV said it would build and operate a storage terminal for more than 1.1 million cu m of oil products in the Port of Amsterdam.

The terminal, which will be used for the storage and blending of gasoline and other clean oil products, will meet the need for additional storage capacity for products in the Amsterdam-Rotterdam-Antwerp region (OGJ Online, May 28, 2009). ✦



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Letters

Waxman-Markey omissions

Sixty percent of our annual greenhouse gas (GHG) emissions are emitted by transportation petroleum-based fuels and coal-based electric power plants. Nowhere in the 1,200-page Waxman-Markey Clean Energy and Security Act (W-M) can you find an effective substitute for those fuels.

Coal plants can be replaced by non-polluting nuclear reactors as in France, but nuclear is not mentioned in W-M. Most developed countries levy taxes on transport fuels, especially on gasoline. That leads to fuel-efficient cars, and the tax revenue funds and encourages the use of energy-efficient public transport. No mention of this approach in W-M.

Instead, we have an array of legislative mandates for renewable energy and efficiency without any explanation of how those mandates are to be achieved. W-M's elaborate cap-and-trade system includes allowances which can be traded in financial markets. Wall Street eagerly waits. Polluters can earn up to 2 billion tons of tradable offsets by supporting renewable projects of uncertain merit in the US and abroad, but their pollution continues.

A complex rebate system is to protect manufacturers whose costs for allowances affect their international competitive position. Importers can also be required to purchase international reserve allowances to raise import costs, also to preserve the US competitive position. How all that will be administered is anyone's guess.

Electric utilities must meet 20% of demand with renewable energy and improved efficiency by 2020. Carbon emissions are to be steadily reduced, with carbon capture and sequestration (CCS) the prime enabling technology. There are no large-scale working CCS installations in the world. A study from scientists at the Universities of Wyoming and Houston estimates a need for 300,000 new injection wells for sequestration to meet W-M targets. Along with ancillary systems and pipelines, plus CO_2 separation costs, CCS costs could exceed $1 trillion/year.

There is $4 billion to support a cash-

for-clunkers program which will lead to the sale of imported cars, as few American cars meet the mileage standards in the program.

W-M supports increased mileage standards for cars and trucks while promoting E85 ethanol fuel, which reduces mileage performance by about 30%.

The efforts of Rep. Collin Peterson (D-Minn.) have added a 49-page amendment which excludes agriculture and forestry from the capped sector. It also excludes indirect land use from the evaluation of the environmental impact of biofuel production. Ethanol and biodiesel are exempted for 5 years from the limits placed on other fuels, although there is little scientific evidence of an environmental benefit from those fuels.

The responsibility for determining which practices are eligible for offsets is transferred from the Environmental Protection Agency to the Secretary of Agriculture. This should result in more emphasis being placed on organic type farming practices as these are eligible for offsets.

The bill creates a program of worker training, education, and transition for jobs in renewable energy, building upgrades, and climate change mitigation. This could be administered under the new federal agency created by W-M, the Clean Energy Deployment Administration. There will also be a National Climate Service set up within the National Oceanic and Atmospheric Administration to support efforts by states to respond to changes brought about by global warming.

The bill encourages developing countries to take emission-reducing actions. Some funds from allowance sales are set aside to reward less developed countries (China?) which have taken verifiable and measurable emission reduction programs. This is expected to open up markets for US environmental technology. And for low-income Americans there is a system of energy refunds to ease the impact of higher prices resulting from W-M.

There are physical reasons that the Energy Information Administration is now forecasting that renewables will provide just over 12% of our electric energy supply in 2020, nearly all from hydro and burning biomass. Wind and solar are at just 2.4% in 2020, and they will not get renewables to the 20% commanded by W-M. Renewables lack the energy density and cost benefit of fossil fuels and fissionable nuclear material. Legislative laws rarely override the laws of physics.

Global warming is real. It is time to grow our nuclear fleet and time to tax fossil fuels to provide the revenue for a world-class, electric-powered public transport system. The marketplace will then provide the remaining objectives of W-M without its massive new bureaucracy.

Rolf Westgard
St. Paul, Minn.

Calendar

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

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SPE Asia Pacific Oil and Gas Conference and Exhibition, Jakarta, (972) 952-9393, (972) 952-9435 (fax), e-mail: spedal@spe.org, website: www.spe.org. 4-6.

EnerCom's The Oil & Gas Conference, Denver, (303) 296-8834, email: kgrover@enercominc.com, website: www.theoilandgas-conference.com. 9-13.

ACS Fall National Meeting & Exposition, Washington, (202) 872-4600, e-mail: service@acs.org, website: www.acs.org. 16-20.

Petroleum Association of Wyoming (PAW) Annual Meeting, Casper, (307) 234-5333, (307) 266-2189 (fax), e-mail: suz@pawyo.org, website: www.pawyo.org. 18-19.

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.

Summer NAPE, Houston, (817) 847-7700, (817) 847-7704 (fax), e-mail: info@napeexpo.com, website: www.napeonline.com. 27-28.

SEPTEMBER

Oil & Gas Maintenance Technology North America Conference, New Orleans, (918) 831-9160, (918) 831-9161 (fax), e-mail: registration@pennwell.com, website: www.ogmtna.com. 1-3.

EAGE Near Surface European Meeting, Dublin, +31 88 995 5055, +31 30 6343524 (fax), e-mail: eage@eage.org, website: www.eage.org. 7-9.

IAEE European Conference, Vienna, (216) 464-5365, e-mail: iaee@iaee.org, website: www.iaee.org. 7-10.

Offshore Europe Conference, Aberdeen, +44 (0) 20 7299 3300, e-mail: nbradbury@spe.org, website: www.offshore-europe.co.uk. 8-11.

GPA Rocky Mountain Annual Meeting, Denver, (918) 493-3872, (918) 493-3875 (fax), e-mail: pmirkin@gpaglobal.org, website: www.gpaglobal.org. 9.

GITA's GIS Annual Oil & Gas Conference, Houston, (303) 337-0513, (303) 337-1001 (fax), e-mail: info@gita.org, website: www.gita.org/ogca. 14-16.

Turbomachinery Symposium, Houston, (979) 845-7417, (979) 847-9500 (fax), e-mail: inquiry@turbo-lab.tamu.edu, website: http://turbolab.tamu.edu. 14-17.

Annual IPLOCA Convention, San Francisco, +41 22 306 02 30, +41 22 306 02 39 (fax), e-mail: info@iploca.com, website: www.iploca.com. 14-18.

Polar Petroleum Potential 3P Conference, Moscow, (918) 584-2555, (918) 560-2665 (fax), website: www.aapg.org. 16-18.

✦European Drilling Engineering ERD and Association Technology Meeting, Stavanger, +44 (0) 1483-598000, e-mail: Dukes@otmnet.com, website: www.dea-europe.com. 17-18.

Annual Energy Policy Conference, Oklahoma City, (202) 580-6532, (202) 580-6559 (fax), e-mail: info@energyadvocates.org, website: www.energyadvocates.org. 20-22.

Multiphase User Roundtable-Mexico, Villahermosa, (979) 268-8959, (979) 268-8718 (fax), e-mail: Heather@petroleumetc.com, website: www.mur-mexico.org. 22-23.

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.

SPE Eastern Regional Meeting, Charleston, W.Va., (972) 952-9393, (972) 952-9435 (fax), e-mail: spedal@spe.org, website: www.spe.org. 23-25.

Calendar

ERTC Sustainable Refining Conference, Brussels, 44 1737 365100, +44 1737 365101 (fax), e-mail: events@gtforum.com, website: www.gtforum.com. 28-30.

DGMK Production and Use of Light Olefins Conference, Dresden, 040 639004 0, 040 639004 50, website: www.dgmk.de. 28-30.

IADC Advanced Rig Technology Conference, Houston, (713) 292-1945, (713) 292-1946 (fax), e-mail: conferences@iadc.org, website: www.iadc.org. 29.

Unconventional Gas International Conference & Exhibition, Fort Worth, Tex., (918) 831-9160, (918) 831-9161 (fax), e-mail: registration@pennwell.com, website: www.unconventionalgas.net. Sept. 29-Oct. 1.

ERTC Biofuels+ Conference, Brussels, 44 1737 365100, +44 1737 365101 (fax), e-mail: events@gtforum.com, website: www.gtforum.com. Sept. 30-Oct. 2.

OCTOBER

Interstate Oil and Gas Compact Commission Annual Meeting (IOGCC), Biloxi, Miss., (405) 525-3556, (405) 525-3592 (fax), e-mail: iogcc@iogcc.state.ok.us, website: www.iogcc.state.ok.us. 4-6.

SPE Annual Technical Conference and Exhibition, New Orleans, (972) 952-9393, (972) 952-9435 (fax), e-mail: spedal@spe.org, website: www.spe.org. 4-7.

World Gas Conference, Buenos Aires, +54 11 5252 9801, e-mail: registration@wgc2009.com, website: www.wgc2009.com. 5-9.

ISA EXPO, Houston, (919) 549-8411, (919) 549-8288 (fax), e-mail: info@isa.org, website: www.isa.org. 6-8.

Kazakhstan International Oil & Gas Exhibition & Conference (KIOGE), Almaty, +44 (0) 207 596 5233, +44 (0) 207 596 5106 (fax), e-mail: oilgas@ite-exhibitions.com, website: www.oilgas-events.com. 6-9.

NPRA Q&A and Technology Forum, Ft. Worth, Tex., (202) 457-0480, (202) 457-0486 (fax), e-mail: info@npra.org, website: www.npra.org. 11-14.

API Fall Petroleum Measurement Standards Meeting, Calgary, Alta., (202) 682-8000, (202) 682-8222 (fax), website: www.api.org. 12-15.

GPA Houston Annual Meeting, Houston, (918) 493-3872, (918) 493-3875 (fax), e-mail: pmirkin@gpaglobal.org, website: www.gpaglobal.org. 13.

International Oil & Gas Exploration, Production & Refining Exhibition, Jakarta, +44 (0)20 7840 2100, +44 (0)20 7840 2111 (fax), e-mail: ogti@oesallworld.com, website: www.allworldexhibitions.com. 14-17.

✦Expandable Technology Forum, Houston, +44 (0) 1483 598000, e-mail: sally.marriage@otmnet.com, website: www.expandableforum.com. 14-15.

SPE/EAGE Reservoir Characterization and Simulation Conference and Exhibition, Abu Dhabi, (972) 952-9393, (972) 952-9435 (fax), e-mail: spedal@spe.org, website: www.spe.org. 18-21.

GSA Annual Meeting, Portland, (303) 357-1000, (303) 357-1070 (fax), e-mail: meetings@geosociety.org, website: www.geosociety.org. 18-21.

Oil Shale Symposium, Golden, Colo., (303) 384-2235, e-mail: jboak@mines.edu, website: www.mines.edu/outreach/cont_ed/oilshale/. 19-23.

Oil and Gas Transportation in the CIS and Caspain Region Annual Meeting, Moscow, +44 (0) 20 7067 1800, +44 (0) 20 7242 2673 (fax), website: www.theenergyexchange.co.uk. 20-22.

SEG International Exposition and Annual Meeting, Houston, (918) 497-5500, (918) 497-5557 (fax), e-mail: register@seg.org, website: www.seg.org. 25-30.

SPE/IADC Middle East Drilling Conference & Exhibition, Manama, +971 4 390 3540, +971 4 366 4648 (fax), e-mail: spedal@spe.org, website: www.spe.org. 26-28.

✦European Drilling Engineering Association Passive Inflow Control Technology Meeting, Copenhagen, +44 (0) 1483-598000, e-mail: Dukes@otmnet.com, website: www.inflowcontrol.com. 27-28.

Louisiana Gulf Coast Oil Exposition (LAGCOE), Lafayette, (337) 235-4055, (337) 237-1030 (fax), e-mail: lynette@lagcoe.com, website: www.lagcoe.com. 27-29.

North African Oil and Gas Summit, Tunis, +44 (0) 20 7067 1800, +44 (0) 20

7242 2673 (fax), website: www.theenergyexchange.co.uk. 27-29.

Offshore Middle East Conference & Exhibition, Manama, (918) 831-9160, (918) 831-9161 (fax), e-mail: registration@pennwell.com, website: www.offshoremiddleeast.com. 27-29.

NOVEMBER

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

IPAA Annual Meeting, New Orleans, (202) 857-4722, (202) 857-4799 (fax), website: www.ipaa.org. 4-6.

GPA North Texas Annual Meeting, Dallas, (918) 493-3872, (918) 493-3875 (fax), e-mail: pmirkin@gpaglobal.org, website: www.gpaglobal.org. 5.

Capture and Geological Storage of CO_2 Symposium, Paris, +33 1 47 52 67 21, +33 1 47 52 70 96 (fax), e-mail: patricia.fulgoni@ifp.fr, website: www.CO2symposium.com. 5-6.

Sulphur International Conference and Exhibition, Vancouver, +44 20 7903 2058, +44 20 7903 2172 (fax), e-mail: cruevents@crugroup.com, website: www.sulphurconference.com. 8-11.

Gas Turbine Users International (GTUI) Annual Conference, Calgary, Alta., +9714 804 7738, +9714 804 7764 (fax), e-mail: info@gtui.org, website: www.gtui.org. 8-13.

IADC Annual Meeting, Miami, (713) 292-1945, (713) 292-1946 (fax), e-mail: conferences@iadc.org, website: www.iadc.org. 9-10.

Multiphase User Roundtable-South America, Rio de Janeiro, (979) 268-8959, (979) 268-8718 (fax), e-mail: Heather@petroleumetc.com, website: www.mur-sa.org. 9-10.

API Fall Refining and Equipment Standards Meeting, Dallas, (202) 682-8000, (202) 682-8222 (fax), website: www.api.org/events. 9-11.

Digital E&P Event, Houston, (646) 200-7444, (212) 885-2733 (fax), e-mail: cambrosio@wbresearch.com, website: www.digitaleandp.com. 9-11.

wwwPetroleum Association of Wyoming (PAW) Annual Oil & Gas Statewide Reclamation Conference, Casper, (307) 234-5333, (307) 266-2189 (fax), e-mail: cheryl@pawyo.org, website: www.pawyo.org. 10.

Deepwater Operations Conference & Exhibition, Galveston, Tex., (918) 831-9160, (918) 831-9161 (fax), e-mail: registration@pennwell.com, website: www.deepwateroperations.com. 10-12.

SPE International Oil and Gas China Conference & Exhibition, Beijing, (972) 952-9393, (972) 952-9435 (fax), e-mail: spedal@spe.org, website: www.spe.org. 10-12.

ASME International Mechanical Engineering Congress and Exposition (IMECE), Lake Buena Vista, Fla., (973) 882-1170, (973) 882-1717 (fax), e-mail: infocentral@asme.org, website: www.asme.org. 13-19.

PIRA Natural Gas Markets Conference, New York, (212) 686-6808, (212) 686-6628 (fax), e-mail: sales@pira.com, website: www.pira.com. 14-15.

IADC Completions Conference, Houston, (713) 292-1945, (713) 292-1946 (fax), e-mail: conferences@iadc.org, website: www.iadc.org. 17.

Houston Energy Financial Forum, Houston, (918) 831-9160, (918) 831-9161 (fax), e-mail: registration@pennwell.com, website: www.accessanalyst.net. 17-19.

IADC Well Control Asia Pacific Conference & Exhibition, Bangkok, (713) 292-1945, (713) 292-1946 (fax), e-mail: conferences@iadc.org, website: www.iadc.org. 18-19.

DECEMBER

Refining and Petrochemicals in Russia and the CIS Countries Annual Meeting, Amsterdam, +44 (0) 20 7067 1800, +44 (0) 20 7242 2673 (fax), website: www.theenergyexchange.co.uk. 1-3.

World LNG Summit, Barcelona, +44 (0)20 7978 0000, +44 (0)20 7978 0099 (fax), e-mail: info@thecwcgroup.com, website: www.thecwcgroup.com. 1-4.

✦ European Drilling Engineering Association Expandables, Multilaterals and Technologies Meeting, Vienna, +44 (0) 1483-598000, e-mail: Dukes@otmnet.com, website: www.dea-europe.com. 3-4.

Emerging Unconventional Resources Conference & Exhibition, Shreveport, (918) 831-9160, (918) 831-9161 (fax), e-mail: registration@pennwell.com, website: www.emergingresourcesconference.com. 8-10.

PIRA Understanding Natural Gas and LNG Markets Seminar, New York, (212) 686-6808, (212) 686-6628 (fax), website: www.pira.com. 14-15.

PIRA Understanding Global Oil Markets Seminar, New York, (212) 686-6808, (212) 686-6628 (fax), website: www.pira.com. 16-17.

2010

JANUARY

Oil & Gas Maintenance Technology Conference & Exhibition Co-located with Pipeline Rehabilitation and Maintenance, Cairo, (918) 831-9160, (918) 831-9161 (fax), e-mail: registration@pennwell.com, website: www.oilandgasmaintenance.com. 19-21.

Pipeline Rehabilitation & Maintenance Co-located with Oil & Gas Maintenance Technology, Cairo, (918) 831-9160, (918) 831-9161 (fax), e-mail: registration@pennwell.com, website: www.pipeline-rehab.com. 19-21.

API Exploration and Production Winter Standards Meeting, New Orleans, (202) 682-8000, (202) 682-8222, website: www.api.org. 25-29.

The European Gas Conference and Annual Meeting, Vienna, +44 (0) 20 7067 1800, +44 (0) 20 7242 2673 (fax), website: www.theenergyexchange.co.uk. 26-28.

Annual Gas Arabia Summit, Abu Dhabi, +44 (0) 20 7067 1800, +44 (0) 20 7242 2673 (fax), website: www.theenergyexchange.co.uk. Jan. 31- Feb. 3.

FEBRUARY

Deep Offshore Technology International Conference & Exhibition, Houston, (713) 963-6271, (713) 963 6296 (fax), e-mail: registration@pennwell.com, website: www.dotinternational.net. 2-4.

Russia Offshore Annual Meeting, Moscow, +44 (0) 20 7067 1800, +44 (0) 20 7242 2673 (fax), website: www.theenergyexchange.co.uk. 2-4.

Annual Petroleum Coke Conference, Seattle, (832) 351-7828, (832) 351-7887 (fax), e-mail: petcoke.conference@jacobs.com, website: www.petcokes.com. 12-13.

Laurance Reid Conditioning Conference, Norman, Okla., (512) 970-5019, (512) 233-2877 (fax), e-mail: bettyk@ou.edu, website: www.lrgcc.org. 21-24.

Nitrogen + Syngas International Conference and Exhibition, Bahrain, +44 20 7903 2058, +44 20 7903 2172 (fax), e-mail: cruevents@crugroup.com, website: www.nitrogenandsyngas2010.com. Feb. 28-Mar. 3.

MARCH

Subsea Tieback Forum & Exhibition, Galveston, Tex., (918) 831-9160, (918) 831-9161 (fax), e-mail: registration@pennwell.com, website: www.subseatiebackforum.com. 2-4.

Middle East Geosciences Conference and Exhibition, Manama, +973 17 550033, +973 17 553288 (fax), e-mail: fawzi@aeminfo.com.bh, website: www.geobahrain.org. 7-10.

GPA Annual Convention, Austin, Tex., (918) 493-3872, (918) 493-3875 (fax), e-mail: pmirkin@gpaglobal.org, website: www.GPAglobal.org. 21-24.

Offshore West Africa Conference & Exhibition, Luanda, (918) 831-9160, (918) 831-9161 (fax), e-mail: registration@pennwell.com, website: www.offshorewestafrica.com. 23-25.

APRIL

Rocky Mountain Unconventional Resources Conference & Exhibition, Denver, (918) 831-9160, (918) 831-9161 (fax), e-mail: registration@pennwell.com, website: www.RMURconference.com. 6-8.

SPE Improved Oil Recovery International Liquefied Natural Gas Conference and Exhibition, Oran, +44 (0) 20 7596 5000, +44 (0) 20 7596 5111 (fax), website: www.lng16.org. 18-21.

Oil & Gas West Asia Conference, Muscat, +968 24660124, +968 24660125 (fax), e-mail: omanexpo@omantel.net.om, website: www.ogwaexpo.com. 19-21.

Symposium, Tulsa, (918) 366-7033, (918) 366-7064 (fax), e-mail: IOR@SPEIOR.ORG, Website: www.speior.org. 24-28.

Prudhoe's oil and gas future

Alan Petzet
Chief Editor-Exploration

Forty-one years after discovery on Alaska's North Slope, Prudhoe Bay field remains the largest oil-producing field in the US.

It is approaching time for the field, producing 400,000 b/d, to begin a transition to gas sales, said Scott Digert, waterflood/full field resource manager for BP Exploration (Alaska) Inc. BP's Thunder Horse field in the Gulf of Mexico is a close second.

Prudhoe has produced 12.5 billion stb of oil and appears headed towards 14 billion bbl of ultimate oil recovery, up from the 9.6 billion bbl estimated at discovery. Digert reckons that half the recovery above the initial figure is due to increased gas cycling.

The 234-sq-mile reservoir is an anchor for 25 other ANS producing fields. BP operates Prudhoe for itself and other owners.

Field life conceivably could reach 100 years, said Digert, who came to BP from ARCO Oil & Gas Co. in 2000.

Prudhoe Bay today

Besides being an oil supergiant, Prudhoe has long been known to be a gas supergiant without a market.

Discovery well celebrations were muted because the wells penetrated the giant gas cap weeks before hitting oil (OGJ, Jan. 22, 1968, p. 40; Feb. 26, 1968, p. 55).

The field is nearly fully developed, Digert said. It has 2,500 penetrations, including 1,200 active wells. Almost all new wells are horizontals, including Alaska's first stacked hexalateral with 29,198 ft of hole drilled in 2008.

Prudhoe and its core satellites have more than 1,000 producing wells, 30 gas injectors, and 140 water injectors.

Wells are drilled radially from 42 central pads. Well spacing is 160 acres broadly and 80 acres in some areas.

Six gathering stations handle produced oil and associated gas, sending oil to the Trans-Alaska Pipeline and gas for natural gas liquids separation and reinjection to maintain field pressure.

The field produces as much as 8.8 bcfd of gas in winter (5 bcfd in summer) that goes into an 8.5 bcfd gas processing plant, the world's largest. Then 450 MMcfd goes for fuel, making BP Alaska's largest gas user.

The plant extracts 70,000 b/d of NGL, of which 25,000 b/d goes to Kuparuk field for blending into miscible injectant. Some NGL is blended with produced gas to make miscible injectant for Prudhoe, and the rest goes down the oil pipeline.

Gas and water injection have slowed the field's decline rate the past 2 years to 1-2%/year from the 7-8%/year averaged since 1988. And 450,000-600,000 b/d of water injected into the gas cap supports at least 10,000 b/d of current oil production and could lead to recovery of more than 150 million bbl of oil, Digert said.

Gas outlook

The length of Prudhoe's future depends on continuing to produce oil while beginning to sell its other resource, gas.

Prudhoe, with an estimated 24 tcf of recoverable gas, and Point Thomson, 60 miles east with more than 8 tcf and 200 million bbl of condensate estimated recoverable, are the slope's two chief gas reservoirs (OGJ Online, July 15, 2008). Other gas may yet be found.

Options being evaluated to move gas from the ANS range up to a 48-52-in., 4-5 bcfd pipeline (OGJ Online, July 6, 2009).

A 20 billion bbl resource of viscous and heavy oil extends from western Prudhoe across through Milne Point and Greater Kuparuk. With viscosity in the hundreds or thousands of centipoise, the deposit has not been proven economic. A research group is working on the problems.

The oil pipeline corridor's next license extension date is 2075.

"At the very high oil prices we saw last year, there could be cases that extend that far out," Digert said. "With gas and with the successful major development of heavy oil, those things look possible. When we look at it under today's prices, we're not going to make it out that far."

Beside the 1 million hp gas processing and compression plants is a site where a gas pipeline consortium could build a 2-4 bcfd gas treatment plant. It would strip carbon dioxide, dry residue gas, set calorific values, and compress to 2,500 psi from 650 psi for shipment down a gas pipeline. Gas shipments would begin around 2018 at the earliest.

Digert said, "While Prudhoe is ready and capable of supporting a gas sales project in this timeframe, a project would also benefit from having other gas sources available at the start. This would allow us to optimize gas offtake from Prudhoe and maximize both oil and gas recovery." ✦

Editorial

An upstart contradiction

Contradictions of energy policy emerge so spontaneously these days in the US that it's rare to have the chance to warn of one before it has fully developed and begun gorging itself on the national welfare.

Examples abound:

- Officials assert energy independence as a guiding principle of energy policy yet withdraw federal land from oil and gas exploration and propose special taxation of the dominant, domestically produced energy forms.
- Lawmakers and regulators claim to want to lower the carbon intensity of energy use yet threaten to impose redundant and inevitably obstructionist federal regulation on hydraulic fracturing, a technology that has unlocked vast potential of the hydrocarbon lightest in carbon, natural gas.
- Politicians promise "green jobs" yet refuse to acknowledge how the essential subsidies and other imposed inefficiencies corrode employment in more-productive sectors of the economy.

The list goes on. Contradictions like these arise when politicians push political agendas at the expense of national interests. Indebted to antioil environmentalists and promoters of uneconomic energy, politicians now in power don't worry about the inefficiencies of manipulating markets. They use appeals to "independence" to do anything they wish, sensible or not, on energy. They want Americans to fear worst-case scenarios about climate change and the political instability of oil exporters—but not to worry about the costly futility of their remedies.

Trading culture

At the center of the upstart contradiction is a trading culture that has contributed in arguable degrees to extreme gyrations in the price of crude oil and to financial collapse in the US. The popular imagination, shaped as it is by media distortion and political opportunism, thus conjures twin scoundrels: "speculators" and Wall Street bankers. In response to one, the Commodity Futures Trading Commission is considering position limits on energy commodities for speculators. In response to the other, lawmakers have begun writing legislation to implement President Barack Obama's plan to overhaul the financial system. The temptation in both cases will be to overreact, to assume problems result from too little regulation and to respond with too much.

Problems of regulation are nevertheless evident. Otherwise inexplicable oil price extremes recently have coincided with extraordinary movements of investment funds into and out of oil futures positions. More ominously, large maverick trades have influenced pricing, however briefly. In the latest reported instance, unauthorized activity by a PVM Oil Associates Ltd. trader on June 30 elevated futures prices unreasonably for a while.

More broadly, elaborate trading schemes based on obscure financial mechanisms masked credit hyperextension in the US and allowed a serious problem to become a global crisis. The failure of governance became only too obvious when regulators spent the first months of economic decline providing mistaken assurances that the meltdown could be confined to specific markets or was in other ways manageable. Now the few financial institutions that have been able to repay their federal bailout money are reporting big profits and reinstating the aristocratic bonus systems that many observers blame at least in part for the earlier, catastrophic excesses.

Political flammability in both cases raises chances for intrusive governance. In both cases, however, more regulation than before is in order. The trading business has become too sophisticated for its own good. Its lavish rewards for risk-taking too easily obscure systemic exposure to risk. Its lapses have global repercussions. It needs—carefully—to be changed.

Trader's delight

Until constructive change is in place, though, a system defined by its failures of control should not be entrusted with a new market contrived by politics. Yet Congress is working feverishly to do just that with climate change legislation, which the House has passed and on which the Senate has begun work.

The cap-and-trade system at the core of that effort would be a trader's delight. If passed, it would be abused—not by all traders but by scofflaws willing to bet the market on next quarter's bonus. The system in present form can't prevent that kind of mischief. Until it's fixed, introduction of a cap-and-trade scheme would be the costliest and most irresponsible contradiction yet. ✦

COMMENT

US exaggerating hope for renewable energy

Donald F. Anthrop
San Jose State University
San Jose, Calif.

Far from learning any lessons from their ill-conceived foray into biofuels through the Energy Independence and Security Act of 2007 (EISA), Congress and the Obama administration appear destined to compound their mistakes in the huge climate bill now making its way through Congress. The House version of this bill would require that renewable energy sources account for 20% of US electrical production by 2020. President Barack Obama, both during the campaign and in office, has asked that 25% be derived from renewable sources by 2025.

Because of the potential for more government mandates, some electrical utilities are planning to build power plants fueled with biomass. The Energy Information Administration (EIA) is forecasting 230 billion kw-hr of electrical energy from biomass by 2030.[1] This amounts to about 5.6% of 2008 US electrical energy generation (4,110 billion kw-hr).[2]

Government policy-makers would like us to believe there are vast quantities of crops, crop residues, and unused wood waste that can be easily converted into energy. The facts are quite different.

Let's start with the renewable fuel standard (RFS) that the Environmental Protection Agency proposed on May 6. The EISA mandates the use of 36 billion gal/year of biofuels by 2022. It also caps ethanol derived from corn starch at 15 billion gal. The RFS proposed by EPA requires the use of 16 billion gal of cellulosic ethanol (i.e., ethanol derived from the cellulose in plant material) and at least 1 billion gal of biodiesel. At present, 4 billion gal of biofuel remains unspecified, but EPA may require up to 5 billion gal of biodiesel after 2012.[3 4 5]

Corn ethanol

Let's first look at ethanol derived from corn starch. Production of 15 billion gal of ethanol, the yield for which is about 2.4 gal/bushel of corn, would consume 6 billion bushels of corn, or half of last year's corn crop of 12.1 billion bushels from 71.6 million harvested acres.[6] The area of cropland needed to produce 15 billion gal of ethanol is 39 million acres.

About 14% of US corn production comes from irrigated land, almost all of which is irrigated with groundwater that is overdrafted from the Ogallala aquifer. Last year, an area of about 9.5 million acres of corn land was irrigated, of which about 8.9 million acres was irrigated with groundwater from the Ogallala aquifer.[7] This irrigated acreage consumed some 18 million acre-feet of groundwater.[8] To put this in perspective, the average annual flow of the Colorado River at Lee's Ferry, Ariz., is only about 14 million acre-ft.

If the US were able to produce 15 billion gal/year of ethanol from corn starch, how much gasoline would this ethanol displace? The answer is about 7.5% of year 2008 gasoline consumption, estimated by the EIA in its Monthly Energy Review of May 2009 at 8.964 million b/d. This calculation uses approximate heat values from the same source of 5.150 million btu/bbl of reformulated gasoline and 3.539 million btu/bbl of fuel ethanol.

A policy that requires dedication of 39 million acres of prime cropland to produce a crop, one seventh of which is grown with overdrafted groundwater, in order to replace 7.5% of US gasoline supply hardly qualifies as environmentally sustainable and surely does little to achieve energy independence, especially since the renewable energy content of corn ethanol has been found to be only 5-26%.[9] The balance of the energy input to corn ethanol is primarily natural gas and coal.

Cellulosic ethanol

Even more daunting is the mandate for 16 billion gal of cellulosic ethanol

SUMMARY OF AVERAGE US CROP RESIDUES—2004-08

Table 1

Crop	Harvested acreage, million acres	Production	Yield, units/acre	Residue produced, million tons	Harvested residue, million tons	Energy content, trillion btu	Ethanol produced, billion gal
Corn	76.909	11.718 billion bushels	152.4 bushels	351	105	1,581	7.58
Wheat	50.711	2.124 billion bushels	41.9 bushels	106	55.5	832	3.83
Barley	3.502	224.3 million bushels	64.0 bushels	8.97[1]	5.472	82	0.38[3]
Oats	1.615	100.6 million bushels	62.3 bushels	2.52[4]	0.902	13.5	0.062[3]
Rice	3.047	210.4 million hundredweight (cwt)	69.0 cwt	10.7[5]	7.62[5]	107	0.50[6]
Soybeans	71.720	3.005 billion bushels	41.9 bushels	67.6	0	0	0
Dry hay	61.056	148.4 million tons	2.43 tons	0	0	0	0
Total	**268.560**			**546.8**	**174.5**	**2,616**	**12.35**

[1]Calculated using an estimate of 80 lb residue/bushel barley from "Crop Residue, Wyoming Biomass Inventory: Crop Production and Residue, 2006," Wyoming State Forestry Division., Cheyenne, Wyo., 2007. [2]Calculation based on the assumption 2,000 lb residue/acre retained for erosion control, the same as wheat. [3]Ethanol yield = 69 gal/ton straw. [4]Calculated using an estimate of 50 lb residue/bushel oats from source in footnote 1. [5]Katrba, R., "The Rumplestiltskin of Rice Straw," Ethanol Producer Magazine, August 2007. [6]Rice straw contains up to 13% silica. Because of the high silica content we have estimated an ethanol yield of 65 gal/ton straw.

by 2022. There is no commercial production of cellulosic ethanol at present. Even if commercial production is attained, the ability of the industry to expand production to meet these mandates is very uncertain.

More worrisome, however, is the availability of potential feedstocks for cellulosic ethanol. Corn produces the most residue of any crop grown in the US. During the 5-year period 2004-08, when the average corn yield was 152.4 bushels/acre, the average annual residue produced by the US corn crop was 352 million tons.[10] This is based on estimated corn residue of 6,000 lb/acre for a grain yield of 100 bushels/acre and 9,000 lb/acre for a grain yield of 150 bushels /acre.[11]

However, agronomists are becoming increasingly alarmed at the prospect of residue removal for energy production because of the deleterious effects on soils—namely increased erosion; reduced soil organic matter; loss of nutrients, especially phosphorus and potash; and soil compaction.[12 13 14 15] Agronomists are advising farmers to remove no more than 30% of corn residues.[12] Corn residue yields about 72 gal of ethanol/ton.[16] If 30% of the residue were collected from the entire US corn crop, about 7.6 billion gal of ethanol could be produced from the 105 million tons of residue.

In reality, probably only half of the available residue would be collected because of the economics and fuel consumed in transporting it to a processing plant. Four states—Iowa, Illinois, Nebraska, and Minnesota—account for about half of the US corn acreage. To put the residue collection problem in some perspective, collection of half of the available residue in the US would be the equivalent of collecting all of the available residue in these four states.

Small grains—wheat, oats, barley, rice—produce much less residue than corn. During 2004-08, wheat produced about 2.1 tons of residue per acre.[17] Agronomists have urged farmers to leave at least 1 ton/acre in place for erosion control and soil fertility maintenance.[18 19] If the extra 1.1 tons/acre were removed from the entire US wheat acreage (50.7 million acres) and converted to cellulosic ethanol, about 3.8 billion gal of ethanol could be produced. This calculation uses an ethanol yield of 69 gal/ton of straw.[19]

Data for crop residue, energy content of the residue, and potential ethanol yield from the residue for the major field crops are summarized in Table 1. Heat values for specific residues appear in Table 2.

The data in the table indicate the maximum cellulosic ethanol production from crop residue if all of the available residues, in excess of those needed for erosion protection, were collected is about 12.4 billion gal/year. The total energy content of these residues is only about 2.6% of total annual US energy consumption.

In reality, probably only half of these residues could be economically collected. Soybeans do not produce enough residue to make removal feasible. Hay, the other major crop, produces no field residue. The total acreage of the above crops is 269 million acres—almost 80% of the land in the US that is used for crop production.

RESIDUE HEAT VALUES

Table 2

Residue	Heat value (btu/lb)
Corn	7,500
Wheat	7,500
Barley	7,500
Oats	7,500
Rice	7,000
Wood	6,500

Biodiesel

As noted earlier, the RFS proposed by EPA requires the use of at least 1 billion gal of biodiesel by 2022, although the EPA may require use of greater volumes of biodiesel after 2012—possibly up to a total of 5 billion gal.

Virtually all of the biodiesel fuel produced in the US is made from oilseeds, primarily soybeans. Production of 1 billion gal of biodiesel will require 17 million acres of soybeans or 24% of the US soybean crop. This is based on the average soybean yield during 2004-08 of 41.9 bushels/acre and a biodiesel yield of 0.02357 gal/lb.[20 21] And how much diesel fuel will these soybeans replace? A miniscule 1.2% of the year 2008 distillate consumption reported by EIA in May!

Since soybeans require a warm, humid climate, they cannot be grown in the West, even with irrigation. Consequently, soybeans and corn compete for the same cropland. Because of the

39 million acres that will be needed for the 15 billion gal of ethanol from corn starch, corn land will not be available for soybean production.

This is an even more ludicrous undertaking than cellulosic ethanol.

Renewable electricity

Now let's look at the Obama administration's ill-conceived proposal to require electric utilities to obtain 25% of their electrical energy from renewable sources.

As noted earlier, EIA is forecasting 230 billion kw-hr of electrical energy from biomass in 2030. We have already seen that the US does not produce enough crop residues to meet the RFS mandates even if all of the available residues could be collected. Consequently, utilities are looking at wood as a fuel source for these plants.

The days are long past when lumber mills and wood processors disposed of sawdust and mill waste by burning. Today, these residues are either converted into building products or burned in cogeneration plants on-site, and logging residue—limbs, branches, needles, split logs—is typically left on the forest floor for erosion control and nutrient replenishment.

A modern coal-fired electrical generating plant has an overall conversion efficiency of about 40%. Although it is likely to be lower for a wood-fired plant, let's assume a conversion efficiency of 40%. The average annual timber growth (all species) on US commercial timberland is 44 cu ft/acre.[22] In order to produce 230 billion kw-hr/year of electrical energy, the US would need to dedicate 156 million acres of commercial timberland to fuelwood production. This is based on an average density for softwoods and hardwoods of 39.1 lb/cu ft.[23]

The US would need to devote 29% of its commercial timberland, which totals 541.1 million acres, to fuelwood production in order to obtain 5.6% of its electrical energy.[22] And the environmentalists were complaining about road construction in the national forests under the Bush administration.

The government needs to get out of the energy business before misadventures in biofuels lead to economic and environmental ruin. ✦

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Local approaches may help US in oil-rich areas overseas

Nick Snow
Washington Editor

The US government should be ready to engage local and state governments overseas in addition to national officials as it tries to secure foreign oil and gas supplies, a US senate committee was told on July 16.

The strategy could make a significant difference in Nigeria, Philip Carter III, principal deputy assistant secretary of the US Department of State's Bureau of African Affairs, told the Senate Foreign Relations Committee.

"There have been efforts to have international oil companies engage in efforts to improve transparency flows, but these have mostly involved the national government there," he said during a hearing entitled "$150 Oil: Instability, Terrorism, and Economic Disruption."

"The key to resolving the problems of the Niger Delta is engaging the state governments. The companies which are there engage with civil governments on several levels, but their jobs are to pump the oil. Ours should be to help those governments solve their pressing problems," Carter said.

Carter was joined by Richard L. Morningstar, special envoy for Eurasian Energy; William J. Hudson, acting deputy assistant secretary in the Bureau for Near Eastern Affairs; and Richard J. Schmierer, US ambassador to Oman, who said that the disagreement over the Kurdistan area's substantial resources has hampered Iraq's ability to revive its oil and gas industry.

Talks possible

"But broader issues also are important," Carter said. "There continues to be disagreement over boundaries, particularly in the Kuridstan region. We're encouraged by [United Nations] efforts to get the regional and national government to engage in a dialogue. Both sides have named politically connected and qualified representatives, so there could be a breakthrough," he said.

Working more closely with local and state government's in Iraq's oil-rich Kirkuk area also could make a difference, Schmierer said. "We have tried to use our good will to encourage each party, particularly their security forces, to not get into violent situations. We've had some success, but it's a process where there's some ways to go," he said.

The ultimate overall goal is to establish greater financial transparency in overseas oil and gas producing areas, starting with the Extractive Industries Transparency Initiative (EITI), the four State Department officials agreed. "Transparency is a very major part of our program in dealing with Eurasian countries," said Morningstar. "We talk about EITI and encourage countries we're dealing with to comply. Azerbaijan is a success story, and Kazakhstan is a candidate member. We'd like to work with Turkmenistan and have it participate."

> *"The key to resolving the problems of the Niger Delta is engaging the state governments."* **—Philip Carter III, principal deputy assistant secretary of the US Department of State's Bureau of African Affairs**

Morningstar said the US signed an Apr. 29 declaration at a natural gas summit in Sofia, Bulgaria, that recognizes the need for transparency and enhanced public financial reporting and accountability by all participants. "Energy cooperation should comply with the best environmental and social practices,

public disclosure, and dialogue with various stakeholders at all levels of the gas chain," it reads in part. "Extending transparency [to] all levels of gas chain transactions and best international, market-based practices to all parts of the supply chain should be strongly encouraged," it said.

Carter said transparency is a major consideration, along with sustaining gains in human rights and democracy, as the Obama administration develops its policy toward Africa. "It plays an increasingly important role when we talk about oil exporting countries. In Nigeria, the Niger Delta question is key. We look at Angola, and they hope to have a strategic partnership with us. There's also Ghana, which has the potential of being an oil and gas exporter and a member of the [US government's Millennium Challenge Corp.] compact," Carter said.

> *"Transparency is a very major part of our program in dealing with Eurasian countries."* **—Richard L. Morningstar, special envoy for Eurasian Energy**

Political will

Carter said that, in the Niger Delta region, where the critical issue is how the US government engages on social and economic conditions that contribute to civil unrest, there has been an effort over several months to establish a multilevel working group. The US also is looking at its overall development program in Nigeria, much of which involves public health, and is looking for ways to engage state and local governments, he told the committee. "Unfortunately, the national government is focusing on what it considers criminal activity. We don't see the kind of political will on the parts of state and national governments to engage in other social issues," Carter said.

Despite its problems, however, Nigeria is the only African country that has moved closer to full EITI membership, he went on. "We are trying to push aggressively on the accountability and transparency issue. EITI can be stronger and better. Right now, it's a voluntary program but it provides a framework toward providing other areas of assistance once financial responsibility and transparency have been demonstrated. In the end, it rests on the citizenry of these countries and their governments to manage their resources and husband them effectively," he said.

The US government could do more to encourage countries to embrace EITI's principles, one committee member suggested. "I think we should evaluate technical assistance we provide for countries to comply with the EITI to make it easier for them to go down that path," said Sen. Benjamin L. Cardin (D-Md.). "I also think more attention needs to be paid to it so we can tell countries when we realize they're not complying with it. And third, it should be a standard for international investment and participation of international organizations in that country," he said.

"I know it's voluntary, but there should be rewards for those which are making progress and trying to do the right thing. The framework is right, but it's more urgent than ever that advancements be made in this area," Cardin said.

> *"We can see Libya becoming a major oil exporter once again in the near future."* **—William J. Hudson, acting deputy assistant secretary in the Bureau for Near Eastern Affairs**

Chairman John F. Kerry (D-Mass.) said in his opening statement that making supplies more stable is crucial. "It may seem strange to be discussing $150 oil with the price hovering in the $60 range. But given the tremendous volatility of recent years, today's price should not be a gauge of urgency. In fact, such volatility itself is a major problem in its own right: Last year, we almost reached $150/bbl. By the beginning of this year the price had plummeted to less than $35. Since January we have seen prices double. Such dramatic swings in such a short time span are devastating to our economy," he said.

'Painfully reminded'

Kerry said stable supplies are crucial for gas as well as oil "as Europe was painfully reminded during the stand-off between Russia and Ukraine…[when] several European nations were left without a vital source of gas during a cold winter." He noted that the committee's ranking minority member, Richard G. Lugar (R-Ind.), represented the US a few days earlier in Ankara, Turkey, at the signing of an intergovernmental agreement for the Nabucco Pipeline.

In his opening statement, Lugar said the agreement was significant beyond the gas that the pipeline will carry. "Agreement on Nabucco is a bold demonstration that governments representing diverse peoples and interests can overcome divisions," Lugar said. "It required substantial agreement on energy security between European Union nations, Turkey, Georgia, Azerbaijan, and the United States. It is a signal to the rest of the world that partner governments will not acquiesce to manipulation of energy supplies for political ends. It also has the potential to build new avenues for peaceful cooperation," he said.

Morningstar said the Nabucco project will make supplies more diverse for countries potentially affected by a Russian gas shutoff. But he also suggested that energy security should play a prominent role within the North Atlantic Treaty Organization. "The issue

is what actions it could take, particular whether its members could agree to invoke Article 5 during an energy crisis. More realistic, I think NATO should work with its member states to encourage them to take actions to protect themselves," he said.

Morningstar and Schmierer each said Iran's possibly supplying gas for the Nabucco pipeline isn't likely because of its nuclear weapons programs. "We have tried to engage with Iran and have not got a positive response at this point," Morningstar said, adding, "If, in fact, their government does make the choice to engage and resolve the nuclear issue, then participation in their energy sector would be a positive result. In talking with other countries in the area, I've tried to convince them that resolving this issue would lead to this positive result sometime in the future. I don't think anyone expects participation now."

Responding to committee member Jeanne Shaheen's (D-Vt.) question about how China's growing energy demand is affecting US policies toward Middle Eastern and African oil suppliers, Carter said: "It has drawn increasing attention. China has been an active oil investor, largely in the Sudan but also potentially on the West Coast and in Ghana. We see the Chinese as economic rivals, but not as a threat to our national energy security only so far as we work to make sure the bidding process follows international standards."

Similar process

Carter continued, "It comes back to transparency. In the end, we've seen that the Chinese have not fared well when they have tried to seek a sweetheart deal with certain African governments, and that they need to follow a process similar to what we and the Europeans follow in dealing with those African governments."

Morningstar added that China is having an increasingly heavy influence in Central Asia, having just agreed to build a pipeline to move gas from Turkmenistan and provide a $3 billion loan to produce the gas. "It is hard for us to compete with China, particularly in countries that are more insulated. In Turkmenistan, it essentially offered a deal that was easy to accept. We can't compete on that basis, but we have to develop a strategy to deal with it. I think Turkmenistan understands that it shouldn't be dependent on one or two countries. Our companies need to develop approaches that can recognize this," Morningstar said.

Morningstar said the US should explore more opportunities to cooperate with China, where US oil and gas producers already are working to help produce deep gas. "The question becomes whether it makes sense to our companies, our country, and China to cooperate in a place like Turkmenistan. We don't have a clear answer. Our first priority is to get our companies into Turkmenistan. China is already there. We would help determine what, for instance, the safety standards would be," he said.

Morningstar said he also has been encouraged by countries' efforts to use energy more efficiently. "Russia's energy efficiency is terrible right now, and they want to improve it. In Ukraine, as we're encouraging them to reform their gas sector to help mitigate some of their problems in dealing with Russia, one of their biggest problems is efficiency. In fact, it's one of the least efficient countries in the world because energy there is essentially free to consumers. We're also working closely with Kazakhstan and Turkmenistan," he said.

> *"We have tried to use our good will to encourage each party, particularly their security forces, to not get into violent situations. We've had some success, but it's a process where there's some ways to go."* **—Richard J. Schmierer, US ambassador to Oman**

US relations are also starting to improve with Libya, according to Hudson. "We recently exchanged ambassadors and our relationship is proceeding to a normal level. I'm happy to report that US oil companies are the most active there, and Libyans are eager to use their technology. The Chinese are participating, but our countries are taking the lead. We can see Libya becoming a major oil exporter once again in the near future," he said. ✦

California ponders offshore oil project to ease budget crisis

Nick Snow
Washington Editor

California's legislature might vote soon to authorize the first new oil activity off Santa Barbara in 40 years as a way to help resolve the state's budget crisis.

The proposal reportedly was part of an agreement Gov. Arnold Schwarzenegger reached on July 20 with majority and minority leaders of the state's senate and assembly to eliminate California's $26.3 billion budget deficit. It includes $15.5 billion in cuts, defers other costs, and takes funds from cities and counties, several news reports said.

The proposal also could clear the way for Plains Exploration & Production Co. to directionally drill into state waters from an existing platform in

WATCHING GOVERNMENT

Nick Snow, Washington Editor

Blog at www.ogjonline.com

E15 opponents want more tests

A coalition of eight environmental and public health organizations raised objections similar to refiners' in opposing a petition for federal approval to raise allowable US gasoline levels to 15%.

It wasn't surprising that refiners opposed Growth Energy's request for US Environmental Protection Agency approval to increase gasoline ethanol levels to 15% as the public comment period ended on July 20.

The fuel ethanol advocacy organization argues that allowing an ethanol level higher than 10% will increase jobs. Opponents, including the American Lung Association, the Center for Auto Safety, the Sierra Club, and the Natural Resources Defense Council, contend that it could simply create problems.

Their primary concern is similar to that of the National Petrochemical & Refiners Association. "Ethanol should not be blended into gasoline at levels higher than 10% for use in nonflexible fuel motor vehicles and nonroad gasoline-powered engines until comprehensive and independent testing shows that midlevel ethanol blends are safe for consumers and do not harm the environment or public health," NPRA said in its comments.

Incomplete science

"The science regarding the impact of midlevel ethanol blends on consumer safety, engine performance, and potential environmental harm has not been completed, and likely will not be completed for at least 2 years," NPRA told EPA. It called the information Growth Energy submitted to EPA in support of the petition "a woefully inadequate foundation upon which to base such an important change in the nation's supply of gasoline."

The eight-group coalition noted that the 2007 Energy Independence and Security Act included a new requirement for the EPA administrator to make an applicant demonstrate that a new fuel will not cause emissions device or systems failures in off-road engines. It said that Growth Energy has not done this.

NPRA also said that potential approval of Growth Energy's petition is not an effective short- or medium-term solution to avoiding the "blendwall" problem caused by the increasing conventional biofuels volumes mandated under EISA.

Below mandate

It explained that while ethanol is currently blended into about 75% of all the gasoline sold in the US, mandated volumes of conventional and cellulosic biofuels are so high that making all gasoline 10% ethanol will fall short of EISA's compliance goal.

"However, EPA should not rush approval of E15 in order to postpone the blendwall," it continued. "The agency should make a scientifically sound decision based on an analysis of the safety of midlevel ethanol blends for use in all US gasoline-powered motor vehicles and engines. Safety is paramount."

The coalition agreed, telling EPA, "We believe that the combination of hurdles, not all of which have been identified, virtually assures that E15 could not be marketed in substantial volumes for multiple years." ✦

federal waters, generating $1.8 billion of revenue for the state by 2022. "We await final legislative action on the bill, and remain committed to work with the state leaders to ensure the legislation allows the benefits of the historic agreement [Plains E&P] reached with the environmental community to come to fruition," a company spokesman said on July 22.

The Houston independent producer won support earlier this year from Get Oil Out and other local environmental groups for the Tranquillon Ridge project, but the state land commission denied the application in January. The legislature essentially would be voting on whether to overturn that decision.

A spokeswoman for Schwarzenegger would not confirm whether the proposal was part of the budget agreement with the legislature's leaders. "The governor and legislative leaders have come to an agreement to solve California's budget deficit. Details will be made available as the legislature drafts language to be voted on later this week," she told OGJ on July 21.

Schwarzenegger has said, however, that while he continues to oppose new oil and gas activity off California's coast in general, he favors the Tranquillon Ridge project because it would be from an existing structure, Platform Irene, and extend into state waters without disturbing them.

'Revenue and jobs'

Joe Sparano, president of the Western States Petroleum Association in Sacramento, said, "It would be new revenue. It would not require new taxes. It would generate state and local revenue and jobs, all of which would help in a state suffering a severe economic downturn and a very severe deficit."

In Washington, US Rep. Doc Hastings (R-Wash.), the House Natural Resources Committee's ranking minority, called the apparent agreement a responsible bipartisan response to California's 11.6% unemployment rate and $26.2 billion budget shortfall. "By responsibly developing energy resources in their

own backyard, Californians will have access to new, high-paying jobs and over $1.8 billion in revenue to reduce their state's deficit," Hastins said on July 21.

"The good news is that the rest of America can also reap economic benefits by opening additional areas to offshore drilling and energy production. The bad news is that the Obama Administration continues to stand in the way of all-of-the-above energy development," Hastings said, adding, "With 9.5% of Americans out of work and an unprecedented $1 trillion national deficit, what are Democrats waiting on?"

While the proposal could be part of the budget agreement reached by the so-called "Big Five" of California's government, others are criticizing it as the legislature prepares to work on it because it would bypass the state land commission's oil leasing approval authority which it has held since 1938.

"The governor just put California's coastline up for sale when he had other options that don't put our natural resources at risk," said Lt. Gov. John Garamendi, who chairs the commission. "He refused to approve a plan to tax oil companies that now extract oil in California to fund healthcare services, children's programs, and education. California is the only oil-producing state without an oil severance tax, and it would generate $1.2 billion annually for our state," Garamendi said.

'Incredibly reckless'

Garamendi said, "Instead, we are taking dirty money. Big Oil has offered to California $100 million to seduce the state into granting the first new oil drilling lease in California since the Santa Barbara oil spill 41 years ago. The loan must be repaid by forgiving future royalty payments to California. This is an incredibly reckless fiscal policy."

Garamendi referred to an initial $100 million payment by Plains E&P, which would be followed by royalty payments up to $2.3 billion/year over the project's 13-year lifespan. The company previously won environmental organizations' support for its proposal by agreeing to shut down production at Platform Irene in 2022 and three other rigs off Point Arguelo by 2017, close two onshore facilities in Lompoc and along the Gaviota Coast, and donate about 4,000 acres of land to the public.

US Rep. Lois Capps (D-Calif.), whose district includes Santa Barbara and who usually opposes offshore oil and gas development, backed the Tranquillon Ridge proposal when it went before the state lands commission but questioned Schwarzenegger's using it to help resolve the current budget crisis. "She believes these decisions on important energy and environmental policy should remain with the appropriate policymakers, the State Lands Commission and the Coastal Commission, rather than allow legislators and the governor to try and use offshore drilling as a silver bullet for their budgetary challenges," a spokeswoman for the federal lawmaker said on July 22.

WSPA's Sparano said the project could show Californians how safely oil could be produced off their coast. "It would use new, slant drilling technology from an existing structure with no new pipes. It would help bring oil which is sitting there to market. It also would help California's energy supply rely less on imports. With production in the state declining, any new production, onshore and offshore, is a big deal," he told OGJ on July 21.

It also could bring new attention to the US Minerals Management Service's new 5-year Outer Continental Shelf plan, which is currently being developed, Sparano continued. The US Department of the Interior agency is having to rely on data that is 20 years old, but which nevertheless suggests that 10.5 billion bbl of oil and 3 tcf of gas off the Pacific Coast, most of it off California, he said.

"I think we'll get a chance, if it goes through, to show what a careful environmental steward the domestic oil and gas industry is," Sparano said. ✦

Oil, gas demand drive Asian boundary disputes

Eric Watkins
Oil Diplomacy Editor

A subcommittee of the US Senate Foreign Relations Committee was told that growing demand for oil and gas is one of the main drivers of increasing "friction and tension" over maritime boundaries in waters of East and Southeast Asia.

"In recent years, we have observed an increase in friction and tension over these disputes," said US Deputy Assistant Secretary of Defense Robert Scher, referring to what he called a series of "persistent territorial disputes" over maritime territories in Southeast Asia and the South China Sea.

While Scher said the sources of the rising friction are varied, he told members of the Subcommittee on East Asian and Pacific Affairs that "increased demand for oil and natural gas naturally increases the perceived stakes among claimants in securing resource rights."

Scher also said that China, while intent on securing its own interests in the region, "actively opposes any activity by other claimants to assert their own sovereignty claims" and that "China has increased and will continue to increase its force posture in the South China Sea."

Peter Dutton, associate professor at the US Naval War College, said China was more likely to use its position of strength as the means to achieve its goals, either now or in the future.

"If it is not in a strong enough

position today to gain acceptance of its sovereignty over the islands [of the South China Sea], rather than negotiate a partial result China will likely wait until such future time as its position is suitably strengthened to finalize all of its claims," Dutton said.

Still, he held out hope that "with active US involvement it may be possible to bring together all parties to at least open multilateral discussions to manage friction and prevent escalation of competing sovereignty claims, EEZ and continental shelf claims, security claims, and access rights."

China-Vietnam tension

Meanwhile, US Deputy Assistant Secretary of State Scot Marciel said Washington remains concerned "about tension between China and Vietnam, as both countries seek to tap potential oil and gas deposits that lie beneath the South China Sea."

Marciel noted that starting in the summer of 2007, China told a number of US and foreign oil and gas firms to stop exploration work with Vietnamese partners in the South China Sea or face unspecified consequences in their business dealings with China.

"We object to any effort to intimidate US companies," Marciel said, reminding his audience of a visit to Vietnam in September 2008 by former Deputy Secretary of State John Negroponte.

According to Marciel, Negroponte "asserted the rights of US companies operating in the South China Sea, and stated that we believe that disputed claims should be dealt with peacefully and without resort to any type of coercion."

China-Japan disputes

Dan Blumenthal, resident fellow of the American Enterprise Institute, said that of all the regional territorial disputes, "the Sino-Japanese quarrel in the East China Sea is the most vexing, and perhaps most dangerous."

Blumenthal said the dispute is grounded in great power competition, historical animosity, the desire to exploit potential energy resources beneath the sea, and concerns over the ultimate disposition of Taiwan.

"This combination of issues is particularly volatile," said Blumenthal, who noted that both countries claim sovereignty over the Senkaku/Diaoyu islands, and both include the islands in their EEZ/continental shelf claims.

Referring to energy security, Blumenthal noted that both countries make claims to the Chunxiao gas field, which China claims is 5 km away from the Japanese median line in the East China Sea.

"Currently, the Chinese energy company CNOOC is the operator of the field, and energy experts estimate that the Chunxiao could have as much as 250 tcf of natural gas and between 70-160 billion bbl of oil," he said.

"Since both Japan and China are committed to diversifying their sources of their energy supplies, the natural gas and oil in the East China Sea is of utmost importance to both," Blumenthal said.

He noted that an additional concern for China is the maritime distance between its ports and its main oil suppliers in the Persian Gulf and that Beijing is increasingly uncomfortable about relying on US goodwill to patrol those waters.

"Both national pride and suspicion of the United States drive China to seek alternative sources and routes of supply, preferably closer to the mainland in areas where China can project military power," Blumenthal said.

"The Chunxiao field is thus an important piece of Chinese energy security strategy," he said. ✦

EU slaps antidumping, antisubsidy duties on US biodiesel

Eric Watkins
Oil Diplomacy Editor

The European Biodiesel Board (EBB), representing the major biofuels producing industry in the European Union, praised the European Council for approving what it called "definitive antidumping and countervailing measures against unfair US biodiesel exports."

The group, which launched two legal complaints against US imports in early 2008, said the ministers' decision "confirms that the US claims were misleading and self-defeating." The group said, "They could not break the strong causality link between unfair US biodiesel trade and the damage suffered here in Europe."

EBB Sec. Gen. Raffaello Garofalo said, "It is our greatest satisfaction to see the positive conclusion of a process initiated by EBB more than 2 years ago, involving considerable time and resources, for the defense of our endangered industry."

The EBB statement came after the EU, saying it had to protect European producers from unfair American subsidies and below-cost selling, extended temporary import fees on US biodiesel.

The EU's 27 nations issued a joint statement, saying they would extend the temporary fees imposed in March for 5 more years beginning on July 12—a decision that will affect biodiesel sold to Europe by Archer Daniels Midland Co., Cargill Inc., and several other US firms.

In announcing the temporary measures last March, Lutz Guellner, EU spokesperson for trade, said, "After a thorough investigation based on the facts in this case, the commission has today decided to apply temporary duties on imports of US biodiesel."

Guellner said the decision was taken on "the basis of clear evidence that unfair subsidization and dumping of

US biodiesel has taken place, and that this is harming otherwise competitive EU industry, with potentially dire long term effects."

Guellner said the temporary measures would come into effect from Mar. 13 and would remain in place for 4 months while the investigation and contacts with stakeholders continued.

"The level of the measures, which are applied together, is set at between €211.20-237/tonne for the antisubsidy duties and between €23.60-208.20/tonne for the antidumping measures," Guellner said.

The EU decision followed a trade investigation that said US producers sold biodiesel to Europe at a price far below the real cost of production, while also receiving federal tax credits and state subsidies.

According to EBB, "For more than 2 years, US biodiesel has been sold in the European market at a substantial discount, at an even lower price than the vegetable oil raw materials purchased by the EU industry for producing biodiesel."

As a result of such discounts, underwritten by the unfair state subsidies and federal tax credits, Guellner said that US exporters were able to increase their share of the EU biodiesel market to 17% from April 2007 to March 2008. The sharp rise was in marked contrast to US market share in 2005, which stood at 0.4%.

"By imposing dissuasive measures the EU is paving the way for a fair and sustainable EU biodiesel market, allowing operators to reap the benefits of their sustained investments in biodiesel production," the EBB said, adding that it is "confident that the definitive EU measures will contribute to re-establishing the level-playing field EU producers have long hoped for."

Still, the EBB said it will remain particularly vigilant regarding "any possible circumvention attempt, and is already liaising with EU authorities to track and report any shipment of US biodiesel that would fraudulently enter the EC market directly or indirectly via third countries." ✦

WATCHING THE WORLD

Eric Watkins, Oil Diplomacy Editor

Blog at www.ogjonline.com

Khodorkovsky case

The oil and gas industry now and then suffers the slings and arrows of outrageous fortune. In Russia, that outrageous fortune has taken the shape of the country's political leaders—including its president and prime minister.

What else can one think when the trial of former Yukos head Mikhail Khodorkovsky and his colleague Platon Lebedev is described as "a politically motivated case of selective arrest and prosecution that serves as a test of the rule of law and independence of the judicial system of Russia."

Those are the words of US Sens. Roger F. Wicker (R-Miss.) and Benjamin L. Cardin (D-Md.) in a resolution they introduced on June 18 that was then referred to the Senate Foreign Relations Committee.

The two senators had an impressive stack of evidence to back up their claims, but even more evidence has been mounting in support of their view that the case was politically motivated.

Putin speaks

Former Russian Prime Minister Mikhail Kasyanov has disclosed details of a private conversation he claims to have had with Russia's then-President Vladimir Putin, revealing political motives behind the state's hounding of Khodorkovsky.

Kasyanov has filed an affidavit in the European Court of Human Rights (ECHR), including Putin's alleged explanation for the persecution of Khodorkovsky and his Yukos oil company: that Khodorkovsky was financing the Communist party without his agreement.

More precisely, Putin said Khodorkovsky had "crossed a line" by financing the communists without his permission while also financing two other political parties in accord with orders from the Kremlin.

Kasyanov's statement could add weight to Khodorkovsky's appeal against the Russian government in the ECHR, which claims that his arrest in 2003 was politically motivated—a claim Moscow denies.

"We are preparing for the hearings, scheduled for the fall," said Russia's Justice Minister Alexander Konovalov.

Potential embarrassment

Meanwhile, Russian President Dmitry Medvedev, perhaps desirous of heading off potential embarrassment for Putin this fall, said the issue of pardoning Khodorkovsky can only be dealt with in the context of the general procedures, applied in Russia.

"Pardoning Khodorkovsky, or any other person is a procedure that complies with the rules current in this country," said Medvedev, adding, "The person in question must apply to the president, plead guilty, and request the corresponding approval."

To obtain a pardon, of course, Khodorkovsky would have to drop his case in the ECHR—along with all of his claims about the political motivation behind the case against him.

Medvedev claims to see no politics in the case at all. "You know, I don't take this the way many analysts probably do," he said. "I look at this from the angle of law. And there can't be any other approach for the president."

In his view: "Khodorkovsky and some businessmen here in Russia have been convicted in court. It is not a political campaign." ✦

Court ruling leaves key oil fields to Sudanese government

Eric Watkins
Oil Diplomacy Editor

The Permanent Court of Arbitration in The Hague has readjusted the borders of Sudan's oil-rich Abyei region, effectively awarding control of key oil facilities in the area to the Khartoum-based northern government.

The oil fields had been appended to the Abyei region in 2005, after a peace agreement signed between the northern government and the Sudan People's Liberation Movement—a decision that Khartoum disputed.

In 2008, the two parties decided to refer the matter to the PCA after violent clashes in the region left 100 dead, with thousands of others forced to flee the fighting.

Altogether, the PCA's ruling reduced the land mass of the Abyei region by 8,099 sq km by redrawing its northern, eastern, and western borders, while leaving the southern border unchanged.

As a result of the PCA ruling, the Khartoum government was able to boast of significant gains to the north, west, and east of the town of Abyei, particularly in terms of control of oil fields.

"We have made a very important gain in this award," said Dirdeiry Mohamed Ahmed, the Sudanese government representative at the tribunal, adding, "This territory includes the disputed oil fields."

In particular, Abyei's new eastern border means that Khartoum will be able to keep the key Heglig and Bamboo oil fields, part of a block operated by the Greater Nile Petroleum Operating Co., a consortium led by China National Petroleum Corp.

The court ruling effectively awarded the Diffra oil field Abyei, but its production is thought to be falling.

Despite the loss of the key oil-producing areas, leaders of the SPLM, which heads the autonomous regional government in the south, agreed to abide by the court ruling.

SPLM representative Riek Machar said, "We want peace. We think this decision is going to consolidate the peace. We came to see justice and it's a decision we will respect."

Independent observers said there is still potential for long-term problems, in particular whether SPLM supporters will accept the loss of Heglig, Bamboo, and other oil fields, once the implications of the ruling have been assessed.

The most immediate effect will be loss of revenues, both to the government of Southern Sudan and to local communities, who were promised a proportion of Abyei's oil revenues under earlier interim agreements.

Under a peace deal agreed between the north and south in 2005, Abyei will hold a referendum in 2011 on whether to retain special status within north Sudan, or join the south, where a simultaneous vote will be held on independence.

But the oil fields will remain part of northern Sudan, according to this week's ruling by the PCA, however the people of Abyei vote in the forthcoming referenda. ✦

Abu Dhabi awards $9 billion in gas project contracts

Abu Dhabi Gas Industries Ltd. (Gasco) has awarded more than $9 billion in lump-sum turnkey contracts for engineering, procurement, construction, and commissioning of its integrated gas development project at Ruwais and Habshan.

Recipients of the contracts include a joint venture of JGC of Japan and Tecnimont of Italy (for $4.7 billion), Hyundai Engineering & Construction of South Korea ($1.7 billion), a joint venture of Petrofac of UAE and GS Engineering of South Korea ($2.1 billion), and CB&I of the US ($533 million).

Elements of the contract are:

- Habshan 5 process plant: JGC and Tecnimont.
- Habshan 5 utilities and off sites: Hyundai.
- Ruwais fourth NGL train: Petrofac of UAE and GS Engineering.
- Ruwais storage tanks: CB&I.

Ruwais complex

The Ruwais fractionation plant, part of the Ruwais Industrial Complex and the Abu Dhabi onshore hydrocarbon chain, receives feedstock from Gasco's NGL extraction plants at Asab, Bu Hasa, Habshan, and Bab, as well as LPG from the neighboring Takreer refinery (Abu Dhabi Refinery Co.).

The plant has two parallel fractionation trains that can process 7.8 million tonnes/year (tpy) of NGL, storage facilities, and a loading jetty to export propane, butane, and paraffinic naphtha.

The two trains send ethane to the neighboring Bourouge petrochemical plant to produce ethylene. The other three products are stored at Ruwais before transfer via the Gasco Ruwais jetty to gas carriers or via the refinery jetty to paraffinic naphtha tankers for markets worldwide.

Construction has been under way since 2005 on a third NGL train at Ruwais to handle 8.9 million tpy of additional NGL produced from Habshan 3, Asab 2, and other projects and to produce about 6,400 tonnes/day (tpd) more of raw ethane for Rouge's petrochemical plant, 6,000 tpd each

of propane and butane, and 5,800 tpd more of paraffinic naphtha products.

The project also involves construction of new product storage. Gasco awarded the EPC contract for the third train to M/S Snamprogetti in March 2005; facilities are in final stages of construction and precommissioning in advance of imminent start-up.

IGD project

The IGD projects are scheduled for completion by third-quarter 2013.

At Habshan, the IGD project will be built at a new location entitled "Habshan 5." There will be four gas processing trains with total processing capacity of 2 bcfd. Of this, 1 bcfd will be transported from offshore Umm Shaif field via Das Island to enable Abu Dhabi Marine Operating Co. to meet its planned increase in oil production.

The remaining 1 bcfd will consist of a mix of associated gas from increased oil production by Abu Dhabi Co. for Onshore Oil Operations of 1.8 million b/d from 1.4 million b/d and sour nonassociated gases from Habshan gas fields.

The Habshan 5 complex will also have four new sulfur-recovery units with recovery efficiency up to 99.9%. Gasco claims this capability will reduce emission of toxic gases to meet the environment standards of Abu Dhabi National Oil Co.

After commissioning of these facilities, Habshan 5 will produce 900 MMscfd of sales gas, 12,000 tpd of NGL, and 5,000 tpd of liquid sulfur.

While the additional products (C3, C4, C5+, and sulfur) will be exported, ethane will be transported to the nearby petrochemical complex for feedstock.

Gasco said the IGD project, in addition to providing sale gas to the consumers in the Emirate, will also provide a permanent link between offshore and onshore facilities of the ADNOC Group of companies to "provide operational flexibility for oil and gas production." ✦

Regas units for floating LNG being installed

Testing of LNG regasification packages for floating installations is taking place this summer in advance of commissioning off Brazil, Boston, and Dubai. The units are supplied by Hamworthy PLC, Dorset, UK.

Brazil

Work is under way in the Keppel Shipyard, Singapore, to install three Hamworthy LNG propane regasification skids aboard the floating storage and regasification unit (FSRU) Golar Winter, said the supplier in an announcement. Chartered by Petroleo Brasileiro SA (Petrobras), the 138,000-cu m vessel will soon sail for Brazil to tie up in Guanabara Bay, Rio de Janeiro, and send vaporized LNG into the local onshore grid. Gas trials and start-up are to take place this month.

Hamworthy delivered the three skids at the end of 2008. Capacity of each skid is 7 million cu m/day; outlet pressure is 103 bar (about 1,500 psi), and outlet temperature up to 6° C. Two skids will be used during nominal send-out, said the supplier, while the third is on standby.

Each 70-tonne skid is 10.5 m long, 6.1 m wide, 8 m high, and contains pumps, motors, heat exchangers, instrumentation, and control systems. The equipment is designed for marine installations and cryogenic working conditions and can handle large variations in send-out capacity, said the Hamworthy announcement.

"The equipment…is based on seawater heating and therefore requires less fuel and operating cost to regasify the LNG than steam-based systems," said Tore Lunde, managing director of Hamworthy Gas Systems. The Golar Winter system is based on seawater heating in a closed propane loop; the intermediate propane circuit between seawater and LNG is applied to avoid freezing.

Petrobras completed installation on its first floating regas terminal, at Pecem, Ceara state, earlier this year. That vessel is the 127,000-cu m Golar Spirit (OGJ, Mar. 16, 2009, p. 64).

Off Boston, Dubai

Golar Winter's plant was the company's second system to be delivered. Hamworthy delivered the first plant in summer 2008 for installation aboard the 145,000-cu m LNG shuttle regasification vessel (SRV) Suez Neptune. That vessel is the first of two SRVs ordered from Samsung in South Korea for Hoegh LNG to serve the Neptune terminal off Boston. Gas trials are scheduled for next month.

SRVs are designed to transport and store LNG and then vaporize it to be sent ashore by subsea pipeline. Hamworthy is supplying three regasification skids per ship. Each ship's set will have a regasification capacity of 210 tonnes/hr of LNG with send-out pressure of 115 bar. Gas trials will be taking place on the second Neptune SRV, Suez Cape Ann, in June 2010.

Hamworthy's third regasification project is for the 126,000-cu m FSRU Golar Freeze for Dubai Supply Authority and Shell in Dubai. Hamworthy is delivering the regasification skids for this vessel in September, it said.

The system will be installed on the 1977-built LNG carrier that is being converted into an FSRU before being time-chartered by Dubai Supply for 10 years, with options to extend for up to another 5 years.

After its delivery to DUSUP in second quarter 2010, Hamworthy says the Golar Freeze will be permanently moored alongside a purpose-built jetty within the existing Jebel Ali port. The FSRU will be capable of storing 125,000 cu m of LNG and delivering up to 14 million cu m/day (about 3 million tonnes/year) of regasified LNG to Dubai Supply for delivery into the Dubai gas network. ✦

Indonesia opens 24 oil, gas blocks for bidding

The Indonesian government, seeking international investment to boost the country's falling output of oil, has released 24 new oil and gas blocks for exploration and production contracts.

Evita Legowo, director general at Indonesia's energy ministry, said 17 of the blocks will be offered through tenders, while the remaining 7 blocks will be offered directly. Proposals for direct appointments will be accepted until July 30 and tender bids may be submitted until Oct. 13.

The 17 blocks offered under regular tender are: Tomini Bay I-V; Gorontalo Tomini I-II; North Bone; Kolaka Lasusua; Kabena; Jampea; Buton III; Menui Asera; Morowali; Sula I-II, and Bird's Head. The 7 blocks offered directly include: Kubu; North East Ogan Komering; Offshore West Java; Blora; North Makassar; East Simenggaris; and Digul.

Expected revenue

Legowo said the government expects to earn at least $56.5 million in signing bonuses from the 24 new oil and gas blocks, with a different minimum signing bonus for each block, depending on the size of potential reserves.

"If the early survey found the indication that the blocks have big reserves, then government sets a higher minimum signing bonus," said Legowo, who added that minimum signing bonuses range from $1 million to $5 million.

The Tomini Bay I-V and Gorontalo Tomini I-II blocks stand out as the most expensive, with the highest minimum signing bonus of $5 million on each of them due to their potentially high reserves of oil or gas.

"We set the highest minimum signing bonus for these blocks, because the areas are very promising," Legowo said. "We estimate the blocks contain huge reserves, especially gas reserves."

According to analyst Global Insight, "the [Indonesian] government recently put proven and probable reserves of oil and gas at 8.2 billion bbl and 170 tcf, respectively, which suggests the results of exploration could be positive."

Eastern basin costs

Most of the blocks offered are in the eastern part of Indonesia, and Legowo said the government asked for a lower production split for those blocks due to the higher costs involved.

"The split is 65% for the government and 35% for contractors," said Legowo, who noted that the government normally takes 80-85%.

The reduced government share should be seen as an incentive for oil and gas companies to operate in the more difficult conditions in eastern part of Indonesia, Legowo said.

According to Edy Hermantoro, director of oil and gas upstream watchdog BPMigas, the average drilling cost for a wildcat well off eastern Indonesia can reach $40-50 million, while in western Indonesia the cost is $7-8 million.

The cost of a wildcat well can reach $40-50 million off eastern Indonesia compared with $7-8 million off western Indonesia.

Boosting oil output

The release of the 24 blocks coincides with government efforts to boost oil output in the face of a recent downward trend over the past 5 years.

Jakarta has set a production target of 960,000 b/d for this year, but as of April, production has been slightly lower at 956,000 b/d, Legowo said.

The 24 blocks and their locations, generally from west to east, are:

- Kubu, off central Sumatra.
- North East Ogan Komering, onshore South Sumatra.
- West Java, off West Java.
- Blora, onshore Central Java.

• East Simenggaris, off East Kalimantan.
• North Makassar, in the Makassar Strait.
• Tomini Bay I, II, III, IV, and V, off north-central Sulawesi.
• Gorontalo Tomini I and II, off North Sulawesi.
• Buton III, North Bone, Kolaka Lususua, Kabena, and Jampea, off South Sulawesi.
• North Sulawesi Menui Asera and North Sulawesi Morowali, off southeast Sulawesi.
• North Sulawesi Sula I and II, off Moluccasp.
• North Sulawesi Bird's Head, off West Papua Province.
• Digul, onshore Papua Province. ✦

Ghana approves first Jubilee development phase

Uchenna Izundu
International Editor

Ghana has formally approved the first development phase of giant Jubilee oil field, which will tap 300 million bbl and is to begin producing in the second half of 2010.

Tullow Oil PLC, which operates the deepwater Tano block that contains part of the field, said Ghana's energy ministry had also sanctioned the unitization agreement.

Jubilee will come on stream via a floating, production, storage, and offloading vessel with a plateau oil rate of 120,000 b/d, water injection capacity of 230,000 bw/d, and gas export and injection capacity of as much as 160 MMscfd.

"By securing rig capacity and commencing the construction and drilling phases in advance," said Paul McDade, Tullow Oil chief operating officer, "Tullow is confident that it will deliver first oil from this deepwater project just over three years since the first discovery well was drilled."

The unitization agreement will allow the partners to reallocate their shares in the Jubilee unit as further field data become available.

Currently, Tullow's share is 34.7%. Other partner interests are Kosmos Energy 23.49%, Anadarko Petroleum Corp. 23.49%, Sabre Oil & Gas 2.81%, EO Group 1.75%, and Ghana National Petroleum Corp. 13.75%.

Kosmos Energy operates the West Cape Three Points block, which Jubilee extends into, and it has secured a $750 million loan from the International Finance Corp. and other banks to fund its share of the first phase of the project.

Kosmos will have to repay the loan by December 2015.

Financing confidence

W. Greg Dunlevy, Kosmos executive vice-president and chief financial officer, said the loan was a major achievement considering the drying up of the credit market. "This is evidence of the confidence of the international financial community in Kosmos' team of seasoned executives and employees, as well as its strong support of investment in the emerging Ghanaian oil sector."

Kosmos operates the West Cape Three Points block and drilled the Mahogany-1 exploration well in 2007 which discovered Jubilee field. It has drilled seven consecutive successful exploration and appraisal wells, which has proved oil in all of them.

Although it has the cash to proceed with Jubilee, Kosmos has been dogged by reports of seeking buyers for its interests in the Ghanaian licenses it holds. Companies rumored to be interested include GNPC and India's Oil & Natural Gas Corp.

Industry sources told OGJ that Kosmos did not need to sell its assets because it has obtained funding. A company spokesman told OGJ that its strategic alternative process continues. "Our debt placement was an integral part of the process," he said. ✦

ExxonMobil spuds Libya's first deepwater well

ExxonMobil Exploration Co.'s Libyan affiliate has spud the first deepwater exploration well off Libya.

The A1-20/3 well is being drilled in Contract Area 20 in the Sirte basin in the Mediterranean northeast of Misrata, Libya.

ExxonMobil Libya Ltd. didn't give the water depth or projected depth of the well. It is using Noble Africa Ltd.'s Noble Homer Ferrington semisubmersible capable of drilling to 30,000 ft in as much as 7,200 ft of water.

Elsewhere in Libya, the subsidiary has completed two 3D seismic surveys in offshore Contract Areas 20 and 21 and three 2D seismic surveys in offshore Contract Areas 44, 20, and 21. ✦

PDO lets contract for Kauther depletion-compression project

Petroleum Development Oman (PDO) has let a $350 million engineering, procurement, and construction contract to Petrofac Ltd. for the Kauther gas-condensate field depletion-compression project.

Petrofac will design the gas compression system and associated facilities at the Kauther gas plant, as well commission and operate them for 6 months.

Petrofac completed the 20 MMcfd, single-train separation Kauther gas plant in 2007. PDO operates the Al Dakhlia region field (OGJ Online, June 26, 2006). Conditioned gas from the plant flows into the domestic gas system. Condensate is transported to the Saih Rawl central processing plant (OGJ Online, Aug. 1, 2005).

Last year, condensate production increased from 48,000 b/d to over 77,000 b/d, an increase of more than 50% because of the first full year of

operations of the Kauther gas plant.

PDO ordered advanced, high-pressure compression technology from GE Oil & Gas for 16 electric motor-driven centrifugal compressors for high-pressure injection applications in Kauther, Saih Nihayda, and Yibal gas fields of Oman. This contract is worth more than $250 million, and the equipment will be delivered in 2009-15 for 14 projects that will come on line in 2010-16. ✦

Argentina

Americas Petrogas Inc., Calgary, became operator of the 50,900-acre Medanito Sur block in Argentina's Neuquen basin. The company's partners are Argentina's state Energia Argentina SA (Enarsa) and a local private company.

Americas, as operator, is entitled to receive 70% of the cash flow until it has recovered capital expenditures.

Recent analysis and integration of well and seismic data identified as many as 25 lower- risk drilling targets.

Americas Petrogas holds 2 million acres in 16 large blocks in the basin.

Australia

Beach Petroleum Ltd., Adelaide, reported that oil flowed at a 2,600-b/d rate at Butlers-1, a discovery well in PEL 92 and one of the most westerly producing wells in the Cooper-Eromanga basin of South Australia. The well flowed with 43 psi on a 2-in. choke from perforations at 1,300-1,303 m in 4.5-m of Cretaceous-Jurassic Namur sandstone.

The flow rate "confirms the excellent flow characteristics interpreted from logs and will assist in determination of the most appropriate form of artificial lift installation," Beach Petroleum said.

Interests are Beach Petroleum 75% and Cooper Energy Ltd. 25%.

Egypt

Dana Gas Egypt said two wells are averaging 12 MMscfd of dry gas from Sondos field, a February 2009 discovery on the West El Manzala concession in Egypt's Nile Delta.

The field's estimated reserves are 20 bcf. Gas is delivered to the company's South El Manzala plant.

Dana Gas also increased production at El Basant field to an undisclosed level with completion of the El Basant-3 development well in June 2009.

Edison SPA said the western part of the Sidi Abd El Rahman block (Block 8) in the Mediterranean off western Egypt still has oil and gas potential after it abandoned the Saer Offshore-1X wildcat as noncommercial. TD is 4,059 m.

Edison, a subsidiary of PTT Exploration & Production Public Co. Ltd. of Thailand, and Chile's state Sipetrol have shot 3D seismic and identified more prospects in the western part of the block. Edison holds a 40% participation interest in Block 8 with PTTEP and Sipetrol each holding 30% interest. The companies won the 4,294 sq km block in a 2006 Egyptian licensing round.

India

Gujarat State Petroleum Corp. and GeoGlobal Resources Inc., Calgary, are starting development of Tarapur 1 oil field in western India's Cambay basin.

Full field development is to involve 17 wells by the end of 2009. An engineering report attributes 1.753 million stb of proved developed nonproducing oil reserves to the first six wells. GeoGlobal's interest is 14%.

Production in May from the first three wells totaled 8,155 bbl of oil and 3.6 MMscf of gas. In June the three wells averaged 466 b/d and 420 Mcfd.

British Columbia

The shale gas play in Northeast British Columbia's Horn River basin is still attracting participants even though only about 75 wells have been drilled there.

ExxonMobil Corp. and its Canadian affiliate reported having amassed a 250,000-acre position, eight tracts of which it acquired at a provincial land sale in early July. The company said its first four wells tested at 16-18 MMcfd (OGJ Online, July 10, 2009).

Meanwhile, TAQA North, a subsidiary of Abu Dhabi National Energy Co. PJSC, acquired 32,000 acres 30 miles north of Fort Nelson in the same sale.

The Canadian subsidiary was formed in August 2007 to acquire Northrock Resources, a subsidiary of Pogo Producing Co., Houston.

Since then, with two other acquisitions from Pioneer Canada and Prime West Energy Trust, TAQA has vaulted among Canada's top 12 oil and gas producers. It also has operations in Montana, North Dakota, and Wyoming.

Nova Scotia

PetroWorth Resources Inc., Calgary, is shooting 80 line-km of 2D seismic on the Lake Ainslie block on southern Cape Breton Island, NS.

Numerous oil seeps have been observed on the 383,000-acre property, and most of the shallow wells drilled in the late 1800s-early 1900s encountered oil and-or gas. Oil from one well was sold in the US. The seismic survey, aimed at identifying a petroleum system, is to be complete in early August.

New Mexico

Analysis of geological and geophysical data by Thomasson Partner Associates Inc., Denver, revealed indicators of a Pennsylvanian basin buried beneath Cretaceous sediments in Colfax County, NM, said Sun River Energy Inc., Wheat Ridge, Colo. Such "elevator basins," in which a combined source and reservoir rock package are sealed, buried, and matured, exist elsewhere in New Mexico (OGJ, Jan. 8, 2001, p. 32).

Sun River Energy, which holds 120,000 acres in the Raton basin in northern Colfax County, is seeking partners for exploratory drilling. It believes that parts of the acreage may be prospective for coalbed methane, gas in Cretaceous Pierre shale, and oil and gas in the elevator basin.

Well off Mexico illustrates various drilling, completion complications

Wathik Alhashimi
WMA Consulting Inc.
Calgary

A well recently drilled off Mexico, Bolontiku 43, provides an example of numerous drilling problems encountered when drilling tectonically active zones that included extensive faulting, salt zones, clay and shale problems, loss circulations, and high-pressure zones over or underlain by low-pressure zones.

Pemex's Bolontiku field is in Mexico's southwest marine regions of the Gulf of Mexico (Fig. 1).

Fig. 2 shows the planned structural section of the well that includes the Upper Cretaceous, Middle Cretaceous, and top of the Upper Jurassic–Kimmeridgiano.

Before drilling, the extensive planning process for Bolontiku 43 included geoscience studies to determine the best operating window, taking into considerations the complicated and tectonically active zones within the area (Fig. 3)

Fig. 4 shows the planned well configuration.

Drilling highlights

The first part to the drilling operation set the 30 and 20-in. casings at planned depths but problems appeared during drilling of the 17½-22-in. hole, in which the plans called for setting 16-in. casing over the first fault. The drilling below 1,100 m experienced severe high torques, vibrations, and several fishing jobs for twisted off bottomhole assemblies.

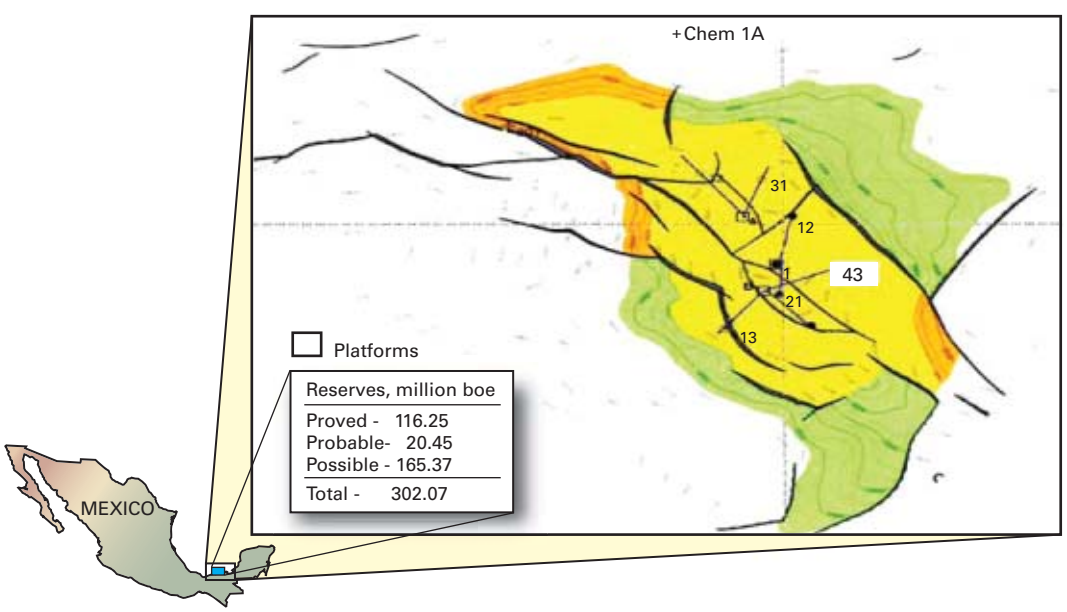
These problems did not occur during drilling of previous offset wells.

Cementing of the 16-in. casing set at 1,690 m encountered lost returns, no cement at surface, and required a top cement job.

After setting of the 16-in. casing, the drilling plan called for increasing mud weight to 2 g/cc from 1.37 g/cc in a 10⅝-in. hole followed by opening the hole to 17½-in. with a 14½-17½-in. step hole opener and setting 13⅜-in.

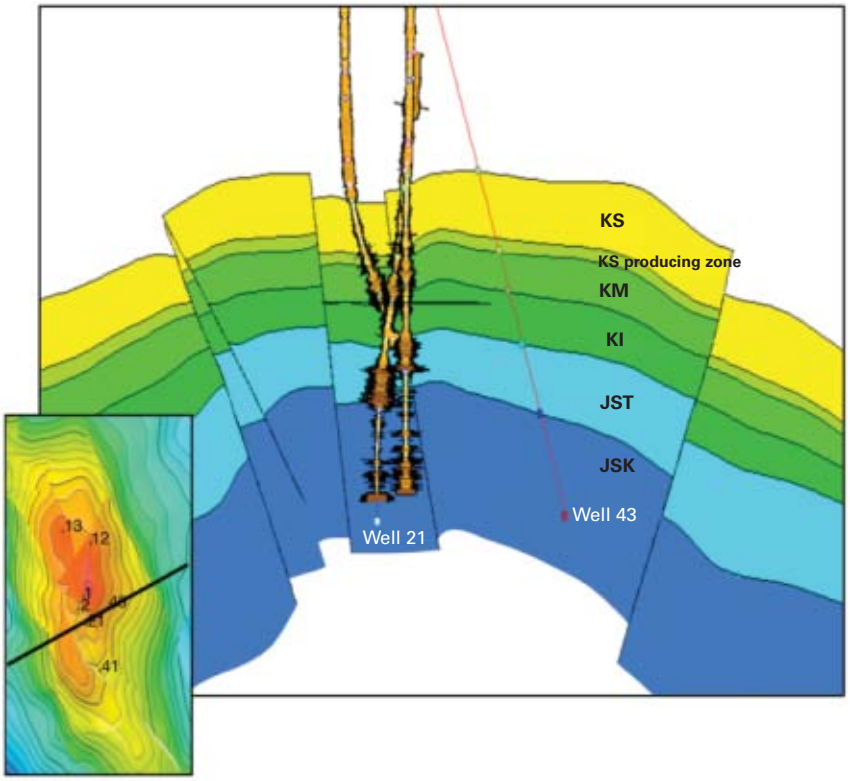
BOLONTIKU FIELD STRUCTURAL MAP

Fig. 1



BOLONTIKU FAULTING

Fig. 2



casing at 3,078 m.

The plan also called for kicking off and building up angle in this zone, so that drilling of this section required steerable bottomhole assemblies.

Drilling of the 10⅝-in. hole proceeded to 2,467 m with few torque and vibration events. Increases in mud weight to 2.04 from 2.00 g/cc ensured wellbore stability but caused light partial mud losses.

The well, however, acted strangely during opening of the hole to 17½ in. When gas-cut mud surfaced at 2,467 m, the assumption was that the well had kicked. This led to increasing the mud weight to 2.06 g/cc.

The hole, nevertheless, continued to act strangely, at times losing mud, suggesting a thief zone, yet other times gaining mud in the surface mud tanks, suggesting a kicking well with gas cut mud to surface, gas to surface, or high combustible gas reading at surface with increased mud salinity. This dynamic gain and loss situation persisted.

Attempts for controlling the well while drilling did not work, yet under static conditions, the well, even with the blowout preventers open, remained stable.

Shut-in drill pipe pressure and shut-in casing pressures did not suggest a well that was kicking.

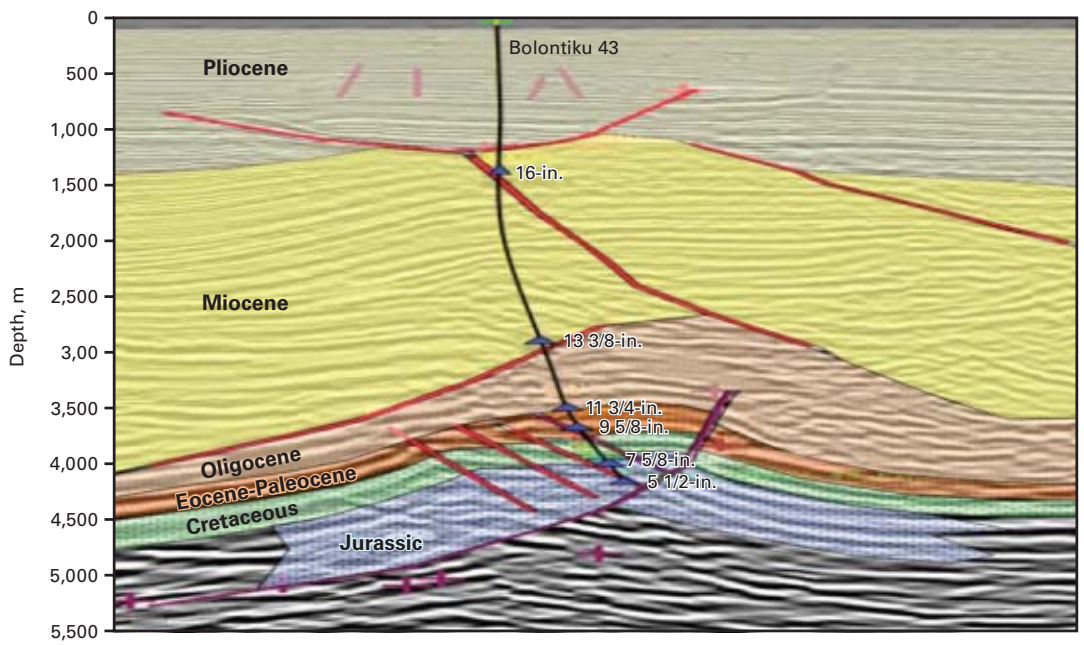
Circulation of the well, after awhile, began returning large formation cuttings to the shale shakers. These cuttings plugged the drillstring and choke manifold at surface.

The two offset wells, Bolontiku-2, only 67 m away, and Bolontiku 41, only 41 m away, did not experience such problems.

The seismic section adopted in drilling plan showed no anomalies (Fig 5). A pumped cement plug shut off the well, however, the gain and loss dynamic recurred upon drilling out the cement plug.

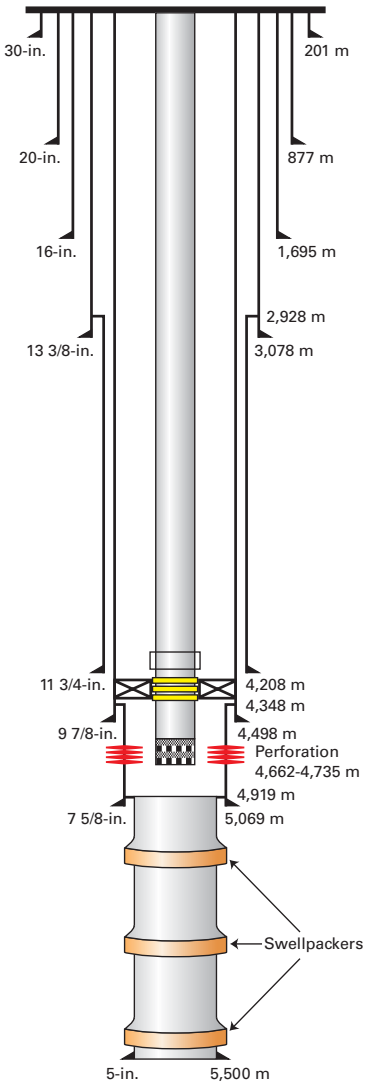
BOLONTIKU 43 PLANNED TRAJECTORY

Fig. 3



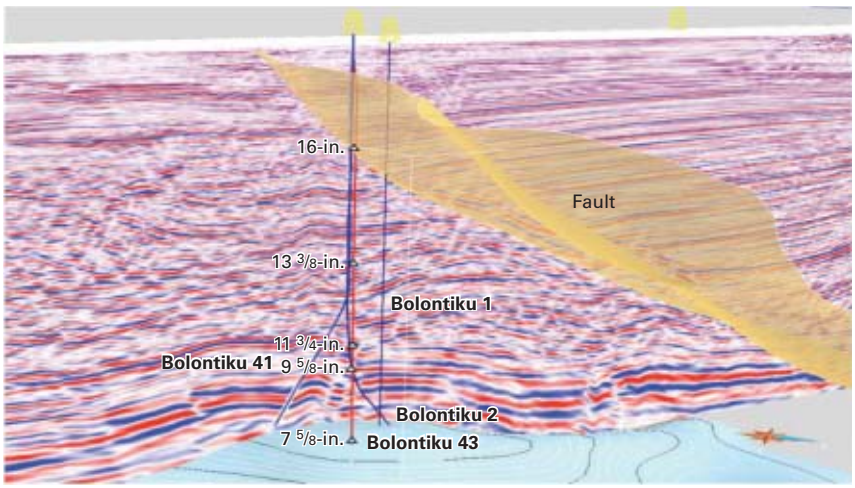
Planned well configuration

Fig. 4



Seismic section planning phase

Fig. 5



To avoid this zone, the operator decided to sidetrack the well. The sidetrack involved setting a cement plug in the open hole and side tracking at 1,715 m. Directional surveys, however, suggested that the well would not sidetrack and was still in the disturbed zone. The buildup rate and azimuth failed to achieve the desired departure from the old wellbore.

The peculiar drilling behavior experienced in the drilling indicated that supercharging or ballooning of the formation might have caused the delays experienced during drilling of the 17½-in. hole with a 10⅝-in. bit and 14½-17½-in. step hole openers.

The 13⅜-in. casing was set at 3,068 m under uncontrolled well conditions. The cement job of the casing was questionable.

Drilled below the 13⅜-in. was a 12¼-in. hole to 4,166 m. A hole opener enlarged the hole to 14¾ in.; the well's peculiar behavior continued, however, with gas cut mud accompanied by the inability to control the well.

To amend the drilling events, the operator added an 11¾-in. contingency string to the well configuration. Indications were that the cement job around the 11¾-in. was poor.

Drilling proceeded with a 10⅝-in. bit and 12¼-in. hole openers to 4,391 m. During attempts to tag the 11¾-in. top of liner, the driller realized that the liner was moving downward and was below its top's reported measured setting depth at 2,916-31 m.

The running of the 9⅞-9⅝-in. intermediate casing involved two steps. The first step set a liner, poorly cemented, in the 13⅜-in. casing and the next step ran a tieback string to surface. The tieback string also had a questionable cement job.

Because of the drilling difficulties, the operator revised the well's program to complete the well in the Cretaceous instead of its original Jurassic objective.

Drilling of the 8½-in. hole also had gas cut mud, gas shows to surface, mud losses, and uncontrollable flow throughout drilling operation to the final measured depth of 5,195 m.

The drilling fluid used below the 16-in. casing shoe to TD was an inverse emulsion mud.

Inverse emulsion may break down due to contamination and mix with formation fluid, allowing the water phase to come in contact and activate clays.

Supercharging

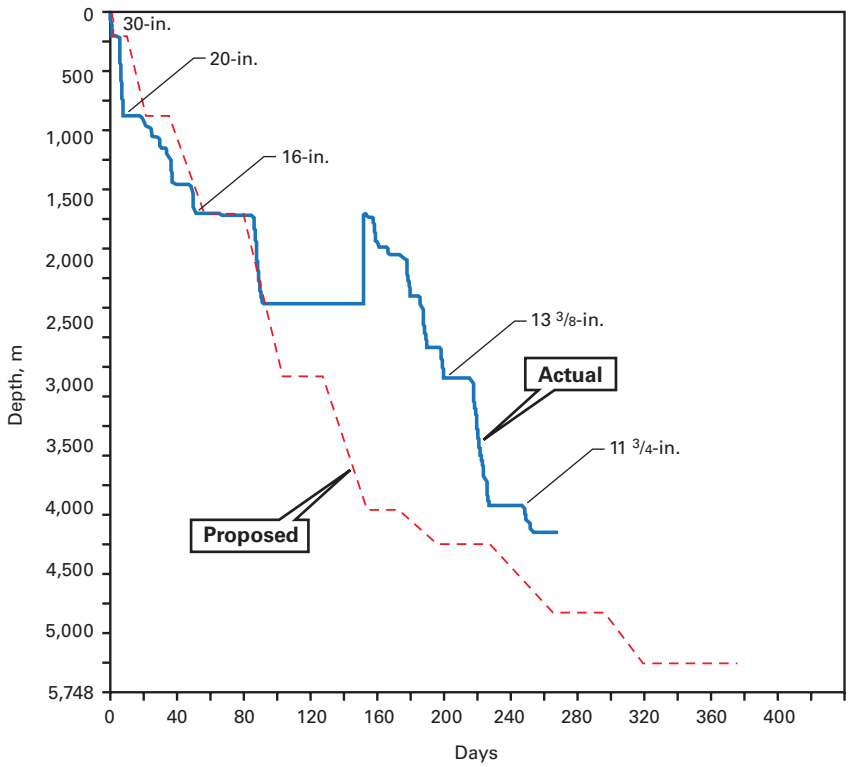
Some shale or clay formations occasionally have an extraneous seam with some permeability that contains fluids. This seam could have subnormal, normal, or abnormal pressure; however, in most cases the pressure is abnormal because the shale or clays being plastic materials transmit overburden pressure to the fluid contained in the seam,

If a borehole penetrates the seam, a well may kick leading to the increase in mud weight to balance the bottomhole pressure. The higher mud weight might increase the bottomhole circulating pressure higher than the pressure of the fluids in the seam, inducing partial mud losses into the seam.

If safety and trip margin considerations add more mud weight, as per routine practices, annular circulating pressures exerted during circulation may cause the seam to balloon from the partial mud losses.

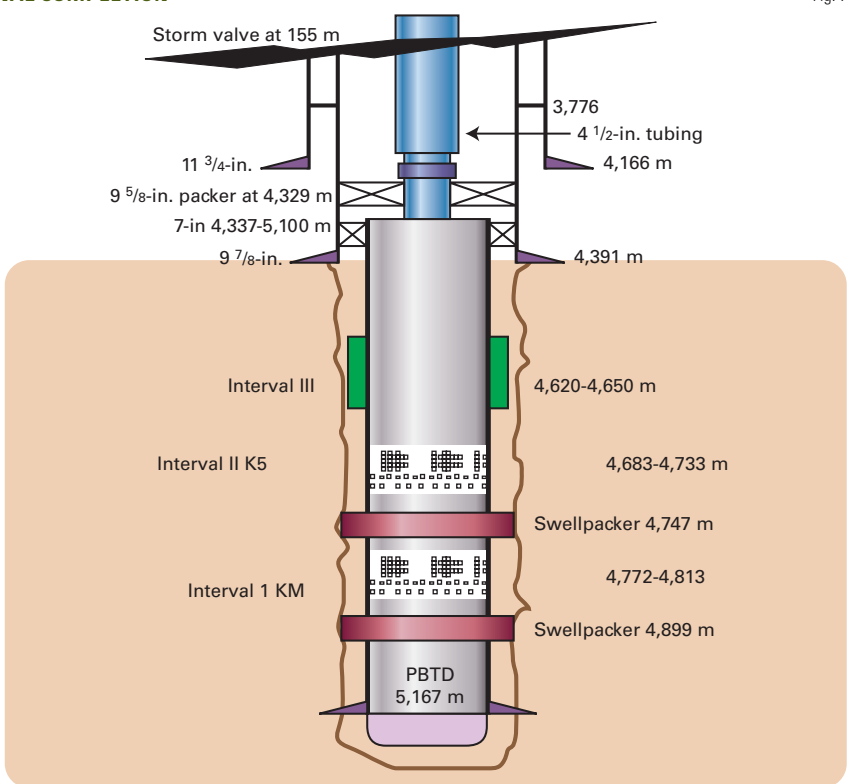
DRILLING PROGRESS

Fig. 6



FINAL COMPLETION

Fig. 7



Under static conditions, no circulation, the seam's new pressure may be higher than the mud hydrostatic pressure, causing the seam to vent to the wellbore. The venting my increase the mud level in the wellbore, pit gain, that may appear to be a kick.

These kick and partial mud loss cycles as well as routine increases and decreases of lost-circulation material to the mud may cause pressure of the fluid within the seam to reach a supercharged state in which the pressure not only affects the seam matrix and fluid but also affects the surrounding shale or clay.

The formation and seams, in time, may reach a fluidized state and begin to slough and cave into the wellbore, producing a high volume of large cuttings.

The sooner one recognizes the supercharging phenomenon, the sooner one can bring stability to the wellbore and seam.

The breakdown phase, however, requires special and lengthy procedures to unload the hole before resuming normal operations.

Unloading requires circulating of the supercharged wellbore to reduce the amount of suspended cuttings in the mud within the wellbore. This entails long circulation periods during which mud conditioning increases the mud's carrying capacities for lifting large caved or sloughed cuttings to the surface and simultaneously venting of the extra pressure of the ballooned zone.

The velocity of the cuttings is a function of gravitational forces and mud rheology. Larger particles will reach a depth at which they either float, do not move, or start to fall back downhole.

Cavities create nests where annular velocity decreases. In these areas, mud flow regime changes from turbulent to laminar or plug regime, inducing flow channels. These channels allow cuttings to accumulate in the overgauged hole and nest that may fall downhole as soon as circulation stops, especially when mud properties deteriorate because of contamination.

Caliper logs showed a large cavity at

the 16-in. casing shoe and another cavity below 1,990 m. Simultaneous fast drilling in the 10⅝-in. hole and hole opening to 14½-17½ in. probably created the cavity.

The bottom of the hole at 2,050 m showed a gauged 10⅝-in. hole that increased upward to more than 25 in. due to bit-hole opener wobble.

Geophysical review

Detailed reviews of different seismic surveys investigated the Bolontiku structures. These reviews showed a disturbed zone straddled by two faults, consisting of crushed rocks and salt diapers from about 1,350 to 1,950 m or about 200 m below the 16-in. casing shoe.

The fault at 1,350 m might have caused cement slurry loss while cementing the 16-in. casing. This interval structurally belongs to a fault that has caused shale movements in the form of a diaper; therefore, the conclusion was that the well was in a highly active tectonic zone that caused the drilling events.

Well completion

The Bolonitku 43 well reached belatedly its target in the Cretaceous (Fig. 6).

Operations proceeded with the running of a 7-in. slotted liner and four 8¼-in. swell-packers. Three of the swell-packers were for isolating three Cretaceous intervals and the fourth was run just above the top of the liner to ensure wellbore integrity.

Due to the 8½-in. hole, 8¼-in. swellpackers, the specially drifted 9⅞-9⅝-in. casing set at 4,391 m, and the uncommon selection of a 9⅝-7⅝ in. liner hanger (OD 8.35-in.), the planned 7-in. liner configuration constituted a stiff liner with very tight annular clearances.

This resulted in the liner failing to reach bottom and its removal. Pulling out the liner from the hole damaged excessively the liner's accessories. The bottom swell-packers were found prematurely activated.

A modified completion scheme included only two 8¼-in. swellpackers with slotted pipe placed at the producing interval.

The well initially produced with a high low-salinity water cut. After a well stimulation job, the well produced with a high 70% low-salinity 40,000 ppm water cut.

Isolation of the slotted pipe and perforating up hole did not improve well performance.

An analysis concluded that the 8½-in. open hole had sustained deep formation damage caused by the inverse emulsion mud. Large quantities of mud were lost to the formation. In addition, longitudinal induced fractures from piston effects caused by tight clearances resulted in casing annuli communication that led to the high low-salinity water cut. ✦

The author

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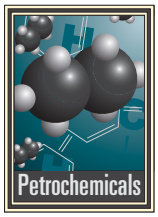


Global ethylene production rises 7 million tpy in 2008

Worldwide ethylene producers added more than 7 million tonnes/year of capacity in 2008, according to Oil & Gas Journal's latest ethylene survey. Primarily due to new plants starting up in the Middle East, the growth in capacity represents record additions. It is a significant increase compared with capacity growth of 2 million tpy in 2007 and only 245,000 tpy in 2006.

Global ethylene production capacity as of Jan. 1, 2009, was 126.7 million tpy, an increase from 119.6 million tpy of capacity reported in last year's survey (OGJ, July 28, 2008, p. 46). The additional capacity represents an increase of nearly 6%.

The latest survey lists five new world-scale ethylene production plants with combined capacity of nearly 6 million tpy, and new trains in two existing plants. None of the ethylene producers surveyed reported any shutdown plants.

Fig. 1 shows the cyclical nature of the ethylene industry. In 2008, capacity additions were the highest in the past 20 years, after recording the lowest addition rate in at least 20 years in 2006.

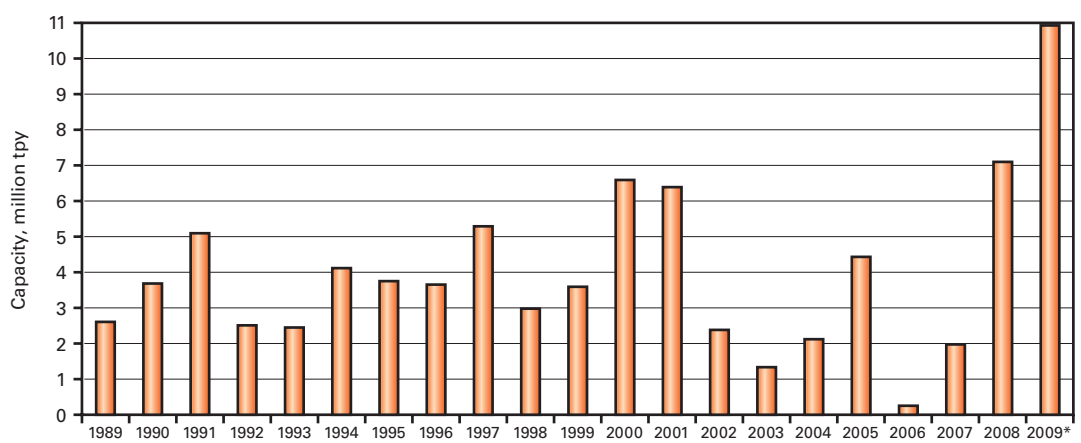
In 2009, more than 10 million tpy of capacity is slated to start up, although the global recession and an oversupplied are likely to make that number far lower. In last year's report, ethylene producers were reporting that they would add more than 17 million tpy of capacity; the actual number was 10 million tpy lower.

New units

Six new ethylene plants appear in this year's survey, all in Iran and Saudi Arabia. In addition, another plant has

GLOBAL ETHYLENE CAPACITY ADDITIONS

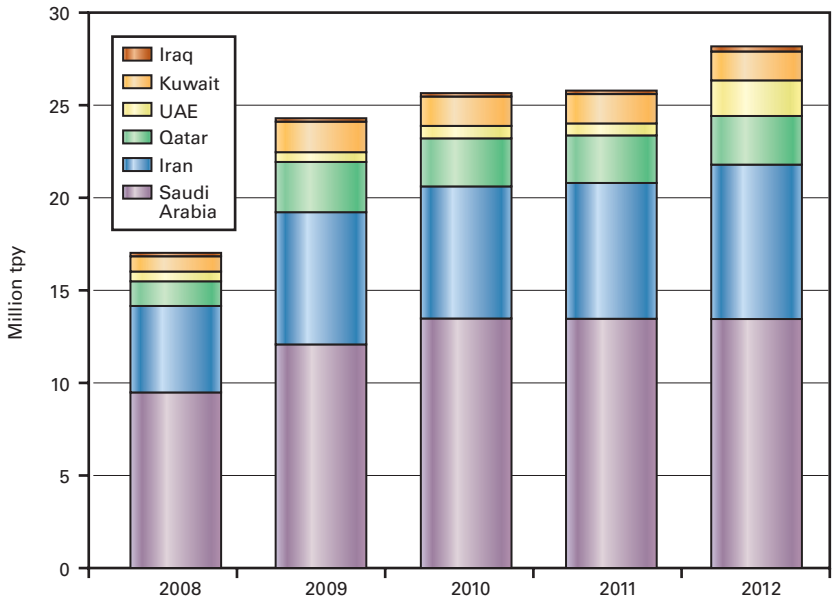
Fig. 1



*Estimate.
Source: ChemSystems, White Plains, NY (1989-99 data). OGJ Energy Database (2000-09 data)

MIDEAST ETHYLENE PRODUCTION CAPACITY

Fig. 2



Source: FACTS Global Energy, OGJ, Mar. 23, 2009, p. 44

started up a new train in an existing plant in Kuwait.

After numerous delays, Iran's National Petrochemical Co. (NPC) started up three of its world-scale ethylene production plants in 2008. The Arya Sasol Polymer Co., a joint venture of NPC and Sasol, started up a 1 million tpy ethylene plant in early 2008.

The Arya Sasol ethane cracker in Assaluyeh produced its first on-spec product in November 2007 and ramped up production in early 2008. The ethylene will feed the joint venture's two new polymers plants.

Also in Assaluyeh, Jam Petrochemical Co. achieved on-spec products in a 1.32 million tpy ethylene plant in February 2008. The Jam Petrochemical complex is the largest ethylene producer in Iran. The plant also produces 305,000 tpy of propylene, 216,000 tpy of pyrolysis gasoline, and other products.

After several delays in construction, the NPC subsidiary's plant started operations in December 2007 and was officially inaugurated in June 2008.

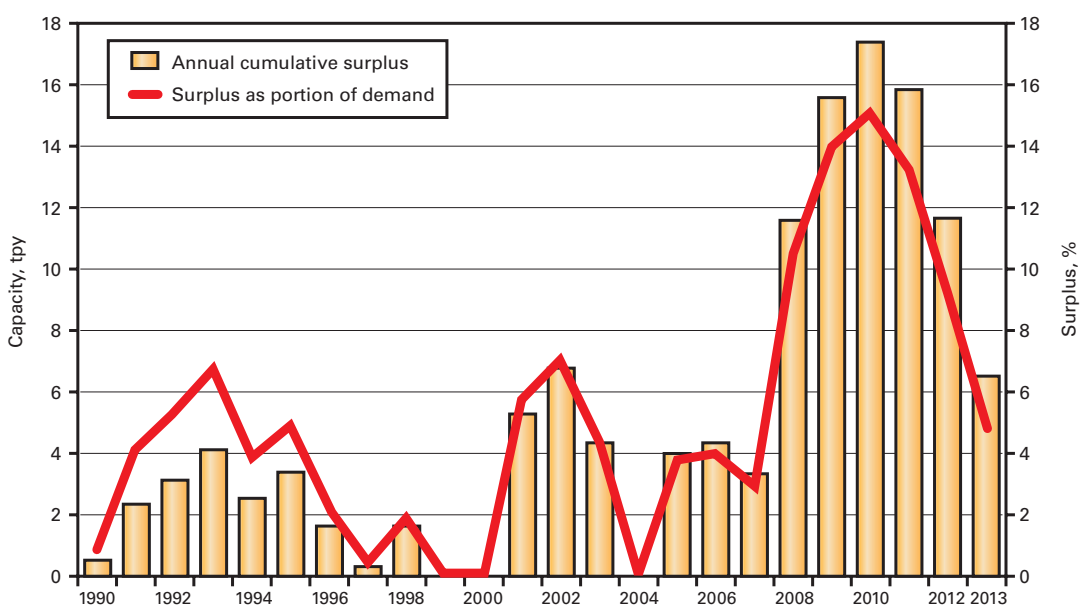
Iran's Marun Petrochemical Co. inaugurated its 1.1 million tpy ethylene plant in August 2007 and achieved production in early 2008. Ethylene from Marun's cracker at Bandar Imam feeds a 300,000 tpy high-density polyethylene plant and a 400,000 tpy monoethylene glycol plant.

In Al-Jubail, Saudi Arabia, an ethylene production plant owned by the Tasnee Petrochemical Co. was completed in September 2008 (OGJ, Mar. 23, 2009, p. 44). The company is a joint venture of Tasnee, LyondellBasell, Saudi International Petrochemical Co. (Sipchem), and Sahara Petrochemical Co.

The Tasnee plant can produce 1 million tpy of ethylene, 285,000 tpy of propylene, and 800,000 tpy of polyethylene.

SURPLUS ETHYLENE CAPACITY

Fig. 3



Source: CMAI, Houston

The Yanbu National Petrochemical Co. (Yansab), a subsidiary of Saudi Basic Industries Corp. (SABIC), completed a world-scale petrochemical complex in October 2008. The complex is capable of producing 1.3 million tpy.

Additionally, Chevron Phillips Chemical Co. reported to OGJ that it had started up a petrochemical plant that can produce 300,000 tpy of ethylene.

In late 2006,

China National Petroleum Corp.'s Lanzhou Petrochemical Co. Ltd. started up a 360,000-tpy ethylene unit in its Lanzhou plant. The total capacity of the facility is now 600,000 tpy.

The ethylene plant is integrated with CNPC's 250,000-b/d refinery. The ethylene expansion was part of an integrated project and other units in the project included 300,000 tpy of polypropylene, 650,000 tpy of polyethylene, and 200,000 tpy of gasoline hydrogenation.

Largest producers

Table 1 shows rankings of the 10 largest ethylene production complexes in the world. Nova Chemical Corp.'s 2.8-million-tpy Joffre plant retains the top spot on the list.

Equate Petrochemical Co. is a new listing in Table 1. The plant more than doubled its capacity to 1.65 million tpy when it started up a new train (Olefins II) at its Shuaiba, Kuwait, plant.

It is now the tenth largest ethylene production complex in the world. Dow Chemical Co.'s 1.64-million-tpy Freeport, Tex., plant fell off the list.

Equate announced on Dec. 1, 2008, that it was producing 850,000 tpy from its Olefins II ethylene plant. The train launched commercial operations on Nov. 20, 2008.

Equate is a joint venture of Kuwait's Petrochemical Industries Co. (42.5%), Dow (42.5%), Boubyan Petrochemicals Co. (9%), and Qurain Petrochemical Industries Co. (6%).

ChevronPhillips Chemical Co. slightly lowered the stated capacity of its Sweeny, Tex., plant. This year's survey listed the plant at 1.844 million tpy of capacity, down from 1.868 million tpy last year.

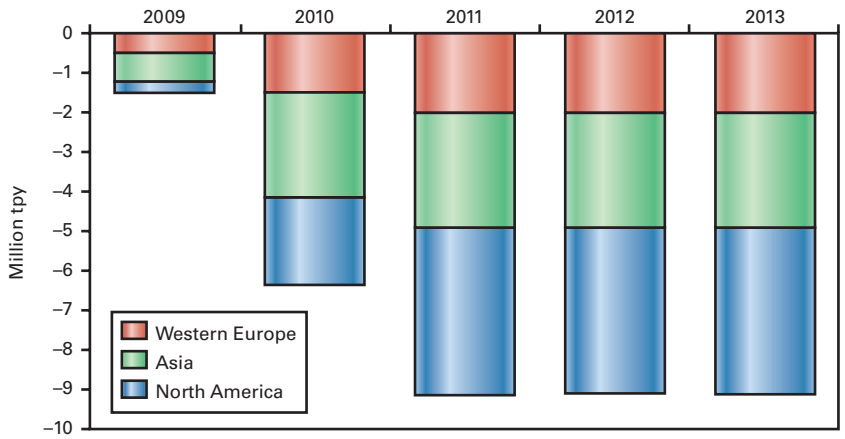
Regional review

Table 2 ranks ethylene production capacity by region.

The biggest gainer by a large margin was the Middle East, which added almost 7 million tpy of capacity. The region increased capacity more than 56% due to six new plants and one new train previously mentioned.

ETHYLENE CLOSURES

Fig. 4



Source: CMAI, Houston

Asia-Pacific and Eastern Europe also added capacity in 2008. Asia-Pacific added 360,000 tpy, all in CNPC's Langzhou expansion.

Eastern Europe showed an increase of 59,000 tpy compared with last year's survey. Unipetrol, which changed its name from Chemopetrol AS, reported to OGJ that the capacity in its Litvinov, Czech Republic, ethylene plant increased to 544,000 tpy from 485,000 tpy as listed in last year's survey.

North America and Western Europe showed slight decreases of 300,700 tpy and 10,000 tpy, respectively. South America did not experience any changes in capacity.

In the US, ChevronPhillips reported slight decreases in units at its Sweeny, Tex., ethylene complex. The decreases were offset by increased capacity in its Cedar Bayou and Port Arthur, Tex., plants. ChevronPhillips reported that its Cedar Bayou increased capacity to 835,000 tpy, up from 794,000 tpy, and Port Arthur raised capacity to 828,000 tpy, also up from 794,000 tpy.

Table 3 ranks ethylene production capacity by country. Iran showed the largest increase, followed by Saudi Arabia, Kuwait, China, and the Czech

TOP 10 ETHYLENE COMPLEXES*

Table 1

	Company	Location	Capacity, tpy
1	Nova Chemicals Corp.	Joffre, Alta.	2,812,000
2	Formosa Petrochemical Corp.	Mailiao, Taiwan, China	2,550,000
3	Arabian Petrochemical Co.	Jubail, Saudi Arabia	2,250,000
4	ExxonMobil Chemical Co.	Baytown, Tex.	2,197,000
5	ChevronPhillips Chemical Co.	Sweeny, Tex.	1,844,000
6	Dow Chemical Co.	Terneuzen, Netherlands	1,800,000
7	Ineos Olefins & Polymers	Chocolate Bayou, Tex.	1,752,000
8	Equistar Chemicals LP	Channelview, Tex.	1,750,000
9	Yanbu Petrochemical Co.	Yanbu, Saudi Arabia	1,705,000
10	Equate Petrochemical Co.	Shuaiba, Kuwait	1,650,000

*As of Jan. 1, 2009.

REGIONAL CAPACITY BREAKDOWN

Table 2

	Ethylene capacity, tpy		Change	
	Jan. 1, 2009	Jan. 1, 2008	tpy	%
Asia-Pacific	33,362,000	33,002,000	360,000	1.09
Eastern Europe	8,571,000	8,512,000	59,000	0.69
Middle East, Africa	19,312,000	12,342,000	6,970,000	56.47
North America	35,407,000	35,707,700	–300,700	–0.84
South America	5,083,500	5,083,500	–	–
Western Europe	24,918,000	24,438,000	–10,000	–0.04
Total capacity	**126,653,500**	**119,575,200**	**7,078,300**	**5.92**

NATIONAL ETHYLENE CAPACITIES

Table 3

Country	Jan. 1, 2009 Ethylene capacity, tpy	Jan. 1, 2008 Ethylene capacity, tpy	Change, tpy
Algeria	133,000	133,000	—
Argentina	838,500	838,500	—
Australia	502,000	502,000	—
Austria	500,000	500,000	—
Azerbaijan	330,000	330,000	—
Belarus	193,000	193,000	—
Belgium	2,460,000	2,460,000	—
Brazil	3,500,000	3,500,000	—
Bulgaria	400,000	400,000	—
Canada	5,531,000	5,531,000	—
Chile	45,000	45,000	—
China	7,348,000	6,988,000	360,000
China, Taiwan	3,621,000	3,621,000	—
Colombia	100,000	100,000	—
Croatia	90,000	90,000	—
Czech Republic	544,000	485,000	59,000
Egypt	330,000	330,000	—
Finland	330,000	330,000	—
France	3,373,000	3,373,000	—
Germany	5,757,000	5,757,000	—
Greece	20,000	20,000	—
Hungary	660,000	660,000	—
India	2,515,000	2,515,000	—
Indonesia	520,000	520,000	—
Iran	4,734,000	1,214,000	3,520,000
Israel	200,000	200,000	—
Italy	2,170,000	2,170,000	—
Japan	7,265,000	7,265,000	—
Kazakhstan	130,000	130,000	—
Kuwait	1,650,000	800,000	850,000
Libya	350,000	350,000	—
Malaysia	1,649,000	1,649,000	—
Mexico	1,384,000	1,384,000	—
Netherlands	3,965,000	3,975,000	–10,000
Nigeria	300,000	300,000	—
North Korea	60,000	60,000	—
Norway	550,000	550,000	—
Poland	700,000	700,000	—
Portugal	330,000	330,000	—
Qatar	1,030,000	1,030,000	—
Romania	844,000	844,000	—
Russia	3,490,000	3,490,000	—
Saudi Arabia	9,400,000	6,800,000	2,600,000
Serbia and Montenegro	200,000	200,000	—
Singapore	1,980,000	1,980,000	—
Slovakia	220,000	220,000	—
South Africa	585,000	585,000	—
South Korea	5,630,000	5,630,000	—
Spain	1,430,000	1,430,000	—
Sweden	625,000	625,000	—
Switzerland	33,000	33,000	—
Thailand	2,272,000	2,272,000	—
Turkey	520,000	520,000	—
Ukraine	630,000	630,000	—
UAE	600,000	600,000	—
United Kingdom	2,855,000	2,855,000	—
United States	28,492,000	28,792,700	–300,700
Uzbekistan	140,000	140,000	—
Venezuela	600,000	600,000	—
Total	**126,653,500**	**119,575,200**	**7,078,300**

Republic, for the reasons previously mentioned.

Lower capacity

Table 3 also shows that only two countries showed a net decrease in capacity: the Netherlands and the US. The total decrease in these two countries was 310,700 tpy.

No plant announced a complete shutdown; therefore, the capacity decreases were due to partial shutdowns or companies restating ethylene capacity.

In the US, net increases in ChevronPhillips's plants were offset with falling capacity in two of Shell Chemicals' plants. Shell reported that capacity in its Deer Park, Tex., complex fell to 1.179 million tpy from 1.426 million tpy, and Norco, La., decreased to 1.451 million tpy from 1.556 million tpy. This is a combined drop of more than 350,000 tpy.

In the Netherlands, SABIC slightly lowered the stated capacity in its Geleen ethylene plant.

Largest producers

Table 4 lists the top 10 owners of ethylene capacity worldwide. There were two changes in the company order.

Iran's NPC is a newcomer to the list, coming in at the seventh largest ethylene producer in the world. NPC increased the capacity in its plants to 4.2 million tpy from 1.2 million tpy stated in last year's survey. This is an increase of nearly 250%. Total AS dropped off the list due to this change.

Starting up a new ethylene plant in Saudi Arabia allowed SABIC to move up to the second largest ethylene producer in the world, passing ExxonMobil Corp, whose capacity stayed the same as 2007. SABIC's capacity increased to 8.4 million tpy from nearly 7.2 million tpy, an 18% rise in plants in which it fully or partially owns.

Half of the 10 largest ethylene producers experienced increases in capacity of wholly owned or partially owned plants: Dow, SABIC, LyondellBasell, NPC, and ChevronPhillips. Only one producer, Shell, had a decrease in capacity.

Construction

Table 5 lists ethylene production

TOP 10 ETHYLENE PRODUCERS[1]

Table 4

	Company	No. of sites	Capacity, tpy: Of entire complexes	Capacity, tpy: With only company partial interests
1	Dow Chemical Co.	15	14,005,000	10,710,750
2	Saudi Basic Industries Corp.	8	10,235,000	8,455,000
3	ExxonMobil Corp.	15	11,470,000	8,352,000
4	Royal Dutch Shell PLC	10	8,613,300	6,489,300
5	LyondellBasell[2]	8	6,200,000	5,450,000
6	Ineos	4	4,656,000	4,286,000
7	National Petrochemical Co.	7	4,734,000	4,234,000
8	Formosa Petrochemical Corp.	2	4,091,000	4,091,000
9	Sinopec	10	4,375,000	4,075,000
10	ChevronPhillips Chemical Co.[3]	5	4,307,000	4,052,000

[1]As of Jan. 1, 2009. [2]Includes subsidiary Equistar Chemicals LP. [3]Ownership: Chevron Corp. 50%, ConocoPhillips 50%.

Ethylene expansions, 2009-13

Table 5

Location	Company	2009	2010	2011	2012	2013
		Ethylene capacity, tpy				
Arzew, Algeria	Total, Sonatrach				1,100,000	
Nanjing, China	BASF-YPC Co. Ltd.	750,000				
Heilongjian Province, China	Daqing Petroleum & Chemical Co.					600,000
Fujian Province, China	Fujian Petrochemical Co. Ltd.	800,000				
Fushun, China	PetroChina			800,000		
Ningbo, China	PetroChina					1,200,000
Sichuan, China	PetroChina				800,000	
Dushanzi, Zinjang, China	PetroChina Dushanzi Petrochemical Co.	1,000,000				
Maoming, Guangdong, China	Sinopec		320,000			
Quanzhou City, China	Sinopec					800,000
Ningbo, Zhejiang, China	Zenhai Refining & Chemical Co.		1,000,000			
Vadinar, Gujarat, India	Essar Gujarat Petrochemicals Ltd.					1,300,000
Dibrugarh, Assam, India	GAIL India Ltd.					220,000
Panipat, India	Indian Oil Co. Ltd.	800,000				
Dahej, India	Oil & Natural Gas Corp.		1,100,000			
Gachsaran, Iran	Gachsaran Olefin				1,000,000	
Ilam, Iran	Ilam Petrochemical Co.				153,000	
Assaluyeh, Iran	Kavyan Petrochemical Co.	2,000,000				
Assaluyeh, Iran	Morvarid Petrochemical Co.	500,000				
Sohar, Oman	Dow Chemical Co.			850,000		
Ras Laffan, Qatar	Qatar Chemical Co. Ltd., Chevron Corp., Total AS	1,300,000				
Ras Laffan, Qatar	Qatar Petroleum Co., ExxonMobil Corp.					1,600,000
Mesaieed, Qatar	Qatar Petroleum Co., Honam Petrochemical Co.				900,000	
Al-Jubail, Saudi Arabia	Eastern Petrochemical Co.	1,300,000				
Al-Jubail, Saudi Arabia	National Petrochemical Industrialization				1,008,000	
Rabigh, Saudi Arabia	Saudi Aramco, Sumitomo Chemical Co.	1,500,000				
Yanbu, Saudi Arabia	Saudi Basic Industries Corp.					1,300,000
Al-Jubail, Saudi Arabia	Saudi Polymers			1,200,000		
Al-Jubail, Saudi Arabia	Tasnee Petrochemicals					1,000,000
Singapore	ExxonMobil Chemical Corp.			1,000,000		
Singapore	Shell Eastern Petroleum Ltd.		800,000			
Kaoshiung Linyuan, Taiwan	Chinese Petroleum Corp.			1,000,000		
Lin Yuan, Taiwan	Chinese Petroleum Corp.					600,000
Map Ta Phut, Thailand	PTT Polyethylene Co. Ltd.	1,000,000				
Rayong, Thailand	Siam Cement PLC, Dow Chemical Co.		900,000			
Trinidad & Tobago	Westlake Chemical Corp.		570,000			
Ruwais, Abu Dhabi, UAE	Abu Dhabi Polymers Co. Ltd.				1,500,000	
El Tablazo, Venezuela	Polinter				1,000,000	
Jose, Anzoategui, Venezuela	Pequiven				1,050,000	
Total		**10,950,000**	**4,690,000**	**4,850,000**	**8,511,000**	**8,620,000**

Source: Oil & Gas Journal construction survey

capacity slated to start up during 2009-13.

Last year, OGJ forecast that an unprecedented 17.4 million tpy of new capacity would come on line in 2008, based on responses to construction surveys. The 7 million tpy of capacity that started up in 2008 did not include two plants in China, one plant in Qatar, and two plants in Saudi Arabia that were listed in Table 5 last year.

According to the latest OGJ construction data, almost 11 million tpy of new capacity is slated to come on stream in 2009 (Table 5). How much will actually start up depends on the global economic situation and demand growth.

All of the new capacity is in the Middle East and Asia-Pacific. Six of the projects list capacities of more than 1 million tpy each.

There are currently several new world-scale ethylene plants under construction in Saudi Arabia, Iran, Qatar, and the UAE.

Fig. 2 shows that Middle East ethylene production capacity is expected to increase to about 28 million tpy in 2012 (OGJ, Mar. 23, 2009, p. 44).

These expansions will more than double the region's capacity from a 2007 level of 12.3 million tpy. In 2009 alone, the region is slated to add nearly 7 million tpy of capacity.

Saudi Arabia, in 2009, will start up two major ethylene production complexes. The first phase of the PetroRabigh complex, a joint venture of Saudi Aramco and Sumitomo Chemical, was scheduled to start commercial production in second-quarter 2009.

The plant will produce 1.3 million tpy of ethylene and 900,000 tpy of propylene. Feedstock to the plant is about 95 MMscfd of ethane and 15,000 b/d of LPG.

In early 2009, SABIC's Eastern Petrochemical Co. (Sharq III) was scheduled

to start up a 1.3 million tpy ethylene plant in Al-Jubail.

Future plans for Saudi Arabia include the Saudi Kayan mega complex with a production capacity of 4 million tpy, and a Dow Chemical-Saudi Aramco joint venture to build a 1.2-million-tpy ethylene plant.

By 2012, Iran's ethylene production capacity will increase to 8.4 million tpy from the current 4.7 million tpy.

Qatar Petrochemical Co. (QAPCO) is scheduled to start up a 1.3 million tpy ethylene plant in Ras Laffan in second-half 2009. Other companies with an ownership share in the plant include Total Petrochemicals, Qatar Petroleum Co., and Chevron Phillips Chemical Co.

Qatar Petroleum also has two joint ventures, one with ExxonMobil and the other with Shell. Both projects are for crackers with capacities of more than 1 million tpy; however, neither is expected to start up before 2013.

In second-half 2009, Fujian Petrochemical Co. Ltd. is scheduled to start up 800,000 tpy of ethylene production. Fujian Petrochemical is a consortium of Sinopec, which owns 50%, ExxonMobil (25%), and Saudi Aramco (25%). The integrated complex will also reportedly produce 1.2 million tpy of polymers, 300,000 tpy of benzene, and 700,000 tpy of paraxylene.

PetroChina's Dushanzi Petrochemical Co. is slated to start up a 1 million tpy ethylene production complex near yearend 2009. The complex will also be capable of producing 1.5 million tpy of polymers and 240,000 tpy of benzene.

Global markets

Ethylene markets are experiencing weakening supply-demand conditions, reversing a trend that started in late 2004. Record levels of excess capacity and a global recession are placing downward pressure on ethylene prices and operating rates.

According to Chemical Market Associates Inc. (CMAI), Houston, excess capacity will reach as high as 17 million tpy in 2010, or about 15% of total demand. This compares to 7% surpluses in 2002 and in 1993 (Fig. 3).

CMAI predicted at its 2009 World Petrochemical Conference, Mar. 25-26, Houston, that global nameplate ethylene capacity will increase to about 145 million tpy by 2010 from 125 million tpy in 2007. Total global demand for ethylene will remain essentially flat at about 115 million tpy.

"The absolute level of surplus capacity in the forecast is moderated by the assumption that the level of closures during this period will reach nearly 9 million tpy," according to CMAI.

Similar to previous downturns in the ethylene industry, lower profitability leads to shutdowns of some older, high-cost plants.

Closures amounting to about 2.5 million tpy have already been announced in North America and Western Europe, according to CMAI. Its forecast suggests an additional 6.5 million tpy will have to be shut down (Fig. 4), spread among North America (4 million tpy), Asia (3 million tpy), and Europe (2 million tpy).

CMAI's energy market forecast favors light-feed cracking vs. heavy-feed cracking. Therefore, its closure assumptions focus on assets that heavily depend on naphtha feedstocks and may not be integrated with refinery operations. ✦

INTERNATIONAL SURVEY OF ETHYLENE FROM STEAM CRACKERS—2009

Leena Koottungal
Survey Editor/News Writer

Capacities as of Jan. 1, 2009

Company	Location	Total nameplate capacity, tonnes/year	Typical feedstock or feedstock mixture on which listed capacity is based, % Ethane	Propane	Butane	Naphtha	Gas oil	Other
ALGERIA								
Sonatrach	Skikda	133,000						
Total Algeria		**133,000**						
ARGENTINA								
Dow Chemical Co.	Bahia Blanca (BB1)	275,000	100					
Dow Chemical Co.	Bahia Blanca (BB2)	490,000	100					
Huntsman Corp.	San Lorenzo	21,000		25		75		
Petrobras Energia	Puerto San Martin	32,500		100				
Petrobras Energia	San Lorenzo	20,000		100				
Total Argentina		**838,500**						
AUSTRALIA								
Huntsman Chemical Co. Australia Ltd.	Melbourne, Vic.	32,000	100					
Qenos Pty. Ltd.	Altona, Vic.	180,000	75	15	10			
Qenos Pty. Ltd.	Botany, NSW	290,000	80			20		
Total Australia		**502,000**						
AUSTRIA								
OMV AG	Schwechat	500,000	15		23	62		
Total Austria		**500,000**						
AZERBAIJAN								
Azerichimia	Sumgait	30,000						
Azerichimia	Sumgait	300,000						
Total Azerbaijan		**330,000**						
BELARUS								
Production Association Polymir	Novopolotsk	73,000						
Production Association Polymir	Novopolotsk	120,000						
Total Belarus		**193,000**						
BELGIUM								
BASF Antwerpen NV	Antwerp	1,080,000		5		95		
Benelux FAO	Antwerp	230,000	16	16	18	50		
Benelux FAO	Antwerp	580,000	16	16	18	50		
Benelux FAO	Antwerp	570,000	16	16	18	50		
Total Belgium		**2,460,000**						
BRAZIL								
Braskem SA	Camacari, Bahia	600,000	5			95		
Braskem SA	Camacari, Bahia	680,000				100		
Copesul	Triunfo, RS	700,000				100		
Copesul	Triunfo, RS	500,000				100		
Petroquimica Uniao SA	Santo Andre, Sao Paulo	500,000				100		
Rio Polimeros	Duque de Caxias	520,000						
Total Brazil		**3,500,000**						
BULGARIA								
Lukoil Neftochim Bourgas JSC	Bourgas	250,000	3.4		10	86.6		
Lukoil Neftochim Bourgas JSC	Bourgas	150,000				100		
Total Bulgaria		**400,000**						
CANADA								
Dow Chemical Co.	Fort Sask., Alta.	1,285,000	100					
Imperial Oil Products & Chemicals	Sarnia, Ont.	300,000	33	33	34			
Nova Chemicals Corp.	Corunna, Ont.	839,002	10	15	30	40	5	
Nova Chemicals Corp.	Joffre, Alta. (E1)	725,624	100					
Nova Chemicals Corp.	Joffre, Alta. (E2)	816,327	100					
Nova Chemicals Corp.	Joffre, Alta. (E3)	1,269,841	100					
Petromont	Varennes, Que.	295,000		10	25	50	15	
Total Canada		**5,530,794**						
CHILE								
Petrox SA	Concepcion	45,000	8		16	76		
Total Chile		**45,000**						
CHINA								
BASF-YPC Co. Ltd.	Nanjing	600,000						
China National Offshore Oil Co.	Daya Bay, Guangdong	800,000						
China National Offshore Oil Co.	Dushanzi	140,000						
China Petrochemical Industrial Corp.	Daqing	320,000						
Dalian Petrochemical Co.	Dalian	4,000						
Fushun Petrochemical Complex	Fushun	115,000						
Gaoqiao Petrochemical Co.	Gaoqiao	14,000						
Guangzhou Petrochemical Co.	Guangzhou	150,000						
Jilin Chemical Industrial Co. Ltd.	Jilin	700,000						
Lanzhou Chemical Industrial Co.	Lanzhou	600,000						

INTERNATIONAL SURVEY OF ETHYLENE FROM STEAM CRACKERS—2009 (CONTINUED)

Company	Location	Total nameplate capacity, tonnes/year	Typical feedstock or feedstock mixture on which listed capacity is based, % Ethane	Propane	Butane	Naphtha	Gas oil	Other
Panjin Ethylene Industry Corp.	Panjin	130,000						
Sinopec	Beijing	660,000				30	70	
Sinopec	Caojing, Shanghai	145,000				30	70	
Sinopec	Caojing, Shanghai	700,000				60	40	
Sinopec	Guangzhou, Guandong	140,000				100		
Sinopec	Maoming, Guangdong	380,000				100		
Sinopec	Neijing	650,000				60	40	
Sinopec	Puyang, Henan	180,000				100		
Sinopec	Qilu	720,000				80	20	
Sinopec	Tianjin	200,000				100		
Total China		**7,348,000**						
CHINA, TAIWAN								
Chinese Petroleum Corp.	Kaohsiung Linyuan	422,000	100					
Chinese Petroleum Corp.	Linyuan	230,000	100					
Chinese Petroleum Corp.	Linyuan	419,000	100					
Formosa Petrochemical Corp.	Mailiao	450,000				100		
Formosa Petrochemical Corp.	Mailiao	900,000						
Formosa Petrochemical Corp.	Mailiao	1,200,000						
Total China, Taiwan		**3,621,000**						
COLOMBIA								
Empresa Colombiana de Petroleos	Barrancabermeja	100,000	80	20				
Total Colombia		**100,000**						
CROATIA								
Polimeri	Zagreb	90,000	100					
Total Croatia		**90,000**						
CZECH REPUBLIC								
Unipetrol	Litvinov	544,000		2	6	56	1	Hydrowax-40
Total Czech Republic		**544,000**						
EGYPT								
Sidi Kerir Petrochemicals Co.	Alexandria	330,000						
Total Egypt		**330,000**						
FINLAND								
Borealis OY	Porvoo	330,000				100		
Total Finland		**330,000**						
FRANCE								
A.P. Feyzin	Feyzin	250,000				100		
ExxonMobil Corp.	Notre Dame de Gravenchon	400,000				100		
Naphthachimie	Lavera	740,000			50	50		
Polimeri Europa France SNC	Dunkerque	370,000	0.5	3.5	20	76		
Societe du Craqueur de L' Aubette SCA	Berre l'Etang	450,000			12	75	13	
Total Petrochemicals	Carling-St. Avold-Marienau	568,000				100		
Total Petrochemicals	Gonfreville l'Orcher	520,000				100		
Total Petrochemicals	Lacq (Snea plant)	75,000	100					
Total France		**3,373,000**						
GERMANY								
Basell Polyfine GMBH	Wesseling	738,000			10	90		
Basell Polyfine GMBH	Wesseling	305,000					100	
BASF AG	Ludwigshafen	620,000		5	5	90		
BP Gelsenkirchen	Gelsenkirchen	580,000		2	8	78	12	
BP Gelsenkirchen	Gelsenkirchen	480,000			9	65	26	
INEOS	Dormagen	550,000				100		
INEOS	Dormagen	544,000				100		
LyondellBasell	Munchsmunster	320,000	13	17	17	53		
Dow Chemical Co.	Bohlen	560,000				100		
OMV Deutschland GMBH	Burghausen, Bavaria	450,000	2.5	6	6	84	1.5	
Shell & DEA Oil GMBH	Heide	110,000						
Shell & DEA Oil GMBH	Wesseling	500,000						
Total Germany		**5,757,000**						
GREECE								
EKO Chemicals Co. AE	Thessaloniki	20,000				65		Ref. gas-35
Total Greece		**20,000**						
HUNGARY								
Tiszai Vegyi Kombinat Ltd.	Tiszaujvaros	370,000			2	96	2	
Tiszai Vegyi Kombinat Ltd.	Tiszaujvaros	290,000		8	15	72	5	
Total Hungary		**660,000**						

INTERNATIONAL SURVEY OF ETHYLENE FROM STEAM CRACKERS—2009 (CONTINUED)

Company	Location	Total nameplate capacity, tonnes/year	Typical feedstock or feedstock mixture on which listed capacity is based, % Ethane	Propane	Butane	Naphtha	Gas oil	Other
INDIA								
Gas Authority of India Ltd.	Pata, Uttar Pradesh	300,000						
Haldia Petrochemicals Ltd.	Haldia, West Bengal	520,000				100		
Indian Petrochemicals Corp. Ltd.	Baroda, Gujarat	130,000				100		
Indian Petrochemicals Corp. Ltd.	Gandhar, Gujarat	300,000	35-50	50-65				
Indian Petrochemicals Corp. Ltd.	Nagothane, Maharashtra	400,000	35-50	50-65				
National Organic Chemical Industries Ltd.	Thane, Maharashtra	75,000				100		
Reliance Industries Ltd.	Hazira, Gujarat	790,000				100		
Total India		**2,515,000**						
INDONESIA								
PT Chandra Asri	Cilegon, West Java	520,000						
Total Indonesia		**520,000**						
IRAN								
Amir Kabir Petrochemical Co.	Amir Kabir	520,000	24	4	12	58		2
Arak Petrochemical	Arak	247,000				100		
Arya Sasol Polymer Co.	Assaluyeh Bushehr	1,000,000						
Bandar Imam Petrochemical Co.	Bandar Imam	311,000	20	3	10			67
Jam Petrochemical Co.	Assaluyeh Bushehr	1,320,000						
Marun Petrochemical Co.	Bandar Assaluyeh	1,200,000						
Tabriz Petrochemical Co.	Tabriz	136,000	4	8	8	80		
Total Iran		**4,734,000**						
IRAQ								
Present status unknown		—						
Total Iraq		**—**						
ISRAEL								
Carmel Olefins Ltd.	Haifa	200,000		10	10	80		
Total Israel		**200,000**						
ITALY								
Polimeri Europa	Brindisi	440,000				100		
Polimeri Europa	Gela	245,000	25	5		70		
Polimeri Europa	Porto Marghera	490,000				100		
Polimeri Europa	Priolo	745,000	2		1	65	32	
Syndial	Porto Torres	250,000				70	30	
Total Italy		**2,170,000**						
JAPAN								
Asahikasei Chemicals Corp.	Kurasiki, Okayama	484,000				100		
Idemitsu Petrochemical Co. Ltd.	Chiba	374,000			2	98		
Idemitsu Petrochemical Co. Ltd.	Tokuyama	450,000				100		
Keiyo Ethylene	Ichihara, Chiba	768,000						
Maruzen Petrochemicals	Chiba	480,000						
Mitsubishi Chemical Corp.	Kashima (Unit 1)	375,000		10	20	55		NGL-15
Mitsubishi Chemical Corp.	Kashima (Unit 2)	453,000		10	20	55		NGL-15
Mitsubishi Chemical Corp.	Mizushima	450,000		5	5	80		NGL-10
Mitsui Chemicals Inc.	Ichihara, Chiba	553,000			10	90		
Mitsui Chemicals Inc.	Takaishi City, Osaka	450,000						
Nippon Petrochemical	Kawasaki	450,000						
Showa Denko KK	Oita	600,000				100		
Sumitomo Chemical Co. Ltd.	Chiba	380,000						
Tonen Chemical Corp.	Kawasaki	505,000				100		
Tosoh Corp.	Yokkaichi	493,000				100		
Total Japan		**7,265,000**						
KAZAKHSTAN								
Akpo	Aktau	100,000						
Government	Atyrau	30,000						
Total Kazakhstan		**130,000**						
KUWAIT								
Equate Petrochemical Co.	Shuaiba	800,000	100					
Equate Petrochemical Co. (Equate II)	Shuaiba	850,000						
Total Kuwait		**1,650,000**						
LIBYA								
National Oil Co.	Ras Lanuf	350,000						
Total Libya		**350,000**						
MALAYSIA								
Ethylene Malaysia Sdn. Bhd.	Kertih	400,000	100					
Optimal Olefins Sdn. Bhd.	Kertih	600,000	100					
Titan Petrochemicals Sdn. Bhd.	Johor	400,000				100		
Titan Petrochemicals Sdn. Bhd.	Pasir Gudang	249,000				100		
Total Malaysia		**1,649,000**						

INTERNATIONAL SURVEY OF ETHYLENE FROM STEAM CRACKERS—2009 (CONTINUED)

Company	Location	Total nameplate capacity, tonnes/year	Typical feedstock or feedstock mixture on which listed capacity is based, % Ethane	Propane	Butane	Naphtha	Gas oil	Other
MEXICO								
Petroleos Mexicanos	La Cangrejera, Veracruz	600,000	100					
Petroleos Mexicanos	Morelos, Veracruz	600,000	100					
Petroleos Mexicanos	Pajaritos, Veracruz	184,000	100					
Total Mexico		**1,384,000**						
NETHERLANDS								
Dow Chemical Co.	Terneuzen (No. 1)	580,000		15		85		
Dow Chemical Co.	Terneuzen (No. 2)	585,000		15		85		
Dow Chemical Co.	Terneuzen (No. 3)	635,000				100		
SABIC Europe	Geleen (No. 3)	595,000				100		
SABIC Europe	Geleen (No. 4)	670,000				100		
Shell Nederland Chemie BV	Moerdijk	900,000						
Total Netherlands		**3,965,000**						
NIGERIA								
Eleme Petrochemical Co. Ltd.	Eleme River	300,000						NGL
Total Nigeria		**300,000**						
NORTH KOREA								
Namhung Youth Chemical Complex	Anju, South P'yong'an Province	60,000						
Total North Korea		**60,000**						
NORWAY								
Noretyl AS	Rafnes, Bamble	550,000	30	45	25			
Total Norway		**550,000**						
POLAND								
PKN Orlen SA	Plock	700,000		5	5	90		
Total Poland		**700,000**						
PORTUGAL								
Repsol YPF SA	Sines	330,000				100		
Total Portugal		**330,000**						
QATAR								
Qatar Petrochemical Co.	Mesaieed	530,000	100					
Q-Chem I	Mesaieed	500,000	80	20				
Total Qatar		**1,030,000**						
ROMANIA								
Petrom SA	Pitesti	200,000	19.5	8.5	23.7	48.4		
Petromidia SA	Navodari	200,000						
Petromidia SA	Constanta	224,000		10.7	5.0	54.7		Kero.-29.6
Petrotel SA	Teleajen	220,000						
Total Romania		**844,000**						
RUSSIA								
Angarskneftorgsintez	Angarsk, Siberia	60,000			5.2	89.2	5.6	
Angarskneftorgsintez	Angarsk, Siberia	240,000			5.2	89.2	5.6	
Nizhnekamskneftekhim	Nizhnekamsk	450,000						
Norsy		300,000				100		
Omskykauchuyk	Omsk, Siberia	90,000						
Orgsintez	Kazan	140,000						
Orgsintez	Kazan	100,000						
Orgsintez	Kazan	100,000						
Oxosyntez	Orsk	45,000						
Polimir		150,000				100		
Salavatneftorgsintez	Salavat	300,000						
Sibur Himprom		30,000						
Sibur-Neftechim	Nizhny Novgorod	300,000			20	80		
Sintezkauchuk		300,000						
Stavrapolpolymer	Prikumsk	350,000						
Tomsk PCC	Tomsk	300,000						
Uraorgsintes	Ufa	235,000						
Total Russia		**3,490,000**						
SAUDI ARABIA								
Al Jubail Petrochemical Co.	Jubail	800,000	50	50				
Arabian Petrochemical Co.	Jubail	800,000				100		
Arabian Petrochemical Co.	Jubail	800,000	50	50				
Arabian Petrochemical Co.	Jubail	650,000	100					
Chevron Phillips Chemical Co. LP	Jubail	300,000						
Jubail United Petrochemical Co.	Jubail	1,000,000						
Saudi Basic Industries Corp.	Yanbu	1,300,000						
Saudi Petrochemical Co.	Jubail	1,045,000	100					
Tasnee	Jubail	1,000,000						

INTERNATIONAL SURVEY OF ETHYLENE FROM STEAM CRACKERS—2009 (CONTINUED)

Company	Location	Total nameplate capacity, tonnes/year	Typical feedstock or feedstock mixture on which listed capacity is based, % Ethane	Propane	Butane	Naphtha	Gas oil	Other
Yanbu Petrochemical Co.	Yanbu	875,000	100					
Yanbu Petrochemical Co.	Yanbu	830,000	16	16	18	50		
Total Saudi Arabia		**9,400,000**						
SERBIA AND MONTENEGRO								
Chemi Industria	Pancevo	200,000						
Total Serbia and Montenegro		**200,000**						
SINGAPORE								
ExxonMobil Chemical Co.	Jurong Island	900,000				33	33	34
Petrochemical Corp. of Singapore Pte. Ltd.	Pulau Ayer Merbau	465,000				100		
Petrochemical Corp. of Singapore Pte. Ltd.	Pulau Ayer Merbau	615,000				100		
Total Singapore		**1,980,000**						
SLOVAKIA								
Slovnaft Petrochemicals	Bratislava	220,000	1	9	12	78		
Total Slovakia		**220,000**						
SOUTH AFRICA								
Sasol Polymers	Sasolburg	110,000	80	20				
Sasol Polymers	Secunda	475,000	75	5		20		
Total South Africa		**585,000**						
SOUTH KOREA								
Honam Petrochemical	Yeochun	700,000				100		
Korea Petrochemical Industries Co. Ltd.	Ulsan	320,000				100		
LG Daesan Petrochemical	Daesan	450,000				100		
LG Petrochemical Co. Ltd.	Yeosu City	760,000				100		
Lotte Daesan Petrochemical	Daesan	600,000				100		
Samsung General Chemicals	Daesan	820,000				100		
SK Corp.	Ulsan	545,000				100		
SK Corp.	Ulsan	185,000				100		
Yeochon	Yeochun	480,000				100		
Yeochon	Yeochun	420,000				100		
Yeochon	Yeochun	350,000				100		
Total South Korea		**5,630,000**						
SPAIN								
Dow Chemical Co.	Tarragona	580,000				100		
Repsol YPF SA	Puertollano	250,000						Ref. streams
Repsol YPF SA	Tarragona	600,000						
Total Spain		**1,430,000**						
SWEDEN								
Borealis AB	Stenungsund	625,000	40	20		40		
Total Sweden		**625,000**						
SWITZERLAND								
Lonza Ltd.	Visp	33,000		24	56	20		
Total Switzerland		**33,000**						
THAILAND								
PTT Chemical	Map Ta Phut, Rayong	437,000	80	6				LPG-14
PTT Chemical	Map Ta Phut, Rayong	385,000	5	18	28	49		
PTT Chemical	Map Ta Phut, Rayong	350,000						
PTT Chemical	Map Ta Phut, Rayong	300,000	100					
Rayong Olefins Ltd.	Map Ta Phut, Rayong	800,000						LPG-60, NGL-40
Total Thailand		**2,272,000**						
TURKEY								
Petkim Petrochemicals Holding Co.	Aliaga, Izmir	520,000				100		
Total Turkey		**520,000**						
UKRAINE								
Chlorvinyl	Kalush	250,000					100	
Oriana		180,000						
TNK-BP	Lisichansk	200,000				100		
Total Ukraine		**630,000**						
UNITED ARAB EMIRATES								
Borouge Abu Dhabi Polymers Co. Ltd.	Ruwais, Abu Dhabi	600,000	100					
Total UAE		**600,000**						

INTERNATIONAL SURVEY OF ETHYLENE FROM STEAM CRACKERS—2009 (CONTINUED)

Company	Location	Total nameplate capacity, tonnes/year	Typical feedstock or feedstock mixture on which listed capacity is based, %					
			Ethane	Propane	Butane	Naphtha	Gas oil	Other
UNITED KINGDOM								
INEOS	Grangemouth	730,000				100		
INEOS	Grangemouth	340,000				100		
ExxonMobil Chemical Co.	Fawley	120,000	9	8	8	25	25	25
ExxonMobil Chemical Co.	Mossmorran Fife	800,000	100					
SABIC Europe	Wilton	865,000		20	10	70		
Total United Kingdom		**2,855,000**						
UNITED STATES								
BASF Fina Petrochemicals	Port Arthur, Tex.	830,000				100		
Chevron Phillips Chemical Co. LP	Cedar Bayou, Tex.	835,000	30	20	25	25		
Chevron Phillips Chemical Co. LP	Port Arthur, Tex.	828,000	70	25	5			
Chevron Phillips Chemical Co. LP	Sweeny, Tex.	923,000	38	37	25			
Chevron Phillips Chemical Co. LP	Sweeny, Tex.	667,000	75	25				
Chevron Phillips Chemical Co. LP	Sweeny, Tex.	254,000	85	15				
Dow Chemical Co.	Freeport (LHC 7), Tex.	630,000	50	50				
Dow Chemical Co.	Freeport (LHC 8), Tex.	1,010,000	10	20		70		
Dow Chemical Co.	Plaquemine (LHC 2), La.	520,000	75	25				
Dow Chemical Co.	Plaquemine (LHC 3), La.	740,000		70	10	20		
Dow Chemical Co.	Taft 1, La.	590,000	20	40		40		
Dow Chemical Co.	Taft 2, La.	410,000	20	40		40		
DuPont	Orange, Tex.	680,000	100					
Eastman Chemical Co.	Longview, Tex.	781,000	25	67	7	1		
Equistar Chemicals LP (LyondellBasell)	Channelview, Tex.	875,000	5			95		
Equistar Chemicals LP (LyondellBasell)	Channelview, Tex.	875,000	5			95		
Equistar Chemicals LP (LyondellBasell)	Chocolate Bayou, Tex.	544,000				100		
Equistar Chemicals LP (LyondellBasell)	Clinton, Iowa	476,000	80	20				
Equistar Chemicals LP (LyondellBasell)	Corpus Christi	771,000	10	30		60		
Equistar Chemicals LP (LyondellBasell)	LaPorte, Tex.	789,000	60	20		20		
Equistar Chemicals LP (LyondellBasell)	Morris, Ill.	550,000	80	20				
ExxonMobil Chemical Co.	Baton Rouge	975,000	9	8	8	25	25	25
ExxonMobil Chemical Co.	Baytown, Tex.	2,197,000	58	8	9	25		
ExxonMobil Chemical Co.	Beaumont, Tex.	816,000	8	8	9	75		
ExxonMobil Chemical Co.	Houston	102,000						100
Formosa Plastics Corp. USA	Point Comfort, Tex.	816,000	45	15		40		
Formosa Plastics Corp. USA	Point Comfort, Tex.	725,000	45	15		40		
Huntsman Corp.	Odessa, Tex.	360,000						
Huntsman Corp.	Port Arthur, Tex.	635,000				60		LPG-40
Huntsman Corp.	Port Neches, Tex.	180,000						
INEOS Olefins and Polymers USA	Chocolate Bayou, Tex.	1,752,000	50	35		15		
Javelina Co.	Corpus Christi	151,000						Ref. Gas-100
Sasol North America Inc.	Lake Charles, La.	453,533	100					
Shell Chemicals Ltd.	Deer Park, Tex.	1,179,138						
Shell Chemicals Ltd.	Norco, La.	1,451,247	5			35	60	
Sunoco Inc.	Marcus Hook, Pa.	225,000	100					
Westlake Petrochemicals Corp.	Calvert City, Ky.	195,000		100				
Westlake Petrochemicals Corp.	Sulphur #1, La.	567,000	100					
Westlake Petrochemicals Corp.	Sulphur #2, La.	522,000	70	30				
Williams Olefins	Geismar, La.	612,245	90	10				
Total United States		**28,492,163**						
UZBEKISTAN								
Uzbekneftegaz	Shurtan	140,000						
Total Uzbekistan		**140,000**						
VENEZUELA								
Pequiven-Petroquimica de Venezuela SA	El Tablazo, Zulia	250,000	30	70				
Pequiven-Petroquimica de Venezuela SA	El Tablazo, Zulia	350,000	100					
Total Venezuela		**600,000**						
Total world		**126,653,457**						

CORROSION—Conclusion

Pitting corrosion models improve integrity management, reliability

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New deterministic and stochastic models for external pitting corrosion in underground pipelines can help improve integrity and reliability analyses. This concluding article applies these models to Monte Carlo-simulated and real pipeline pitting corrosion data obtained from field and in-line inspections (ILI).

Part 1 of this series (OGJ, July 20, 2009, p. 64) described a deterministic predictive model relating pit growth to soil and pipeline characteristics, showing it is possible to establish a physically sound correlation between pitting model parameters and soil and pipeline characteristics.

Part 1 also described a continuous-time, nonhomogenous linear growth Markov process developed for stochastically modeling external pitting corrosion in buried pipelines, showing this type of Markov process to be particularly suitable due to the existence of a closed form solution to the system of Kolmogorov's forward equations.[1]

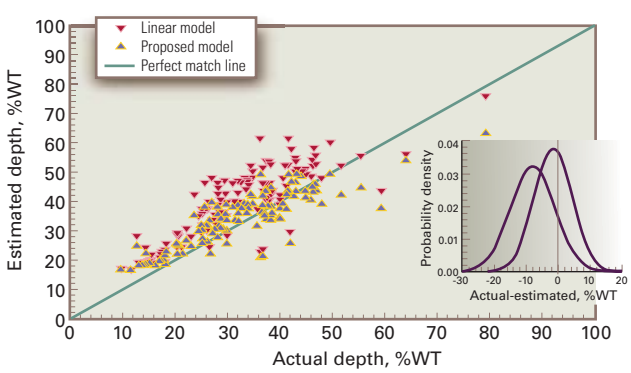
Part 1's results show Monte Carlo simulations effectively predict the probability distributions of soil corrosion pitting depth and rate. The complexity and cost of the necessary field and laboratory studies would otherwise prevent obtaining this information. The probabilistic description of corrosion pitting can realistically estimate the reliability evolution of cathodically protected, coated pipelines, for which the worst-case corrosion rates commonly recommended in the pipeline-corrosion literature might be exceedingly conservative.[2-5]

This article first applies Part 1's deterministic pitting corrosion model to experimental data obtained through ILI and field inspections. A second example applies the pitting corrosion rate distribution obtained in Part 1 to data obtained from repeated ILI. A final example uses Part 1's Markov chain model to predict the time evolution of pit-depth distribution in underground pipelines from soil properties. These examples show how the proposed models help improve pipeline integrity and reliability analyses.

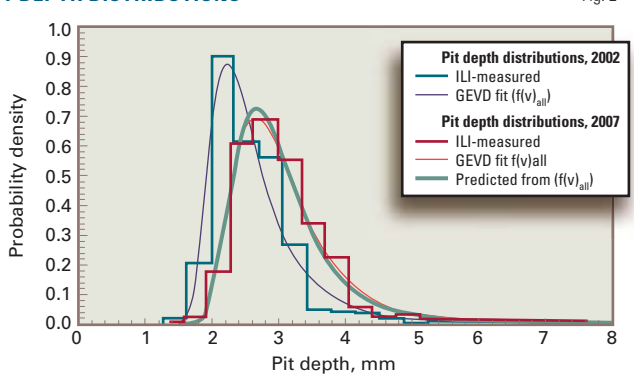
Example 1

This real-life example involves integrity assessment of a coal tar-coated 62-km long underground oil pipeline with a 914-mm OD and an 11-mm WT. Magnetic flux leakage (MFL) ILI inspected the pipeline in 1997, after 18 years of service. Time-to-failure by leakage due to external corrosion pitting provided the basis for a remaining-life estimate. The ILI report and field inspections identified pits as corrosion-caused metal losses with diameter ≤ WT × 2. This same criterion applies to all case

PIT DEPTH ESTIMATIONS Fig. 1



PIT DEPTH DISTRIBUTIONS Fig. 2



studies presented hereafter. A methodology developed by the authors calibrated the ILI reports (OGJ, Sept. 13, 2004, p. 76).[6]

The first stage of ILI-based integrity analysis used the linear pit-growth model, assuming pits began to grow when the pipeline was commissioned (t_0 = 0). The (constant) growth rate ascribed to each pit was determined as the ratio of each pit's measured depth (d_m) to the length of the time interval between the time of inspection (t_{ILI}) and the pipeline's commissioning time (t_C) determined the (constant) growth rate for each pit. Therefore, pit depth at any future time can be estimated with Equation 1.

A second stage of analysis used the prediction model for pit growth proposed in Part 1. Equation 2 computed the time evolution of the depth of the observed pits.

This stage integrated the pit growth rate defined by Equation 3 over the interval from t_{ILI} to t. The parameter values of Table 1 for the all soil category (t_0 = 2.88 years, k' = 0.128 mm yr-$^{1/0.220}$, and n´ = -0.220) evaluated Equation 2 for each pit, modeling the pit growth using typical soil conditions observed for all collected samples.

Repairs followed ILI and many sections of the pipeline were excavated and rehabilitated when necessary. This process measured the depths of a total of 123 pits detected at in-danger pipeline sections in the field. Exposure time for these pits ranged between 19 and 26 years. Fig. 1 plots the pit-depth estimates obtained with the linear growth model (Equation 1) and the proposed growth model (Equation 2) against the pit depths measured in the field (actual depths).

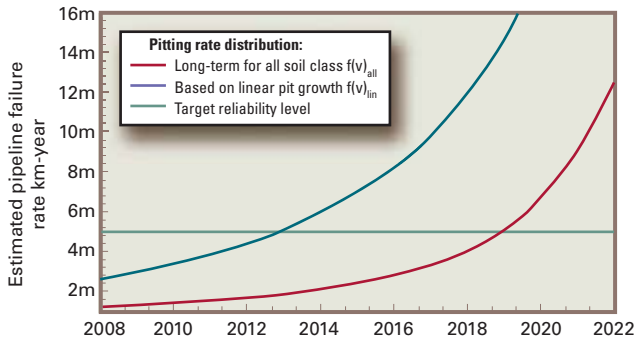
The estimations of both the linear and the proposed growth models show random errors always associated with this type of comparison plot. The perfect match (1:1) line in Fig. 1 shows, with respect to field-measured depths, linear model-based estimations are biased toward larger depths on average. The observed overprediction is considerably higher for the linear growth model than for the proposed model. The linear trend assumed for pit growth in Equation 1 leads to more conservative predictions than the power law trend in Equation 2, explaining the magnitude of the difference in overprediction, particularly when estimations cover relatively long time periods.

The inset in Fig. 1 shows the normal distributions fitted to the residuals obtained for both types of estimations, demonstrating that in addition to a reduction in the large overprediction produced by the linear model, application of the proposed pit growth model also allows for reduction of the uncertainty (scatter) in the estimations. Environmental differences between the observed pipeline and the all soil category explain the relatively small remaining overprediction seen during application of the proposed model.

The increase in accuracy and preci-

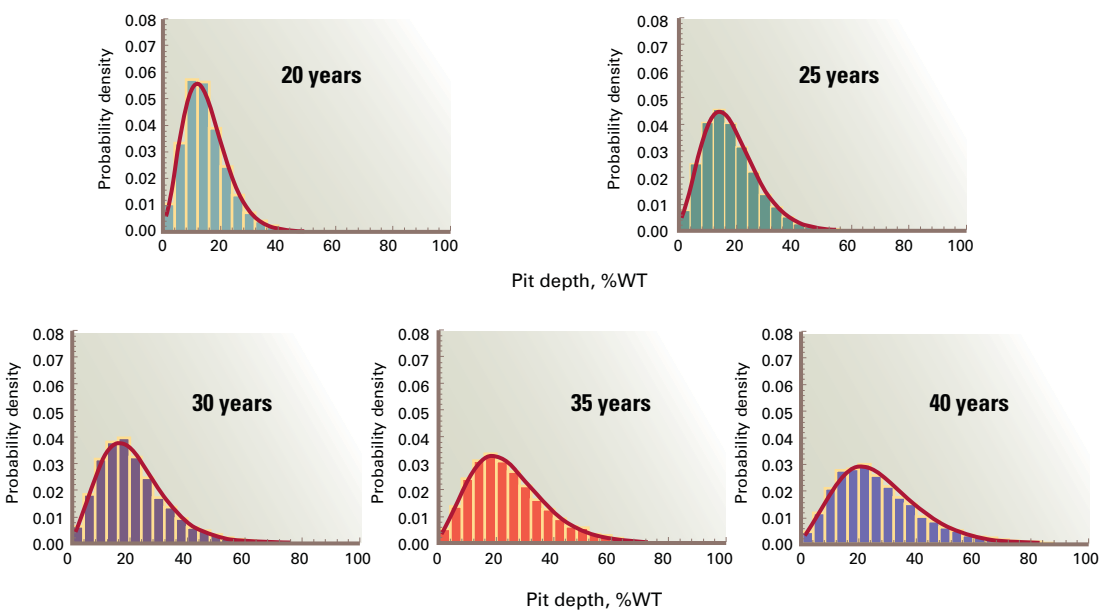
Reliability estimations

Fig. 3



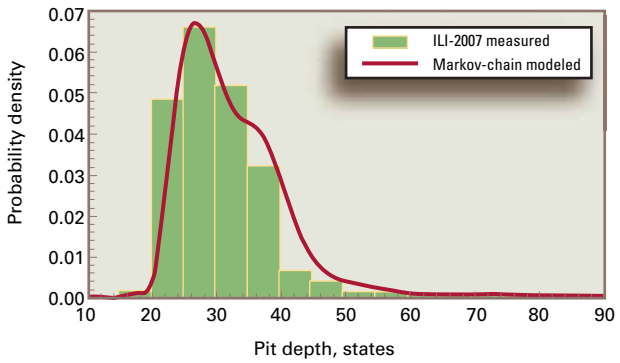
Markov chain modeling

Fig. 4



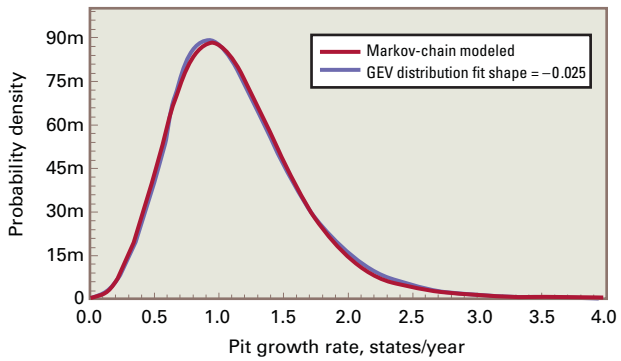
MARKOV CHAIN MODELING, REPEATED ILI

Fig. 5



MARKOV CHAIN-ESTIMATED RATE DISTRIBUTION

Fig. 6



sion of pit-depth estimations produces a longer predicted remaining life for the pipeline and thus fewer scheduled repairs. In this example, even when the typical (average) soil conditions observed for all collected samples were used, a positive impact on integrity management occurred. Collecting the actual soil and pipe characteristics at each exposed pipeline section would likely further improve the accuracy and precision of maximum pit-depth estimations.

Example 2

The second real-life example involves estimation of the reliability trend of a coal-tar-coated, 82-km underground pipeline transporting sweet gas. The pipeline OD and nominal WT measured 355.6 mm and 9.52 mm, respectively. MFL-ILI inspection of the pipeline, commissioned in 1981, took place in 2002 and 2007. Fig. 2 shows the results of these inspections, presenting distributions of the estimated true depths of identified pits. Calibrating the ILI reports with a methodology developed by the authors yielded these distributions (OGJ, Sept. 13, 2004, p. 76). Fig. 2 also shows generalized extreme value (GEV)[6] distributions fitted to the calibrated pit-depth data.

Assuming the soil properties along the pipeline to be similar to those observed for all collected samples allowed use of the time-independent long-term probability distribution of the pitting corrosion rate for the all soil class ($f(v)_{all}$) (last row in Table 2). A preliminary prediction, in which the GEV distribution fit to the ILI-derived pit depth distribution for 2002 ($f(x)_{02}$) was used to predict the pit-depth distribution for 2007 ($f(x)_{07}$), tested the suitability of this selection. This prediction used a time interval (δ) between the two inspections of 5.5 years (Equation 4).

Fig. 2 shows the predicted pit-depth distribution for 2007 ($f(x)_{02}$). It is close to the 2007-ILI-measured pit depth distribution and to the corresponding GEV fitted distribution, supporting the use of the long-term pitting rate distribution associated with the all soil class to predict the evolution of pipeline reliability with time.

After corroboration of the suitability for reliability estimations, ($f(x)_{07}$) ($f(v)_{all}$) estimated the time evolution of pipeline reliability over a 15-year period, beginning in 2007. For the sake of comparison, a second estimation used the pit growth-rate distribution ($f(v)_{lin}$) estimated with a linear pit-growth model. Assuming pits began forming upon pipeline commissioning yielded this estimation from the 2007-ILI pit depth distribution. A detailed description of the estimation of $f(v)_{lin}$ lies elsewhere.[7]

Standard reliability methods predicted the time evolution of the pipeline's annual failure rate/km-year with regard to corrosion-pitting-caused leakage failures (OGJ, Jan. 6, 2003, p. 54; OGJ, Jan. 13, 2003, p. 56). Fig. 3 shows the results of the reliability estimations conducted with $f(v)_{all}$ and $f(v)_{lin}$. The reliability estimates obtained with $f(v)_{all}$ are much less conservative than the estimates based on the pitting rate derived from the linear pit-growth model. Over the time span considered (2007-22), the annual failure rate predicted with $f(v)_{all}$ is, on average, three times smaller and increases much more slowly than that predicted with $f(v)_{lin}$.

If these results were to be used for inspection planning based on a given reliability level of $1-(5 \times 10^{-3}$/km-yr),

EQUATIONS

$$\hat{d}(t) = d_m + d_m \frac{t - t_{ILI}}{t_{ILI} - t_c} \quad (1)$$

$$\hat{d}(t) = d_m + \int_{t_{ILI}}^{t} k'(\tau - t_0)^{n'} d\tau \quad (2)$$

$$v_m(t) = k'(t - t_0)^{n'} \quad (3)$$

where $n' = \tilde{n}1 < 1.0$ and $k' = nk$.

$$\hat{f}(x)_{07} = \int_0^{\infty} f(v)_{all} f_{02}(x - v\delta)_{02} dv \quad (4)$$

$$p_{m,l}(t_i, t) = \binom{l-1}{l-m} p_s(t_i, t)^m (1 - p_s(t_i, t)) \quad (5)$$

$$p_s(t_i, t) - \left(\frac{t_i - t_0}{t - t_0}\right)^n, t \geq t_i \geq t_0 \quad (6)$$

$$p_l(t) = \sum_{m=1}^{l} p_m(t_i) p_{m,l}(t_i, t) \quad (7)$$

$$f(v; m, t_i, t) = p_m(t_i) p_{m,m+v\Delta t}(t_i, t) \Delta t \quad (8)$$

$$f(v; t_i, t) = \sum_{m=1}^{N} f(v; m, t_i, t) \quad (9)$$

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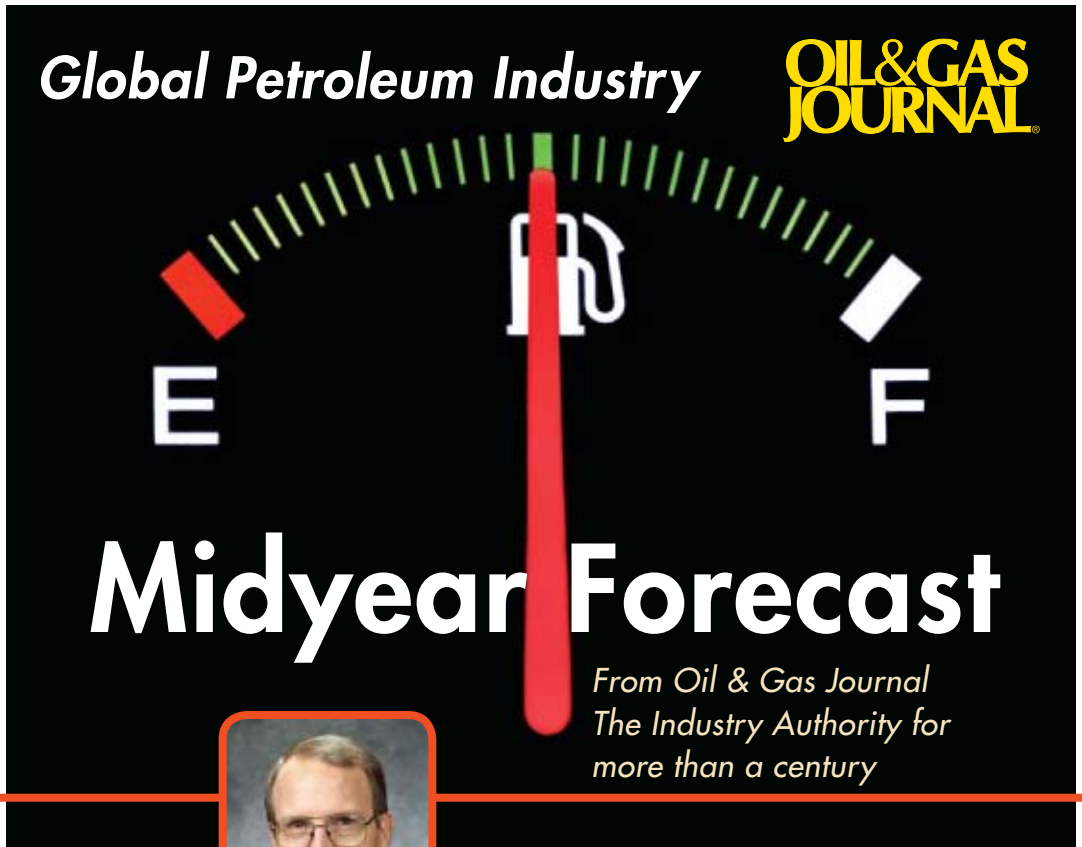
Our July 22nd webcast is all about perspective.



OGJ Editor, Bob Tippee

July 22, 2009

1:30 pm CST

Register free at:
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(webcast section)

The webcast will discuss highlights of Oil & Gas Journal's annual Midyear Forecast. The Midyear Forecast is a special report that uses first-half data to update projections that appeared in OGJ's Annual Forecast and Review this past January. Both reports project oil and gas markets through the end of the year worldwide, analyze demand product by product in the US, and forecast drilling activity in the US and Canada.

The webcast, to be presented by OGJ Editor Bob Tippee, will summarize the Midyear Forecast projections in key categories, note important changes from January's forecasts, and examine reasons for the adjustments. Marilyn Radler, Senior Editor-Economics, and G. Alan Petzet, Chief Editor-Exploration, will be on hand for questions. Marilyn compiles and writes the Midyear Forecast market projections. Alan assembles the drilling forecast.

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PIT GROWTH MODEL COEFFICIENTS, PARAMETERS

Table 1

Variable, parameter	Value by soil class — Clay	Sandy clay loam	Clay loam	All
Soil resistivity, re; Ω – m	-2.2×10^{-4}	-2.1×10^{-4}	-3.0×10^{-4}	-2.6×10^{-4}
Sulfate content, sc; ppm	-5.3×10^{-5}	-1.1×10^{-4}	-2.1×10^{-4}	-1.2×10^{-4}
Bicarbonate content, bc; ppm	-1.3×10^{-3}	-6.8×10^{-4}	-4.9×10^{-4}	-6.4×10^{-4}
Chloride content, cc; ppm	8.4×10^{-4}	8.6×10^{-4}	1.8×10^{-3}	8.7×10^{-4}
Water content, wc; %	3.7×10^{-3}	4.5×10^{-4}	1.7×10^{-2}	4.6×10^{-4}
pH value, ph	-5.9×10^{-2}	-6.4×10^{-2}	-1.2×10^{-1}	-6.5×10^{-2}
Pipe/soil potential, pp; v	4.9×10^{-1}	5.1×10^{-1}	4.6×10^{-1}	5.2×10^{-1}
Bulk density, bd; g/ml	-1.0×10^{-1}	-1.6×10^{-1}	-9.9×10^{-2}	-9.9×10^{-2}
Redox potential, rp; mv	-9.0×10^{-5}	-1.8×10^{-4}	-1.1×10^{-4}	-1.8×10^{-4}
Coating type, ct	$4.\ 7\times10^{-1}$	4.3×10^{-1}	$5\ 7\times10^{-1}$	4.3×10^{-1}
Pitting initiation time, t_0, years	3.0	2.6	3.1	2.9
Constant propagation term, $k_0(mm/yr^{n_0})$	5.5×10–1	6.0×10^{-1}	9.8×10^{-1}	6.1×10^{-1}
Constant exponent term, n_0	8.8×10^{-1}	9.6×10^{-1}	2.8×10^{-1}	8.9×10^{-1}
Pit depth propagation factor, $k_t(mm/yr^{n_t})$	0.178	0.144	0.163	0.164
Pit depth exponent factor, n_t	0.829	0.734	0.793	0.780
Pitting rate propagation factor, k'_t (mm/yr^{n_t})	0.148	0.106	0.129	0.128
Pitting rate exponent factor, n'_t	–0.171	–0.266	–0.207	–0.220

LONG-TERM PIT GROWTH RATE DISTRIBUTION

Table 2

Soil	Frechet cumulative probability function: $F(x) = \exp\{-((x-\lambda)/\eta)^{-\xi}\}$, $x \geq \lambda$, $\xi > 0$, and $\eta > 0$ — ξ	η, mm/year	λ, mm/year	Mean, mm/year	Variance, sq mm/t²; t = year	x_{80}, mm/year
Clay	6.03	0.227	–0.172	0.084	0.0040	0.119
Clay loam	4.04	0.112	–0.079	0.057	0.0032	0.083
Sandy clay loam	24.1	0.453	–0.42	0.044	0.0007	0.062
All	8.01	0.231	–0.191	0.062	0.0020	0.087

an optimal reinspection interval of about 6 years would be predicted from the results of the reliability estimation based on the linear pit growth model. Using the long-term pitting rate for all soils from this study, by contrast, would produce a reinspection interval of about 12 years, demonstrating that a pipeline reliability model based on the long-term pitting rate distributions proposed in this work will realistically predict longer pipeline remaining life, longer reinspection intervals, and fewer unnecessary repairs compared to a reliability model based on the commonly used linear pit growth model.

Example 3

This example uses the proposed Markov chain modeling framework for pitting corrosion proposed in Part 1 to predict the evolution in time of pit-depth distribution in the all soil category. Researches set the initial damage distribution ($p_m(t_i)$) equal to the 10-year Monte Carlo-simulated pit-depth distribution in the all soil class. Equations 5-7 yielded the expected pit-depth distribution $p_l(t)$ for different future moments in time. The values of the parameters t_0, n, and k were set equal to those in Table 1 for the all soil category.

Fig. 4 shows the results of these estimations, where the histograms represent the Monte Carlo-simulated pit-depth distributions and the continuous red lines represent the Markov chain-predicted distributions, $p_l(t)$. The proposed Markov chain model can accurately reproduce the time evolution of pit-depth distribution. The quality of fitting in the other soil classes was similar to the one presented here.[8] The model can reproduce the changes observed in the shape of the pitting depth distribution over the entire estimation interval.

Part 1 of this article noted any of the three extreme value distributions (Weibull, Frechet, or Gumbel)[6] could arise as the best fit to the pitting depth data in the investigated soils depending on exposure time, while the starting distribution is unique for each soil class. The proposed Markov chain model, however, adequately reproduces the variation in the shape of the Monte Carlo-simulated pit-depth distributions in all soil categories, from the beginning of the corrosion pitting damage process through the entire time span considered.

Another application of the proposed Markov chain model estimated the expected 2007 pit-depth distribution in the pipeline from the preceding example from the results of the 2002 ILI run. The empirical depth distribution observed in 2002 (Fig. 2) acted as the initial distribution ($p_m(t_i)$) in the Markov chain-based estimation. WT divided in 0.1-mm-thick states represented the corrosion pitting damage through a Markov chain with N = 100 states. The ratio of the number of pits with depths in the m-th state to the total number of pits observed during the 2002 inspection provided estimated probabilities ($p_m\ (t_i)$.

Given pipeline commissioning in 1981 with soil characteristics assumed to be those of the all category, the values of the parameters necessary to conduct the estimation were: t_i = 21 years, t_0 = 2.9 years, n = 0.780, and t = 26.5 years (Table 1). The histogram in Fig. 5 represents measured pit-depth distribution in the pipeline for mid-2007, while the Markov chain-predicted pitting depth distribution, obtained with Equations 5-7, is shown with a thick red line. The particular shape of the Markov chain-estimated pit-depth distribution in Fig. 5 stems from the discrete nature of the Markov chain estimations as well as the discrete character of the pit-depth variable and its initial distribution $p_m(t_i)$.

The high level of agreement between the empirical pit-depth distribution observed in 2007 and the Markov chain-modeled distribution also points to the accuracy of the proposed model. Validation of its ability to correctly estimate the evolution of the pit-depth dis-

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tribution in the studied pipeline points to the viability of using the proposed model to predict the time evolution of the pitting rate and pipeline reliability over a given time.

Fig. 6 shows the corrosion rate distribution $f(v;t_i,t)$ associated with the entire population of pitting defects 2002–2012, obtained with Equations 8 and 9. The obtained pitting rate distribution is close to a GEV distribution with a shape parameter negative yet also close to zero. Either the Weibull or the Gumbel subfamilies of the GEV distribution, therefore, seem appropriate for describing the pitting rate in the pipeline over the selected estimation period.

One advantage the Markov chain approach has over deterministic and other stochastic models for pitting corrosion is its ability to capture the dependence of pitting rate on pit depth and lifetime. It allows for an estimation of not only the probability distribution of the pitting rate associated with the entire pit population (Fig. 6), but also the pitting-rate distribution for any subpopulation within specific lifetime and depth ranges.

Model limitations

A more complete predictive pit-growth model would incorporate microbial corrosion's role, notably the effects of sulfate-reducing bacteria, as well as seasonal fluctuations in soil properties and their influence on the pitting damage process. The results described in this article apply to corroding pipelines in contact with clay, clay loam, and sandy clay loam soils in tropical regions. Caution should be exercised when applying the results to pipelines in contact with these textural classes in nontropical climates. ✦

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Equipment/Software/Literature

New high pressure, high temperature packer element

A new high pressure, high temperature packer element, featuring newly formulated AFLAS compound, is capable of holding pressures as high as 10,000 psi and temperatures of 450° F. continuous and 540° F. short term.

The AFLAS packer element promises a reliable and robust solution for permanent and retrievable sealing solutions for completion equipment. The packer element has a high resistance to H_2S, steam, and strong acids and bases, helping to ensure that it maintains optimum functionality within a range of environmental parameters, the compamy points out.

The company says AFLAS compound has an excellent chemical, heat, and temperature resistance, suiting it for use in packer elements for extreme environments.

Source: **Rubberatkins Ltd.,** Units 1-3, Hareness Rd., Altens, Aberdeen, AB12 3LE, UK.

New tool streamlines lease evaluation process

The newly released web-based Lease Opportunities Management tool is built and deployed on the Force.com platform.

As the first component of the company's broader Energy Desktop Solution, the Lease Opportunities Management tool streamlines and organizes the lease evaluation process. By allowing exploration and production companies and departments to easily and affordably shift from using spreadsheets and manual processes, the Lease Opportunities tool provides an automated, rules-driven approach that provides a competitive advantage in terms of evaluating and securing choice acreage and lowering the time and cost to do so.

The company says that the Force.com platform is a fast, secure foundation for building and deploying demanding business applications. It says that applications built on the Force.com platform eliminate risk and barriers to entry.

The Energy Desktop and Lease Opportunities tool promises successfully to deliver enterprise class business technology to all industry participants and at less cost than traditional software systems. It makes the process of valuing leases efficient—eliminating duplication of data, driving collaboration between land, geology, finance, legal, and executives, and enabling exploration and production companies to move fast.

This tool also leverages the mobile capabilities (for the iPhone and BlackBerry smart phones) of the Force.com platform.

The tool helps E&P companies better address the increasing demand and complexity of managing land assets—enhancing the ability for E&P employees to find, use, and share information. The product is the first in a suite of tools that will see the addition of operations, production, transaction, and other core E&P business components added and fully integrated into the Energy Desktop.

Source: **Enbase Technology Solutions,** 3303 Louisiana, Suite 210, Houston, TX 77006.

Services/Suppliers

Geoservices Group,

Paris, has acquired Petrospec Technologies Inc., Conroe, Tex., and Kuala Lumpur. Terms were not disclosed. Geoservices has appointed Petrospec Pres. and CEO Mark A. Herkommer CEO of its Petrospec division.

Geoservices provides a range of oil field services that help evaluate hydrocarbon reservoirs and optimize field exploration, development, and production, including mud logging, well intervention, and field surveillance.

Petrospec provides software and services for geopressure, rock property, and wellbore stability analyses from petrophysical and seismic data.

Oil States International Inc.,

Houston, through its subsidiary Oil States Industries Inc., has formed a joint venture with Uniao Engenharia Fabricacao e Montagem Ltda., Vila Velha, Brazil, to provide deepwater production and subsea pipeline solutions to Brazil's expanding offshore construction industry. The JV, Oil States-Uniao SA, will be based in Vila Velha. The two companies have collaborated for several years for client Petroleo Brasileiro SA off Brazil. The JV will leverage Uniao's local manufacturing expertise, relationships, and facilities while making Oil States' deepwater technologies more readily available in the region.

Oil States International manufactures products for deepwater production facilities and subsea pipelines and provides services to the oil and gas industry, including production-related rental tools, work force accommodations and logistics, oil country tubular goods distribution, and land drilling services.

Uniao Engenharia is a Brazilian supplier of engineering, manufacturing, and industrial assembly services, with facilities in Espirito Santo, Brazil.

Stabil Drill,

a subsidiary of New Orleans-based Superior Energy Services specializing in bottomhole assembly rental tools, has opened a new facility in Oklahoma City. The new facility has a complete inventory of downhole tools, including stabilizers, hole openers, roller reamers, non-magnetic collars and stabilizers, torque-subs, and pneumatic mud buckets.

Stabil Drill provides equipment and services worldwide, with full-service facilities in Louisiana, Texas, Wyoming, and Canada, as well as manufacturing and specialty machining facilities along the Gulf Coast, in Atlantic Canada, and in Scotland.

Superior Energy Services is a single-source provider of production-related services, rental tools, and liftboats worldwide.

Tracerco,

part of London-based Johnson Matthey PLC, has established a new service center in Shanghai. The new office will make Tracerco's full range of diagnostic and measurement technologies available to operators across China. Tracerco provides a range of process diagnostics services and specialist measurement solutions to the world's process industries, including oil and gas, refining, and petrochemicals.

Johnson Matthey is a specialty chemicals company focused on catalysts, precious metals, fine chemicals, and process technology.

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Semi-annual construction updates are provided in the following areas:

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- Refining
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- LNG
- Sulfur

The Excel format enables efficient and rapid analysis of planned construction projects. The data collected includes Company, Location, Capacity, Expected Completion Date and Current Status, Contractor, Cost, Engineering and Process Design (when available). Some of these surveys are also available in historical version going back to 1996.

Production Projects Worldwide

Contains upstream projects in 47 countries, shows the development of individual fields, and the supporting infrastructure. The Survey in Excel spreadsheet identifies:

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- project name
- operator & company name
- project phase
- peak year
- development type details
- liquids and gas
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Allows you to focus on what regions will have future growth, type of project, new discoveries, field redevelopment, stranded-gas projects, heavy-oil or deepwater projects and development of unconventional resources such as tight sands, shale gas, and coal bed methane gas.

Offshore Drilling Rig Construction Survey

Four types of vessels are tracked – Jack-up Rigs, Semi-submersibles, Drillships, and Tender Assist Vessels. Include – Rig Name, Owner, Design, Shipyard, and Country, Delivery Date, Cost in $ millions.

Oil Sands Projects

Planned Canadian Oil Sands development projects in four Excel worksheets. Includes: mining upgrading projects, in situ projects, reserves estimate of initial in-place bitumen, and historical table, commercial, experimental and exploration wells.

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Imports of crude and products

	Districts 1–4		District 5		Total US		
	7-10 2009	7-3 2009	7-10 2009	7-3 2009	7-10 2009	7-3 2009	*7-11 2008
	1,000 b/d						
Total motor gasoline	917	1,176	14	31	931	1,207	1,016
Mo. gas. blending comp.	666	913	7	31	673	944	554
Distillate	159	221	0	0	159	221	150
Residual	283	376	54	49	337	425	223
Jet fuel–kerosine	19	36	57	63	76	99	98
Propane–propylene	155	85	5	4	160	89	106
Other	127	(147)	86	30	213	(117)	1,005
Total products	**2,326**	**2,660**	**223**	**208**	**2,549**	**2,868**	**3,152**
Total crude	**8,260**	**8,134**	**1,289**	**1,090**	**9,549**	**9,224**	**10,791**
Total imports	**10,586**	**10,794**	**1,512**	**1,298**	**12,098**	**12,092**	**13,943**

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

Purvin & Gertz LNG netbacks—July 17, 2009

Receiving terminal	Liquefaction plant					
	Algeria	Malaysia	Nigeria	Austr. NW Shelf	Qatar	Trinidad
	$/MMbtu					
Barcelona	6.04	4.09	5.28	3.99	4.62	5.21
Everett	2.77	0.94	2.44	1.05	1.36	3.02
Isle of Grain	2.15	0.41	1.60	0.34	0.82	1.62
Lake Charles	0.93	–0.61	0.74	–0.47	–0.33	1.46
Sodegaura	3.82	5.88	4.08	5.60	4.95	3.52
Zeebrugge	4.53	2.76	3.96	2.68	3.20	4.00

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

Crude and product stocks

District	Crude oil	Motor gasoline		Jet fuel, kerosine	Fuel oils		Propane–propylene
		Total	Blending comp.[1]		Distillate	Residual	
	1,000 bbl						
PADD 1	13,236	55,685	38,231	11,091	67,622	14,736	3,700
PADD 2	82,862	50,833	25,087	7,880	32,545	1,155	26,009
PADD 3	179,276	71,996	39,999	14,734	43,515	14,673	33,859
PADD 4	16,527	6,350	2,027	583	3,414	228	[1]1,007
PADD 5	52,583	29,714	23,524	9,026	12,195	4,948	—
July 10, 2009	**344,484**	**214,578**	**128,868**	**43,314**	**159,291**	**35,740**	**64,575**
July 3, 2009	**347,297**	**213,140**	**126,700**	**42,839**	**158,738**	**36,582**	**62,096**
July 11, 2008[2]	**296,888**	**214,238**	**107,046**	**38,954**	**125,690**	**39,084**	**44,997**

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

Refinery report—July 10, 2009

District	REFINERY OPERATIONS		REFINERY OUTPUT				
	Gross inputs	Crude oil inputs	Total motor gasoline	Jet fuel, kerosine	Fuel oils		Propane–propylene
					Distillate	Residual	
	1,000 b/d						
PADD 1	1,313	1,282	2,132	81	387	95	57
PADD 2	3,388	3,369	2,206	217	865	48	272
PADD 3	7,551	7,377	2,920	734	2,048	292	715
PADD 4	597	591	315	32	201	9	[1]68
PADD 5	2,679	2,486	1,383	436	533	118	—
July 10, 2009	**15,528**	**15,105**	**8,956**	**1,500**	**4,034**	**562**	**1,112**
July 3, 2009	**15,340**	**14,966**	**9,254**	**1,384**	**4,030**	**584**	**1,142**
July 11, 2008[2]	**15,744**	**15,467**	**9,057**	**1,697**	**4,736**	**612**	**1,078**
	17,672 Operable capacity		**87.9% 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

	*7-17-09	*7-18-08	Change	Change, %
	$/bbl			
SPOT PRICES				
Product value	67.53	143.26	–75.73	–52.9
Brent crude	61.23	136.22	–74.99	–55.1
Crack spread	6.31	7.05	–0.74	–10.5
FUTURES MARKET PRICES				
One month				
Product value	69.06	148.16	–79.09	–53.4
Light sweet crude	61.27	135.34	–74.07	–54.7
Crack spread	7.80	12.82	–5.02	–39.2
Six month				
Product value	70.17	150.88	–80.71	–53.5
Light sweet crude	65.93	137.52	–71.60	–52.1
Crack spread	4.25	13.36	–9.11	–68.2

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

OGJ GASOLINE PRICES

	Price ex tax 7-15-09	Pump price* 7-15-09	Pump price 7-16-08
	¢/gal		
(Approx. prices for self-service unleaded gasoline)			
Atlanta	198.1	244.6	410.8
Baltimore	200.5	242.4	401.8
Boston	205.7	247.6	404.8
Buffalo	197.2	258.1	419.8
Miami	211.1	262.7	421.8
Newark	201.1	233.7	394.6
New York	190.5	251.4	412.6
Norfolk	200.3	238.7	393.8
Philadelphia	203.0	253.7	410.8
Pittsburgh	201.3	252.0	400.9
Wash., DC	216.1	254.5	410.8
PAD I avg	202.3	249.0	407.5
Chicago	208.9	273.3	444.8
Cleveland	204.9	251.3	403.7
Des Moines	202.0	242.4	399.8
Detroit	207.9	267.3	410.8
Indianapolis	194.9	254.3	400.8
Kansas City	187.4	223.4	396.8
Louisville	208.4	249.3	403.9
Memphis	187.5	227.3	392.1
Milwaukee	206.7	258.0	412.9
Minn.-St. Paul	201.4	245.4	401.8
Oklahoma City	182.1	217.5	389.9
Omaha	178.2	223.5	401.6
St. Louis	185.4	221.4	393.9
Tulsa	178.1	213.5	389.7
Wichita	183.0	226.4	376.9
PAD II avg	194.5	239.6	401.3
Albuquerque	199.1	235.5	389.8
Birmingham	195.9	235.2	397.8
Dallas-Fort Worth	200.1	238.5	402.8
Houston	196.8	235.2	394.8
Little Rock	193.0	233.2	396.8
New Orleans	198.8	237.2	399.8
San Antonio	199.4	237.8	392.8
PAD III avg	197.6	236.1	396.4
Cheyenne	215.2	247.6	396.2
Denver	214.2	254.6	412.7
Salt Lake City	207.7	250.6	404.2
PAD IV avg	212.4	250.9	404.4
Los Angeles	217.2	284.3	457.2
Phoenix	208.0	245.4	424.2
Portland	222.9	266.3	432.2
San Diego	219.3	286.4	466.2
San Francisco	227.3	294.4	460.5
Seattle	224.5	280.4	441.5
PAD V avg	219.9	276.2	446.9
Week's avg.	**201.9**	**247.5**	**408.8**
June avg.	**214.6**	**260.2**	**404.2**
May avg.	**179.0**	**224.6**	**372.9**
2009 to date	**166.0**	**211.6**	—
2008 to date	**302.8**	**346.5**	—

*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

	7-10-09 ¢/gal		7-10-09 ¢/gal
Spot market product prices			
Motor gasoline (Conventional-regular)		Heating oil No. 2	
New York Harbor	161.21	New York Harbor	149.88
Gulf Coast	157.21	Gulf Coast	146.50
Los Angeles	162.96	Gas oil	
Amsterdam-Rotterdam-Antwerp (ARA)	159.20	ARA	154.57
Singapore	162.02	Singapore	158.81
Motor gasoline (Reformulated-regular)		Residual fuel oil	
New York Harbor	166.21	New York Harbor	124.81
Gulf Coast	164.21	Gulf Coast	134.52
Los Angeles	172.96	Los Angeles	156.42
		ARA	133.86
		Singapore	140.21

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

BAKER HUGHES RIG COUNT

	7-17-09	7-18-08
Alabama	4	5
Alaska	3	7
Arkansas	45	58
California	20	43
Land	20	43
Offshore	0	0
Colorado	42	106
Florida	1	2
Illinois	1	1
Indiana	3	2
Kansas	19	11
Kentucky	9	12
Louisiana	126	173
N. Land	76	63
S. Inland waters	8	25
S. Land	10	28
Offshore	32	57
Maryland	0	1
Michigan	0	1
Mississippi	11	8
Montana	0	14
Nebraska	0	0
New Mexico	42	83
New York	2	5
North Dakota	40	67
Ohio	8	13
Oklahoma	82	205
Pennsylvania	46	24
South Dakota	1	2
Texas	342	922
Offshore	2	9
Inland waters	0	1
Dist. 1	12	18
Dist. 2	15	29
Dist. 3	28	59
Dist. 4	28	89
Dist. 5	81	183
Dist. 6	42	129
Dist. 7B	11	31
Dist. 7C	18	70
Dist. 8	54	144
Dist. 8A	9	29
Dist. 9	17	45
Dist. 10	25	86
Utah	16	49
West Virginia	21	26
Wyoming	29	76
Others—HI-1; NV-1; VA-5;	7	12
Total US	**920**	**1,928**
Total Canada	**152**	**410**
Grand total	**1,072**	**2,338**
US Oil rigs	244	385
US Gas rigs	665	1,534
Total US offshore	35	69
Total US cum. avg. YTD	**1,117**	**1,828**

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

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

SMITH RIG COUNT

Proposed depth, ft	Rig count	7-17-09 Percent footage*	Rig count	7-18-08 Percent footage*
0–2,500	37	5.4	79	3.7
2,501-5,000	68	67.6	132	48.4
5,001-7,500	114	20.1	266	15.4
7,501-10,000	200	3.0	473	3.1
10,001-12,500	182	8.7	494	2.6
12,501-15,000	134	—	309	—
15,001-17,500	122	—	149	—
17,501-20,000	50	—	87	—
20,001-over	32	—	38	—
Total	**939**	**9.9**	**2,027**	**6.7**
INLAND	12		31	
LAND	888		1,935	
OFFSHORE	39		61	

*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]7-17-09	[2]7-18-08
	1,000 b/d	
(Crude oil and lease condensate)		
Alabama	19	21
Alaska	650	644
California	636	647
Colorado	61	66
Florida	6	6
Illinois	29	27
Kansas	97	104
Louisiana	1,404	1,331
Michigan	15	16
Mississippi	61	60
Montana	92	84
New Mexico	160	164
North Dakota	186	169
Oklahoma	167	178
Texas	1,304	1,328
Utah	55	61
Wyoming	150	144
All others	66	75
Total	**5,158**	**5,125**

[1]OGJ estimate. [2]Revised.

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

US CRUDE PRICES

	7-17-09 $/bbl*
Alaska-North Slope 27°	40.78
South Louisiana Sweet	43.75
California-Kern River 13°	54.95
Lost Hills 30°	63.30
Wyoming Sweet	53.06
East Texas Sweet	59.50
West Texas Sour 34°	54.00
West Texas Intermediate	60.00
Oklahoma Sweet	60.00
Texas Upper Gulf Coast	53.00
Michigan Sour	52.00
Kansas Common	59.00
North Dakota Sweet	49.50

*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]	7-10-09
United Kingdom-Brent 38°	61.58
Russia-Urals 32°	61.53
Saudi Light 34°	62.29
Dubai Fateh 32°	64.56
Algeria Saharan 44°	63.15
Nigeria-Bonny Light 37°	64.10
Indonesia-Minas 34°	66.34
Venezuela-Tia Juana Light 31°	61.69
Mexico-Isthmus 33°	61.58
OPEC basket	63.16
Total OPEC[2]	63.07
Total non-OPEC[2]	61.76
Total world[2]	62.50
US imports[3]	60.87

[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]

	7-10-09	7-3-09	7-10-08	Change, %
	bcf			
Producing region	1,032	1,013	738	**39.8**
Consuming region east	1,411	1,349	1,235	**14.3**
Consuming region west	443	434	323	**37.2**
Total US	**2,886**	**2,796**	**2,296**	**25.7**
	Apr. 09	**Apr. 08**	**Change, %**	
Total US[2]	**1,903**	**1,436**	**32.5**	

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

Statistics

World oil balance

	2009 1st qtr.	2008 4th qtr.	2008 3rd qtr.	2008 2nd qtr.	2008 1st qtr.	2007 4th qtr.
	Million b/d					
DEMAND						
OECD						
US & Territories	19.06	19.51	19.13	19.96	20.15	20.90
Canada	2.42	2.33	2.34	2.25	2.37	2.38
Mexico	2.03	2.04	2.11	2.16	2.10	2.16
Japan	4.68	4.67	4.30	4.59	5.41	5.25
South Korea	2.32	2.12	2.07	2.09	2.33	2.31
France	1.99	2.01	1.92	1.92	1.98	2.02
Italy	1.56	1.63	1.66	1.66	1.67	1.75
United Kingdom	1.72	1.71	1.64	1.72	1.72	1.73
Germany	2.56	2.64	2.69	2.41	2.48	2.54
Other OECD Europe	7.01	7.29	7.46	7.24	7.42	7.62
Australia & New Zealand	1.10	1.14	1.12	1.14	1.13	1.15
Total OECD	**46.45**	**47.09**	**46.44**	**47.14**	**48.76**	**49.81**
NON-OECD						
China	7.55	7.36	8.10	7.99	7.96	7.61
FSU	4.11	4.38	4.35	4.31	4.30	4.35
Non-OECD Europe	0.77	0.80	0.80	0.79	0.79	0.81
Other Asia	9.16	8.76	8.96	9.61	9.52	9.29
Other non-OECD	15.31	15.55	16.40	16.03	15.12	15.96
Total non-OECD	**36.90**	**36.85**	**38.61**	**38.73**	**37.69**	**38.02**
TOTAL DEMAND	**83.35**	**83.94**	**85.05**	**85.87**	**86.45**	**87.83**
SUPPLY						
OECD						
US	8.78	8.46	8.18	8.75	8.67	8.58
Canada	3.39	3.40	3.40	3.22	3.38	3.40
Mexico	3.06	3.12	3.15	3.19	3.29	3.33
North Sea	4.41	4.38	4.07	4.33	4.46	4.57
Other OECD	1.55	1.60	1.60	1.58	1.53	1.57
Total OECD	**21.19**	**20.96**	**20.40**	**21.07**	**21.33**	**21.45**
NON–OECD						
FSU	12.60	12.46	12.42	12.60	12.59	12.65
China	3.92	3.99	3.97	4.00	3.94	3.87
Other non–OECD	12.60	12.50	12.41	12.20	12.24	12.12
Total non-OECD, non-OPEC	**29.12**	**28.95**	**28.80**	**28.80**	**28.77**	**28.64**
OPEC*	**33.24**	**35.16**	**36.18**	**35.84**	**35.72**	**36.15**
TOTAL SUPPLY	**83.55**	**85.07**	**85.38**	**85.71**	**85.82**	**86.24**
Stock change	**0.20**	**1.13**	**0.33**	**–0.16**	**–0.63**	**–1.59**

*Includes Angola.
Source: DOE International Petroleum Monthly
Data available in OGJ Online Research Center.

OECD total net oil imports

	Mar. 2009	Feb. 2009	Jan. 2009	Mar. 2008	Chg. vs. previous year Volume	Chg. vs. previous year %
	Million b/d					
Canada	–1,359	–1,437	–1,275	–1,390	31	–2.2
US	10,636	10,369	11,246	10,728	–92	–0.9
Mexico	–1,102	–1,254	–1,213	–1,440	338	–23.5
France	2,025	1,806	1,739	1,862	163	8.8
Germany	2,418	2,325	2,275	2,354	64	2.7
Italy	1,441	1,261	1,485	1,496	–55	–3.7
Netherlands	820	1,233	974	1,225	–405	–33.1
Spain	1,463	1,668	1,360	1,521	–58	–3.8
Other importers	4,021	3,819	3,860	3,954	67	1.7
Norway	–2,413	–2,437	–2,052	–1,842	–571	31.0
United Kingdom	125	–3	226	139	–14	–10.1
Total OECD Europe	**9,900**	**9,672**	**9,867**	**10,709**	**–809**	**–7.6**
Japan	4,374	4,768	4,580	5,359	–985	–18.4
South Korea	2,162	2,519	2,454	2,084	78	3.7
Other OECD	944	786	903	1,027	–83	–8.1
Total OECD	**25,555**	**25,423**	**26,562**	**27,077**	**–1,522**	**–5.6**

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

OECD* total gross imports from OPEC

	Mar. 2009	Feb. 2009	Jan. 2009	Mar. 2008	Chg. vs. previous year Volume	Chg. vs. previous year %
	Million b/d					
Canada	354	392	440	396	–42	–10.6
US	5,215	4,956	5,676	5,916	–701	–11.8
Mexico	23	11	18	10	13	130.0
France	689	722	792	800	–111	–13.9
Germany	347	355	530	475	–128	–26.9
Italy	1,047	966	1,101	1,206	–159	–13.2
Netherlands	516	571	779	668	–152	–22.8
Spain	689	1,036	759	703	–14	–2.0
Other importers	1,139	908	999	1,067	72	6.7
United Kingdom	311	285	257	283	28	9.9
Total OECD Europe	**4,738**	**4,843**	**5,217**	**5,202**	**–464**	**–8.9**
Japan	3,806	4,273	3,712	4,315	–509	–11.8
South Korea	2,274	2,572	2,628	2,212	62	2.8
Other OECD	535	376	612	672	–137	–20.4
Total OECD	**16,945**	**17,423**	**18,303**	**18,723**	–1,778	–9.5

*Organization for Economic Cooperation and Development.
Source: DOE International Petroleum Monthly
Data available in OGJ Online Research Center.

US petroleum imports from source country

	Mar. 2009	Feb. 2009	Average YTD 2009	Average YTD 2008	Chg. vs. previous year Volume	Chg. vs. previous year %
	1,000 b/d					
Algeria	463	372	523	489	34	7.0
Angola	657	671	622	441	181	41.0
Kuwait	181	251	224	235	–11	–4.7
Nigeria	891	498	637	1,132	–495	–43.7
Saudi Arabia	967	1,115	1,149	1,556	–407	–26.2
Venezuela	1,106	1,139	1,201	1,152	49	4.3
Other OPEC	950	910	937	1,066	–129	–12.1
Total OPEC	**5,215**	**4,956**	**5,293**	**6,071**	**–778**	**–12.8**
Canada	2,438	2,515	2,498	2,532	–34	–1.3
Mexico	1,199	1,364	1,330	1,331	–1	–0.1
Norway	192	74	120	88	32	36.4
United Kingdom	208	285	211	196	15	7.7
Virgin Islands	264	333	321	340	–19	–5.6
Other non-OPEC	2,958	2,664	2,853	2,331	522	22.4
Total non-OPEC	**7,259**	**7,235**	**7,333**	**6,818**	**515**	**7.6**
TOTAL IMPORTS	**12,474**	**12,191**	**12,626**	**12,889**	**–263**	**–2.0**

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

Oil stocks in OECD countries*

	Mar. 2009	Feb. 2009	Jan. 2009	Mar. 2008	Chg. vs. previous year Volume	Chg. vs. previous year %
	Million bbl					
France	182	178	179	177	5	2.8
Germany	278	279	280	281	–3	–1.1
Italy	131	128	136	131	—	—
United Kingdom	100	98	100	100	—	—
Other OECD Europe	726	726	715	695	31	4.5
Total OECD Europe	**1,417**	**1,409**	**1,410**	**1,384**	**33**	**2.4**
Canada	193	191	198	194	–1	–0.5
US	1,795	1,770	1,762	1,653	142	8.6
Japan	611	619	618	610	1	0.2
South Korea	155	157	149	143	12	8.4
Other OECD	108	108	114	110	–2	–1.8
Total OECD	**4,279**	**4,254**	**4,251**	**4,094**	**185**	**4.5**

*End of period.
Source: DOE International Petroleum Monthly Report
Data available in OGJ Online Research Center.

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Reporting profits in recession sure to stir public ire

The US oil and gas industry should listen to whatever political problems befall Goldman Sachs Group Inc. for echoes from its own experience.

The financial giant this month reported its largest quarterly profit ever—$3.44 billion. A developing view is that Goldman Sachs, after a short ride aboard its $10 billion federal lifeboat, now feeds on others' flotsam.

The Editor's Perspective

by Bob Tippee, Editor

"With competitors such as Lehman Brothers Holdings Inc. and Bear Stearns Cos. gone and others like Citigroup Inc. flailing, Goldman appears to be pulling off one of the biggest market-share grabs in Wall Street history," the Wall Street Journal reported July 15.

Suggestions of predation join suspicions that Goldman has for years enjoyed political favors from its many former executives who moved into high government positions. In fact, cronyism appears in a flood of allegations, which the firm has denied, published in a widely circulated article by Matt Taibbi in the July 9-23 issue of Rolling Stone.

Taibbi says Goldman exploited six financial bubbles, including the 2008 zoom in oil prices. He makes his conclusions clear early in the article by describing Goldman as "a great vampire squid wrapped around the face of humanity, relentlessly jamming its blood funnel into anything that smells like money." Whatever the mechanism, Goldman does have the money to defend itself against all this and has paid back the bailout dollars. Its larger problem may be timing. For Goldman, prosperity resumes while masses of Americans struggle. As oil companies were reminded early last year, reporting record profits during recession can provoke outrage.

When the oil industry encountered that embarrassment of riches, its public standing already had suffered from disclosure in 2006, after gasoline prices jumped following hurricane damage to Gulf Coast production and refining, of a $400 million retirement package for ExxonMobil Chairman Lee Raymond.

At least some stir might be expected from a public increasingly seeking unemployment benefits, therefore, from Goldman's $11.36 billion first-half reserve for compensation and benefits. According to the Wall Street Journal, that's enough to pay each Goldman employee $386,429.

Of course, the analogy isn't perfect. Taxpayers didn't rescue any big oil companies.

(Online July 17, 2009; author's e-mail: bobt@ogjonline.com)

Market Journal

by Sam Fletcher, Senior Writer

Gas market seeks sign

Four consecutive weeks of smaller-than-expected injections of natural gas into US storage triggered a 12% price jump for the front-month contract on the New York Mercantile Exchange in mid-July in what some hoped might be the first sign that well shut-ins and reduced drilling may be decreasing supply.

The August contract bumped up to $3.67/MMbtu on July 16 after the Energy Information Administration reported the injection of 90 bcf of gas into US storage in the week ended July 10. Still, the price of the front-month gas contract was down 35% since the start of this year and 65% below year-ago levels. There was 2.886 tcf of working gas in storage as of July 10, up 589 bcf from a year ago and 454 bcf above the 5-year average.

Recent data "show a marked decline in weekly injection comparisons vs. 5-year historical averages," acknowledged Adam Sieminski, chief energy economist, Deutsche Bank, Washington, DC. But the data may have been distorted by the Independence Day holiday. Therefore, Sieminski said, "It makes sense to await a couple more weeks of data before declaring a new trend. We actually expect a return to more bearish variances over the next 2 weeks."

Meanwhile, drilling permits increased 4.3% in June (adjusted for comparable numbers of filing days) in 30 states monitored by Barclays Capital Inc., New York. "The month-to-month increase follows seven consecutive monthly declines. Permitting levels remain depressed, currently down 57% vs. last year, and we expect continued weakness in rig activity in the weeks and months ahead," said Barclays Capital analysts.

Baker Hughes Inc. reported 920 rotary rigs working in the US in the week ended July 17. That's down from 1,928 rigs drilling during the same period last year.

In New Orleans, analysts at Pritchard Capital Partners LLC said, "Strength in natural gas came from a report showing that US daily LNG usage averaged 1.44 bcf in the second quarter, well short of the earlier estimates that called for 3-5 bcfd." They added, "After checks with the LNG market observers, it seems there is too much focus on LNG."

Current annual global LNG capacity is 180 million tonnes or 8.3 tcf of gas equivalent. However, Pritchard Capital analysts reported, "We have heard LNG processors are only running at 70% capacity, or 5.8 tcf/year." Even if the US were to import all global production, LNG would meet only 25% of US natural gas requirements. Unless total LNG capacity increases dramatically, the analysts said, "It is unlikely that LNG could ever meet US demand. The long-term implication for US exploration and production companies is bullish as it necessitates the further development and production of US shale plays."

The China syndrome

Crude futures prices rose above $62/bbl in mid-July following "a better-than-expected report on economic growth in China and a late-day rally in equities," said analysts in the Houston office of Raymond James & Associates Inc.

But in some quarters there was "disappointment that the Chinese gross domestic product figure at 7.9% was in-line with the 7.8% estimate and not as high as the plus 8% whisper number some had hoped for," said Pritchard Capital Partners.

Improvement in the Chinese economy prompted Olivier Jakob at Petromatrix, Zug, Switzerland, to question: "If China can grow at basically 8% when the rest of the world is into one of its deepest recessions, what will it be when consumer demand in the West starts to resurface?" Through April and May, Chinese crude oil runs were 650,000 b/d higher than a year ago (up 800,000 b/d in May). "As we have been writing before, in the oil markets as in the economy one needs to look East, not West," said Jakob.

On the other hand, Sieminski said, "The main growth risk during the second half of this year stems from a slowdown in Chinese GDP growth, which we expect will take some time to reveal itself."

At the Centre for Global Energy Studies, London, analysts said, "The fact that the Chinese economy is being driven in large part by state-sponsored lending should perhaps be cause for caution, as is the long-standing suspicion that official Chinese growth statistics might be biased upwards by massaged GDP deflators."

Sieminski said commodity markets "need to be on alert for a further rise in risk aversion levels" that could threaten the global growth outlook, global equity markets, and commodity prices. Nonetheless, Sieminski said, "We are not yet convinced that this will prevent the US economy moving out of recession from October."

(Online July 20, 2009; author's e-mail: samf@ogjonline.com)

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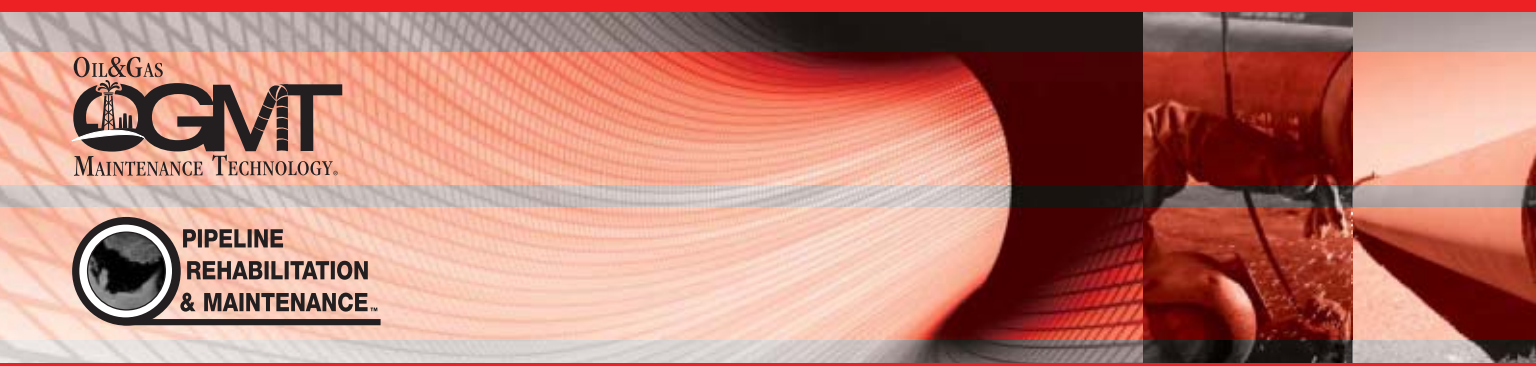

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