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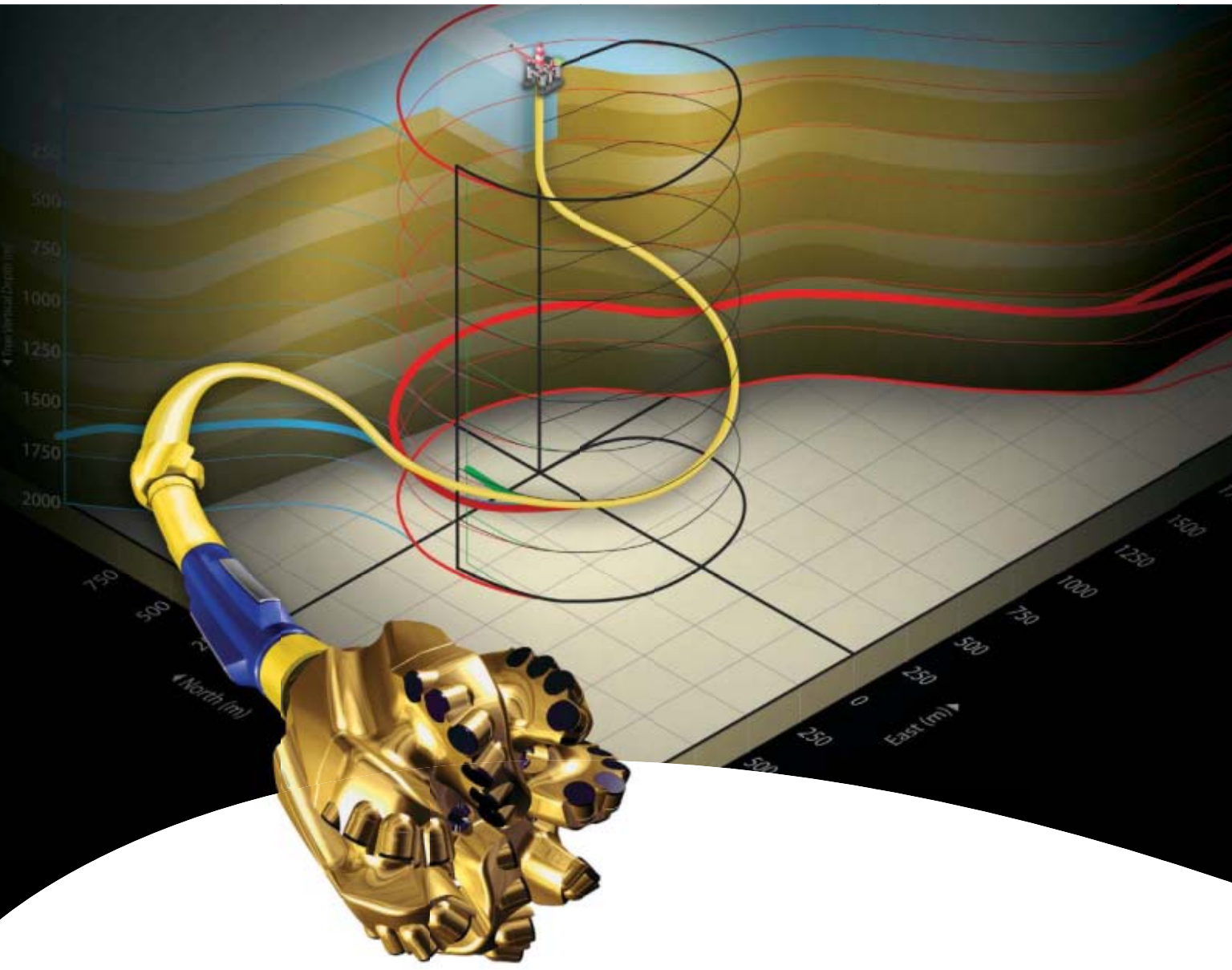

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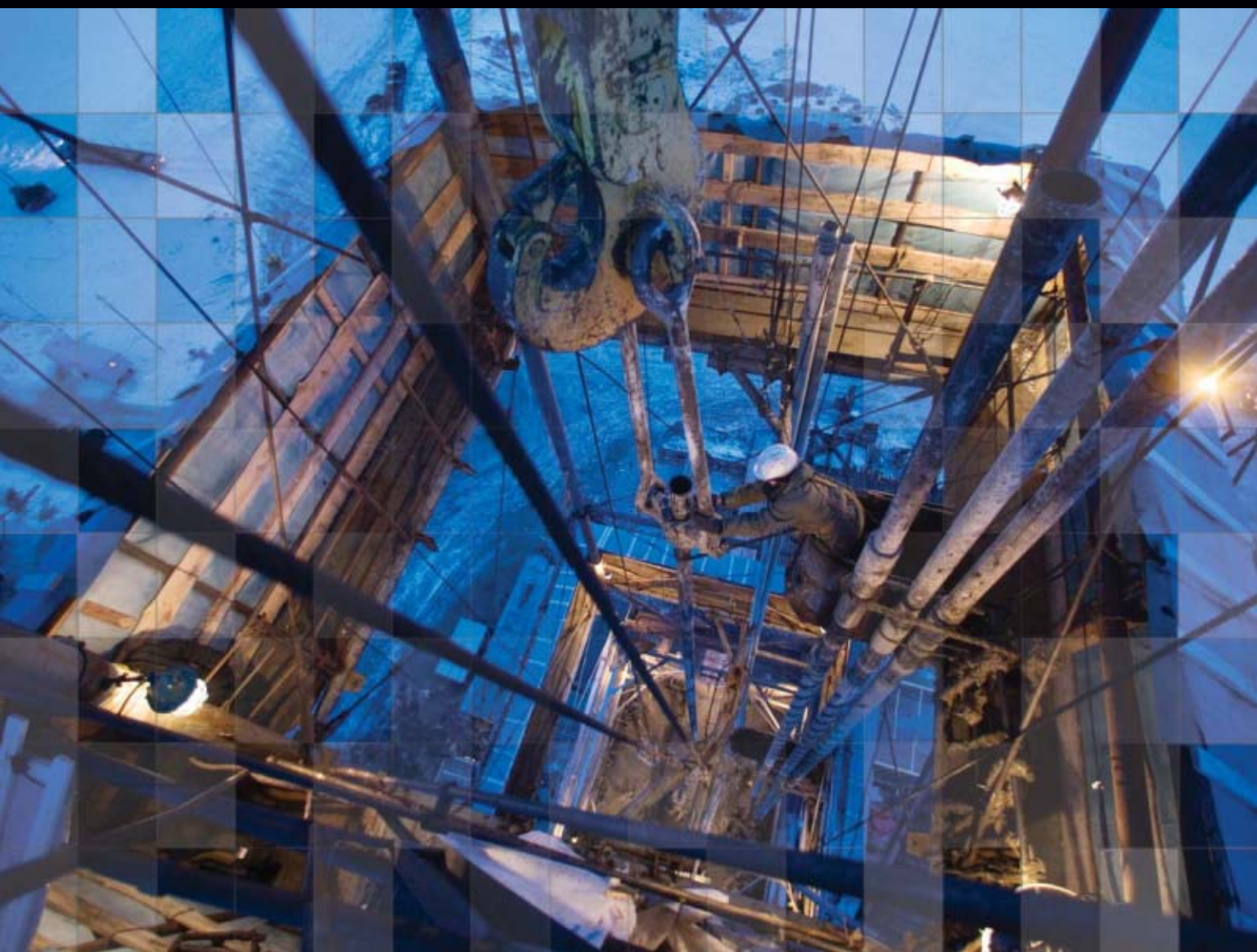

Downhole Technology Review

Did Caspian summit share the sea or Iran's oil riches?
Combining residual anomaly maps and well data
Asset management helps refiners comply with Baker Report
Industry ignoring potential of bidirectional LNG flows

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Downhole Technology Review

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Operators develop, implement new downhole technologies 49
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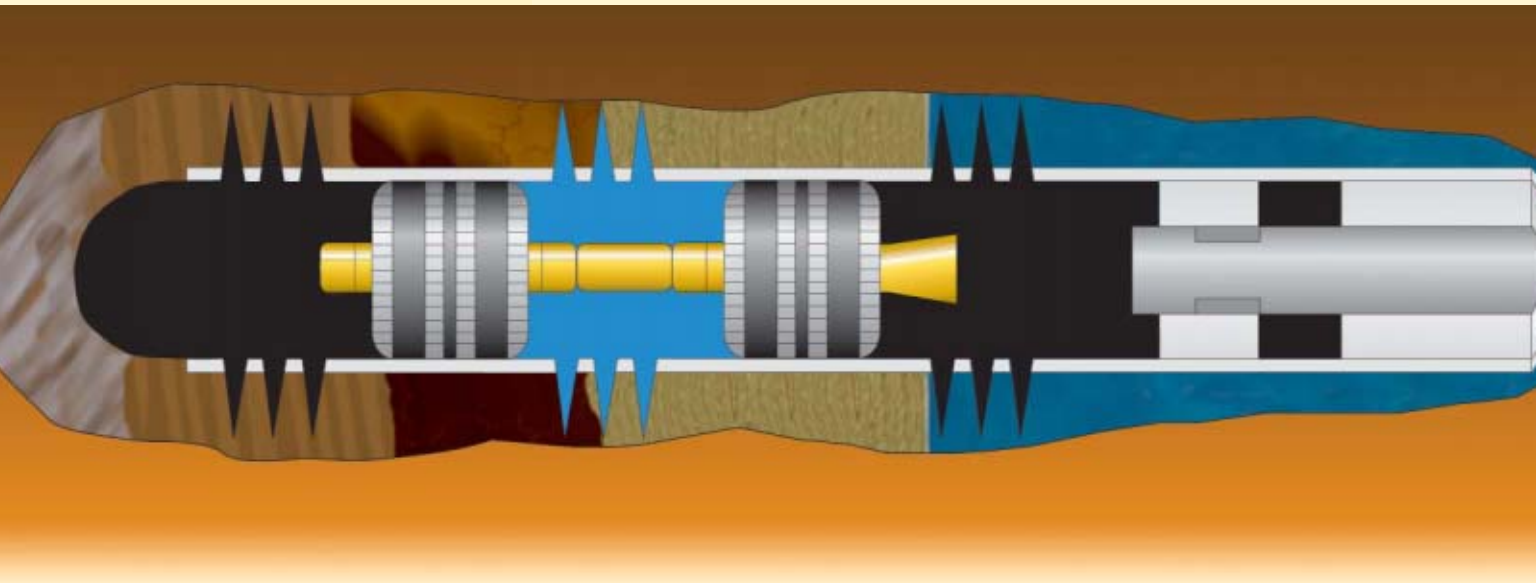

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Cover

The drill pipe, shown on the cover, is in the derrick of a rig used to drill wells for producing Yuzhno Russkoye gas field in West Siberia. Last December, ZAO Achimgaz, a joint venture of BASF AG subsidiary Wintershall and Russia's OAO Gazprom, started producing the field that contains more than 600 billion cu m of recoverable gas. Wintershall says both companies contributed expertise to the joint venture—Gazprom with its Arctic experience and Wintershall with its experience in developing technically demanding reservoirs with horizontal wells under adverse geological conditions. Articles in the Downhole Technology Review special report, starting on p. 43, review new downhole technologies that are allowing companies to recover more of the world's remaining oil and gas resources. Photo from Wintershall.




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General Interest — Quick Takes

WEF forecasts energy supplies as key risk

Stable global energy supplies will be a major risk area for countries in 2008, according to a report published by the World Economic Forum (WEF), signaling that the issue is facing the highest levels of political and economic uncertainty in a decade.

WEF, speaking in advance of its annual event in Davos Jan. 23-7, said that new thinking and concerted action by business leaders and public policymakers were critical to address the problem. Fossil fuel supplies are expected to become tighter over the next 2 decades, and more price shocks are likely to happen.

The report—produced together with a group of insurers and finance experts—said that securing energy supplies and cutting carbon emissions simultaneously will be difficult to achieve.

"With predictions of a 37% increase in oil demand over current levels by 2030, the report sees limited scope for a fall in energy prices over the next decade," WEF reported. "This may be good news for oil and gas producers, but it creates an inherent mismatch between those who bear risk and reward, which should be addressed through better dialogue at all levels," the group added.

David Nadler, vice-chairman of Marsh & McLennan Cos. USA, one of the contributors, said: "A move towards a forward-looking regulatory framework is needed in order to ensure long-term economic viability. This framework should seek to unlock investment and innovation in cleaner energy and, ultimately, deliver an economic price for carbon."

E&Y: UK reliance on gas for power to hit 65% 2025

The UK's reliance on natural gas for electric power generation will soar to as much as 65% by 2025 if the government doesn't fully implement its new proposed energy bill, Ernst & Young warned in a recent report.

E&Y said the UK's security of supply could be jeopardized as gas imports rise due to falling domestic supplies. The report said, "Inaction and investment by default solely in [combined-cycle gas turbines] could see the UK's dependence on gas increase by as much as 30% to 2025."

Included in the energy bill, published earlier this month, the UK government paved the way for a new generation of nuclear power plants by inviting private companies to carry out projects (OGJ Online, Jan. 14, 2008). Failure to stimulate the building of new nuclear capacity, according to the report, would effectively commit the UK to a "no nuclear" future by 2025.

Tony Ward, E&Y utilities director, said energy companies will have to invest as much as £45 billion by 2025 to develop nuclear and clean coal projects to meet the UK's needs. This would be £17 billion more than an alternative mix with unrestricted expansion of gas-fired capacity.

However, burdensome planning rules and regulatory uncertainty remain barriers to potential investment, and these must be changed, the report noted.

UK lease round acreage holds large oil potential

Acreage on offer in the upcoming UK licensing round holds a potential of 17 billion bbl, according to a study by North Sea consultancy Hannon Westwood.

The government plans to launch the 25th licensing round with the largest number of blocks to date, and it will close by the end of April. Hannon Westwood said this bidding round "has the potential to add 648 million boe through discoveries and 16.6 billion boe thorough prospects to the UKCS asset pool."

Examining unlicensed blocks and partial blocks, the report said that there were 36 discoveries, which hold 648 million boe of gross unrisked potential reserves, of which are 389 million bbl oil and 1.55 tcf of gas.

There are 275 prospects within the blocks, and these hold an estimated 16.6 billion boe of unrisked potential reserves. Prospects hold 11.8 billion bbl of oil and 28.6 tcf of gas.

The potential resource in the study compares to 7.5 billion boe in discoveries and about 50 billion boe unrisked, undrilled in exploration prospects in licensed and unlicensed acreage, according to Hannon Westwood's database.

During the last 12 months, exploration and appraisal activity on the UK Continental Shelf had reached record levels over the past 10 years, the study said. In 2007, 65 vertical wells were spudded. Hannon Westwood estimates that there are another 3 years of drilling at the current pace because there are more than 220 exploration and appraisal wells planned for 2008-10. ✦

Exploration & Development — Quick Takes

Deepwater gas find gauged north of Tobago

The first well on deepwater Block 22 in the Caribbean north of Tobago Island is a large gas discovery, said operator Petro-Canada.

The Cassra-1 wildcat in 1,411 ft of water on the northwest edge of a 26-sq-mile seismic amplitude anomaly flowed at an equipment restricted rate of 23 MMcfd from a 30-ft interval in an undisclosed formation. The well went to TD of 5,617 ft and established a gas-water contact for the anomaly.

Petro-Canada said, "Based on the well results and using local field analog recovery factors, our seismic model indicates the discovery could contain in the range of 0.6 to 1.3 tcf of recoverable contingent resources." Appraisal is required to finalize the estimates.

Industry Scoreboard

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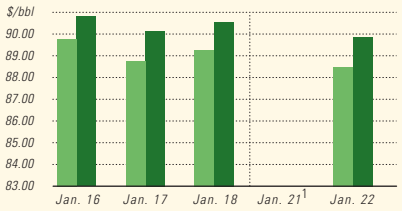
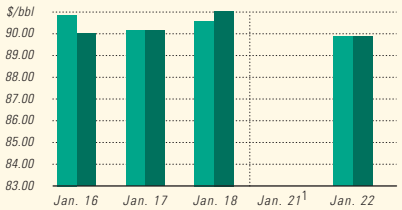
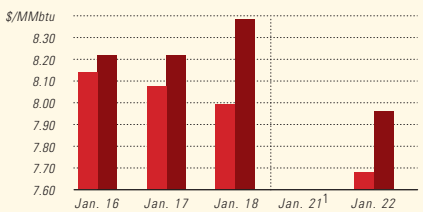


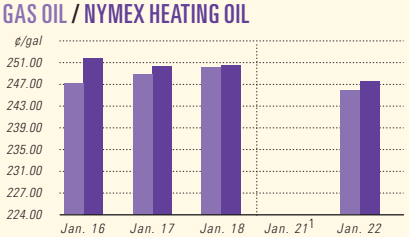
WTI CUSHING / BRENT SPOT



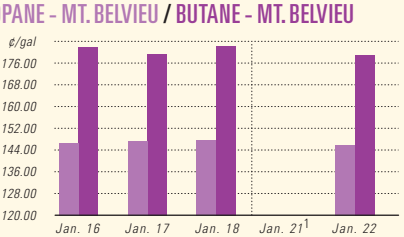
NYMEX NATURAL GAS / SPOT GAS - HENRY HUB



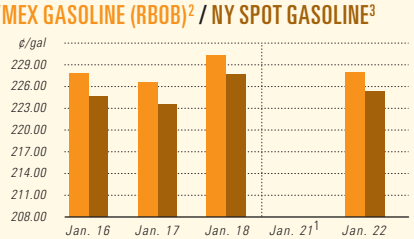
IPE GAS OIL / NYMEX HEATING OIL



PROPANE - MT. BELVIEU / BUTANE - MT. BELVIEU



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



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

US INDUSTRY SCOREBOARD — 1/28

Latest week 1/11	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	9,288	9,178	1.2	9,210	8,891	3.6
Distillate	4,358	4,268	2.1	4,220	4,267	–1.1
Jet fuel	1,573	1,626	–3.3	1,562	1,616	–3.4
Residual	817	740	10.4	757	753	0.6
Other products	5,124	4,899	4.6	5,131	5,032	2.0
TOTAL DEMAND	21,160	20,711	2.2	20,879	20,559	1.6
Supply, 1,000 b/d						
Crude production	5,065	5,177	–2.2	5,032	5,196	–3.2
NGL production[2]	2,409	2,355	2.3	2,390	2,250	6.2
Crude imports	10,002	9,783	2.2	10,098	10,192	–0.9
Product imports	3,160	3,260	–3.1	3,124	3,431	–9.0
Other supply[3]	1,065	882	20.7	960	1,048	–8.4
TOTAL SUPPLY	21,701	21,457	1.1	21,603	22,117	–2.3
Refining, 1,000 b/d						
Crude runs to stills	15,346	15,324	0.1	15,391	14,964	2.9
Input to crude stills	15,513	15,520	—	15,554	15,385	1.1
% utilization	89.0	89.0	—	89.2	88.1	—

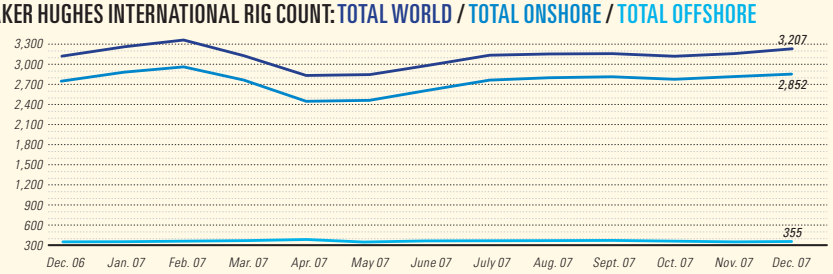
Latest week 1/11	Latest week	Previous week[1]	Change	Same week year ago[1]	Change	Change, %
Stocks, 1,000 bbl						
Crude oil	287,100	282,841	4,259	321,454	–34,354	–10.7
Motor gasoline	215,256	213,063	2,193	216,786	–1,530	–0.7
Distillate	129,845	128,693	1,152	141,875	–12,030	–8.5
Jet fuel-kerosine	40,052	39.716	336	40,186	–134	–0.3
Residual	37,902	37,374	528	46,079	–8,177	–17.7
Stock cover (days)[4]			Change, %		Change, %	
Crude	18.7	18.4	1.6	20.8	–10.1	
Motor gasoline	23.2	22.8	1.8	23.6	–1.7	
Distillate	29.8	28.7	3.8	34.5	–13.6	
Propane	29.9	32.5	–8.0	37.9	–21.1	

Futures prices[5] 1/18			Change		Change	%
Light sweet crude, $/bbl	91.53	94.70	–3.17	53.63	37.90	70.7
Natural gas, $/MMbtu	8.15	8.08	0.07	6.53	1.62	24.8

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

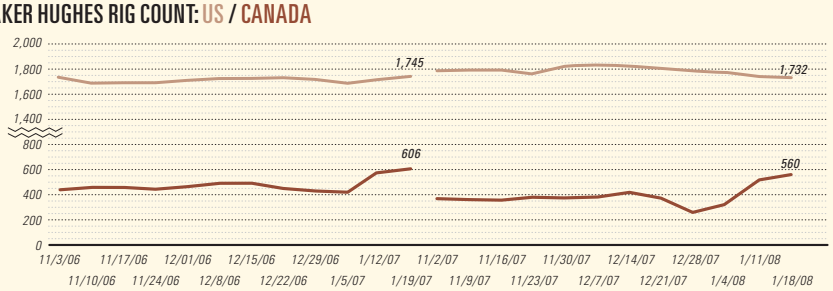
Sources: Energy Information Administration, Wall Street Journal

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



Note: Monthly average count

BAKER HUGHES RIG COUNT: US / CANADA



Note: End of week average count

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Petro-Canada said the discovery validates its exploration model.

The Diamond Offshore Ocean Worker semisubmersible is to move 2.8 miles south to drill Cassra-2, which as part of its objective will appraise the Cassra-1 discovery. Then it will drill two to three other prospects on Block 22 in an expected five-well 2008 drilling program.

Block 22 shareholders are Petro-Canada 90% and Petroleum Co. of Trinidad and Tobago 10%.

The Cassra discovery is 75 miles east-northeast of the North Coast Marine Area, where Petro-Canada produces a net 65 MMcfd to its 17.3% interest in a project that supplies gas for the Atlantic LNG project.

Petro-Canada is also carrying out a multiwell exploration program on Blocks 1a and 1b in the Gulf of Paria, where it holds 80% interest.

Gas-condensate find tested east of Trinidad

A group led by Canadian Superior Energy Inc., Calgary, gauged a gas-condensate discovery on Block 5(c) 60 miles off Trinidad and Tobago's east coast.

At least one uphole zone remained to be tested at the Victory-1 well, while the first formation flowed at restricted rates of 40-45 MMcfd with 30 bbl/MMcf of condensate. Canadian Superior, without giving figures, said, "The flowing wellhead pressure on a restricted basis and bottomhole pressures are comparable or better than other producing wells and fields in the immediate area."

The well, the first in a three-well exploration program on the block, is on the 80,000-acre Intrepid Block just east of Dolphin gas field and 3 miles from a pipeline to shore. TD is 16,150 ft. The Bounty prospect is next, to be followed by Endeavour.

The other participants are BG International Ltd. and Challenger Energy Corp., another Calgary independent.

Exploration due on Trinidad land blocks

Two Canadian independents will prospect on 214,000 acres in the underexplored Central Range in central Trinidad.

Petro Andina Resources Inc., Calgary, plans to acquire a 50% working interest from Voyager Energy Ltd., a private Calgary firm, and become operator of the onshore Central Range Shallow and Central Range Deep blocks. Drilling is likely to begin in 2009.

The blocks are subject to production-sharing contracts, and the deal is subject to approval by the Trinidad and Tobago government. The government awarded the blocks to Voyager on Jan. 10.

Petroleum Co. of Trinidad & Tobago has the right to participate for a 35% working interest in any development on the shallow block and for a 20% working interest in any development on the deep block.

The PSCs provide for an initial 4-year exploration phase with 2-year extension options.

The PSCs apply to hydrocarbon rights above and below 4,500 ft true vertical depth, respectively. They have work obligations of 100 line-km of 2D seismic, 250 sq km of 3D seismic, one well to at least 12,000 ft, and three wells to 4,500 ft or less.

Petro Andina and Voyager will each pay a $2.75 million signature bonus upon final government approval, and Petro Andina will carry the first $5 million of Voyager's seismic acquisition costs in the exploration phase.

Petro Andina estimated its 2008 capital spending in Trinidad and Tobago will total $15 million, mostly for seismic surveying.

Norway expecting more exploration drilling

Operators are expected to drill 35-40 exploration wells on the Norwegian Continental Shelf in 2008, the Norwegian Petroleum Directorate said.

NPD reported 32 wells were spudded last year, resulting in 12 small discoveries. Of the 32 total, 20 were wildcat wells and 12 were appraisal wells.

High oil prices encouraged operators to significantly increase their activities, but this also meant that costs soared too.

"Continued growth in total investment costs is expected," NPD officials said. The shelf produced 1.5 billion boe in 2007, which was 164 million boe less than the record set in 2004.

One problem with exploration growth was the impact on the environment where emissions and discharges rose.

The NPD approved eight plans for development and operation (PDO) for 9 new deposits in 2007. Around 10 PDOs are expected to be submitted to the authorities in 2008. However, gas production rose in 2007 while oil production fell compared with 2006.

Production started from four oil and gas fields: Blane, Enoch, Ormen Lange, and Snohvit.

An additional three fields are expected to start producing in 2008: Alvheim, Vilje, and Volve.

During 2007, NPD collected 2,617 km of seismic data in the Nordland VII and Troms II areas, and it will shoot more data this summer.

StatoilHydro submits Yttergryta development plan

Gas production from Yttergryta field, which lies 33 km east of Asgard B platform in the Norwegian Sea, will start in first quarter 2009. This is according to the plan of development and operation (PDO) that was submitted Jan. 18 to the Norwegian energy ministry.

Yttergryta is expected to produce 1.75 billion cu m of gas over 3-5 years. StatoilHydro will invest 1.2 billion kroner in the project, including drilling expenses. The ministry is expected to take as long as 8 weeks to review the PDO.

Operator StatoilHydro said Yttergryta will be developed with a subsea template tied back to the Asgard B platform, sending 3.5 million cu m/day of gas via the Asgard gas pipeline to the processing plant at Karsto.

The exploration well that was drilled in June 2007 will be converted to a production well in 2008, StatoilHydro said, and the template for the subsea production facility has already been installed.

StatoilHydro holds a 45.75% interest in the project. Other licensees are Total SA 24.5%, Petoro 19.95%, and Eni SPA 9.8%.

CNX spending to target eastern US shales

CNX Gas Corp., Pittsburgh, said its 2008 capital budget includes

exploration for gas in Marcellus, Huron, Chattanooga, and New Albany shales and the Trenton-Black River dolomite in the eastern US.

The overall plan is for a 35% spending increase to $470 million, of which $377 million will go toward the drilling, midstream, and land operations in the company's Virginia and Pennsylvania coalbed methane development projects.

CNX Gas will drill 300 CBM development wells in Virginia, 100 in Mountaineer, and 100 in Nittany. Each exceeds the 2007 program.

The other $88 million includes $27 million for CBM exploration, $46 million for shale and other exploration, and $15 million for land. Some conventional sand horizons will be tested for the presence of oil.

The company sees shale potential in the Marcellus on 16,000 acres in New York, 41,000 acres in Pennsylvania, 26,000 acres in West Virginia, and 78,000 acres in Ohio; in the Huron shale on 193,000 acres in Kentucky and West Virginia; in the Chattanooga shale on 132,000 acres in Tennessee; and in the New Albany shale on 300,000 acres in Kentucky, Indiana, and Illinois. ✦

Drilling & Production — *Quick Takes*

Pemex lets $683 million contract to Halliburton

Mexico's Petroleos Mexicanos has let a 3-year, $683 million contract to Halliburton Co. to manage the drilling and completion of 58 land wells in the southern region of Mexico.

The contract spans a number of well conditions, including depressurized and high-pressure/high-temperature formations, combined with complex geologies and tremendous depths, ranging 3,500-6,500 m.

Halliburton's project management group will provide wellbore-cementing tools, stimulation equipment and wireline technology, as well as drilling fluids, drill bits, directional-drilling services, and completion tools.

Petrobras lets contracts for gulf fields

Petroleo Brasileiro SA subsidiary Petrobras America has awarded two major contacts worth a total $300 million to Technip for the development of the Cascade and Chinook gas fields in the Walker Ridge area of the Gulf of Mexico. The fields lie in 8,200 ft and 8,800 ft of water, respectively.

The first contract covers the engineering, procurement, construction and installation of five free-standing hybrid riser systems for both Cascade and Chinook fields.

The second contract covers the installation of the Cascade infield flowlines and gas export pipeline and includes: welding of about 120 km of 6-in. and 9-in. steel pipelines, design and fabrication of 10 pipeline end termination and 2 inline tees, and installation of the pipelines and associated structures.

Offshore installation is slated to begin in third quarter 2009, using Technip's Deep Blue and Constructor vessels.

Mobil to upgrade Nigerian production facilities

Mobil Producing Nigeria, a unit of ExxonMobil Corp., has let a $220 million contract to a consortium led by AMEC PLC for upgrade work for its oil and gas production facilities in southeast Nigeria over the next 5 years.

AMEC has teamed with Jagal and Netco to manage the project, provide services, and prepare engineering designs to extend the lifespan of production facilities. An AMEC spokesman told OGJ that it hadn't been yet given data on expansion increases as this was a long-term project.

Mobil has more than 800,000 acres in shallow water and production comes from 90 offshore platforms, with 283 flowing completions in 353 wells with a production capacity of about 720,000 b/d of crude, condensate, and natural gas liquids.

Chevron taps Atwood for semi newbuild

Chevron Australia let a contract to Atwood Oceanics Inc. for the construction of a semisubmersible drilling unit for a period of at least 3 years, with an option for up to 6 years.

The rig will be moored in as much as 6,000 ft of water with its own mooring equipment, but could work an additional 2,000 ft using prelaid mooring equipment.

The operating cost of the rig will be $470,000/day for 3 years and, subject to cost escalation provisions in the contract, it may increase.

Atwood said the total cost of the rig, including administrative and overhead costs and capitalized interest, will be $570-590 million.

Atwood executed a construction contract with Jurong Shipyard Pte. Ltd. to construct the drilling unit at Jurong's Singapore shipyard, with delivery expected in early 2011.

A Chevron spokesman said the contract underpins Chevron Australia's long-term commitment to find, appraise, and develop Australian gas resources for domestic and international markets.

Silverstone taps Acergy for Victoria field lines

Silverstone Energy Ltd. granted a £9 million contract to Acergy SA to install the flowline, control umbilical, and other subsea equipment in Victoria gas field in the southern North Sea. Production is due to start by yearend.

Acergy will tie the field back to the Viking BD platform via Vixen, operated by ConocoPhillips.

Reserves to be recovered under Phase 1 are estimated at 36 bcf of gas. The field will be developed through reentry of the discovery well on Block 49/17. The Victoria facilities have been set up to enable rapid development of the additional fault blocks that make up the Victoria and Viking B extension, subject to performance of Phase 1, Silverstone said.

Silverstone will export gas over 130 km through the Viking subsea pipeline to the Theddlethorpe gas terminal onshore in Lincolnshire. At least another four exploration wells are scheduled over the next 12 months.

Silverstone was founded 3 years ago. Operator of the project with a 50% stake, it will work with partners BP PLC and ConocoPhillips. ✦

Processing — *Quick Takes*

CSB team visits BP's Texas City refinery

The US Chemical Safety Board has dispatched a team to BP America Inc.'s Texas City, Tex., refinery to investigate a Jan. 10 process-related accident that killed an employee.

Refinery officials told CSB on Jan. 17 that a chemical explosion may have been involved in the ultracracker unit's overpressure event that led to the employee's death. Earlier reports indicated that water pressure was responsible, CSB said.

CSB said its team, which was slated to arrive on site on Jan. 18, will be led by CSB Supervisory Investigator Don Holmstrom, who led the agency's 2-year investigation of the 2005 fire and explosion at the refinery.

William Joseph Garcia, a shift foreman who had worked at the refinery for 32 years, was killed on Jan. 10 when a metal lid flew off of a water-protection vessel that was attached to the ultracracker, according to initial reports.

EC approves Petroplus's refinery acquisitions

The European Commission has approved Petroplus Holdings AG's $875 million proposal to buy two refineries from Shell International Petroleum Co. Ltd. in France, indicating that the deal will close in the second quarter.

Petroplus Holdings wants to buy the 164,000 b/cd Petit Couronne and 80,000 b/cd Reichstett Vendenheim refineries.

Petit Couronne, 130 km northwest of Paris on the Seine River, produces 40% middle distillates and 20% gasoline. The Reichstett Vendenheim refinery is in Alsace and produces 45% middle distillates and 20% gasoline. ✦

Transportation — *Quick Takes*

Gazprom to acquire Serbian NIS

Serbia was reported Jan. 22 as having agreed to sell OAO Gazprom a controlling interest in state oil company NIS. Terms of the deal were not disclosed, but Gazprom in December 2007 offered €400 million for a 51% stake in the company. At the time, Gazprom also promised an additional €500 million of investment and that it would route the South Stream pipeline through Serbia.

South Stream is a €10 billion gas pipeline project, running 558 miles under the Black Sea via Bulgaria to Italy. Gazprom and Italy's ENI SPA reached commercial terms on the project in December. Feasibility and marketing studies on the 30 billion cu m/year project are under way, to be completed by yearend. Initial plans call for construction to begin in 2009, with an in-service date of 2013.

Gate LNG awards terminal construction contract

Royal Vopak and NV Nederlandse Gasunie, project operators of the planned 9 billion cu m/year Gate liquefaction terminal at Rotterdam, have awarded a turnkey contract to Sener Ingenieria y Sistemas SA and Techint Group to jointly construct the terminal. The value of the contract was not disclosed.

The €800 million plant will take 4 years to construct. Sener and Techint will perform detailed engineering and oversee purchasing, construction, and start-up.

Entrepose Contracting and Vinci Construction PLC—both also participating in the venture—will design and build the three 180,000 cu m LNG tanks, which will have an emission capacity of 9 billion cu m/year of gas. Two tanks of the same size will be added later.

Gate LNG initially will have a jetty for LNG ships having capacities as great as 267,000 cu m. A second jetty will be built at a later date.

Gate will have a greater capacity than the average European LNG plant, a Sener executive said.

Dong Energy, EconGas, and Essent, initial customers for long-term throughput agreements, will each take 3 billion cu m/year.

New shareholders in the terminal are Dong Energy, Essent, and OMV Gas International (as a major shareholder of EconGas), which will each acquire a 5% equity stake.

Afren consortium to study Nigerian LNG plant

Afren PLC, E.On Ruhrgas AG, and African LNG Holdings Ltd. will assess the feasibility of building an LNG plant and related gas facilities in southeastern Nigeria.

The partners will focus on developing gas from a targeted list of assets and will study gas gathering capabilities and potential LNG export possibilities. Afren said the group will then decide on establishing joint corporate structures and funding arrangements.

Under a cooperation agreement the consortium signed Jan. 22, analyses will focus on the Anambra basin and will aim to reduce gas flaring and ensure that domestic demand can be satisfied and export commitments met.

African LNG will be Afren's exclusive downstream liquefaction partner in developing a monetization strategy.

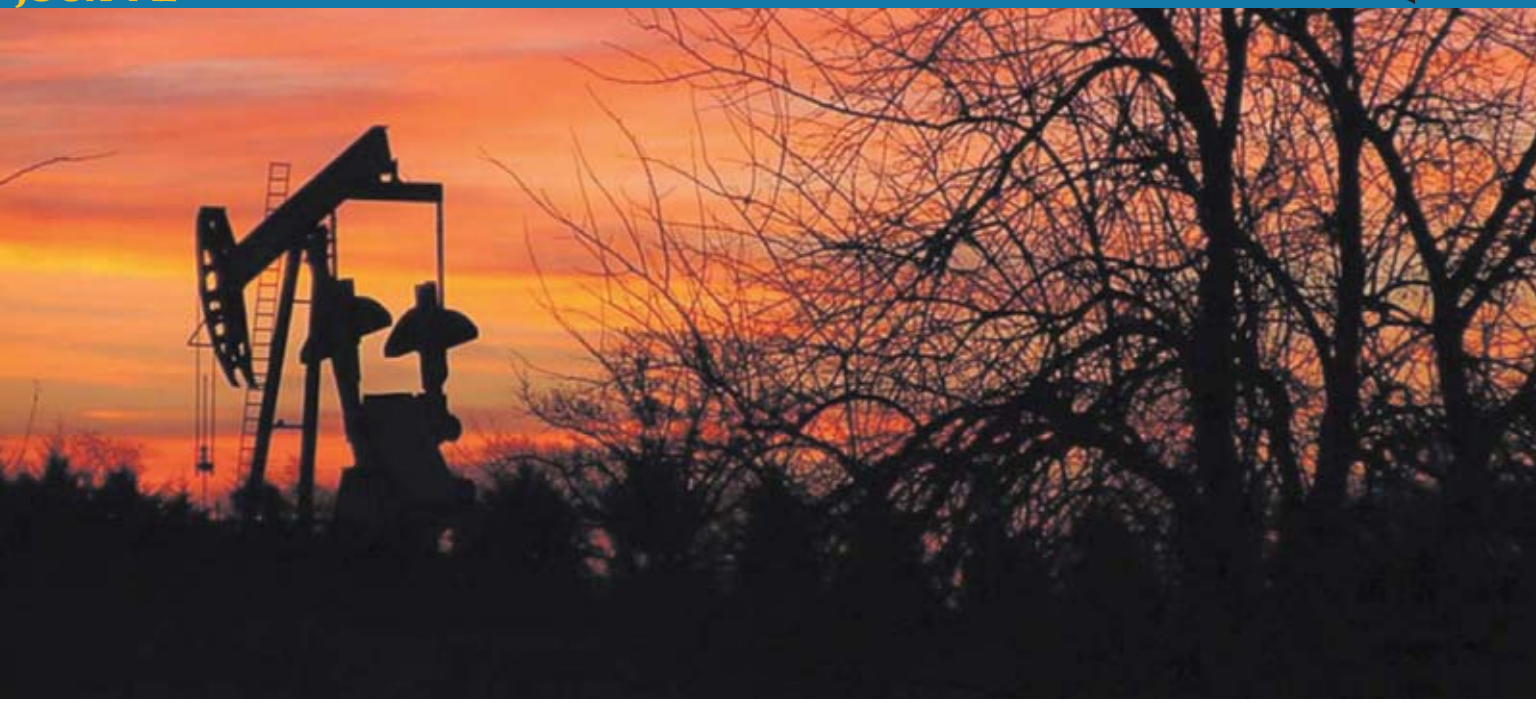
EnCana plans 22-mile Colorado gas pipeline

EnCana Oil & Gas Inc. filed a right-of-way application for the construction of a 22-mile natural gas pipeline with the US Bureau of Land Management's field office in Grand Junction, Colo., BLM reported on Jan. 18.

BLM said the proposed 32-in. line in the Colbran and Plateau Valley area would transport as much as 650 MMscfd of field-grade gas for further processing and delivery to markets.

About 93% of the proposed line would be at the edge of existing pipeline or road corridors. It would begin on Hayes Mesa in the Anderson Gulch area about 5 miles west of Colbran and end at EnCana's Orchard Unit compressor near Interstate 70 about 6 miles northeast of De Beque, BLM said.

BLM's Grand Junction office has been designated lead office for the project and will be preparing an environmental impact statement under the National Environmental Policy Act. It will accept public comments through Feb. 18 to identify issues and concerns to consider during the environmental review, BLM said. ✦



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Letters

Winners and losers

If you simply look at the hard numbers (prices, profitability, margins, capacity utilization), you would draw the opposite conclusion and recognize that the oil industry's best friends are those who claim to be its worst enemies ("Some dislike oil companies; some just dislike oil"; OGJ, Dec. 24, 2007, p. 76). They are more than misguided; they are stupid. What they actually achieve is the opposite of what they desire. Without these people the US would be producing another 5 million b/d offshore California and maybe even New Jersey. With that reality, crude prices would be back down to $25/bbl. The people forcing mogas and diesel sulfur down to 10 ppm can take credit for shutting down half of the US refineries in the last 25 years and certainly all of the hydroskimmers. The survivors have been the big integrated guys who are now making money faster than they can wheel-barrow it to the bank.

Ask yourself, Who are the biggest winners and who are the biggest losers in the reality of the current business environment? The biggest winners are the people who own the molecules. The biggest losers are the people who have to buy the molecules. It can't be any more simple than that.

Tony Pavone
Menlo Park, Calif.

Calendar

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

OIL&GAS JOURNAL online

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

2008

JANUARY

International Forum Process Analytical Technology (IFPAC), Baltimore, (847) 543-6800, (847) 548-1811 (fax), e-mail: info@ifpacnet.org, website: www.ifpac.com. 27-30.

SPE/IADC Managed Pressure Drilling & Underbalanced Operations Conference & Exhibition, Abu Dhabi,

Calendar

(972) 952-9393, (972) 952-9435 (fax), e-mail: spedal@spe.org, website: www.spe.org. 28-29.

Offshore West Africa Conference & Exhibition, Abuja, (918) 831-9160, (918) 831-9161 (fax), e-mail: registration@pennwell.com, website: www.offshorewestafrica.com. 29-31.

Petroleum Exploration Society of Great Britain Geophysical Seminar, London, +44 (0)20 7408 2000, +44 (0)20 7408 2050 (fax), e-mail: pesgb@pesgb.org.co.uk, website: www.pesgb.org.uk. 30-31.

SIHGAZ International Hydrocarbon and Gas Fair, Hassi Messaoud, Algeria, website: www.sihgaz2008.com. Jan. 30-Feb. 3.

FEBRUARY

Middle East Corrosion Conference, Bahrain, + 973 17 729819, + 973 17 7299819 (fax), e-mail: bseng@batelco.com.bh, website: www.mohandis.org. 3-6.

IADC Health, Safety, Environment & Training Conference & Exhibition, Houston, (713) 292-1945, (713) 292-1946 (fax), e-mail: conferences@iadc.org, website: www.iadc.org. 5-6.

SPE Unconventional Reservoirs Conference, Keystone, Colo., (972) 952-9393, (972) 952-9435 (fax), e-mail: spedal@spe.org, website: www.spe.org. 10-12.

International Pipeline Pigging & Integrity Management Conference & Exhibition, Houston, (713) 521-5929, (713) 521-9255 (fax), e-mail: clarion@clarion.org, website: www.clarion.org. 12-14.

Deep Offshore Technology International Conference & Exhibition, Houston, (918) 831-9160, (918) 831-9161 (fax), e-mail: registration@pennwell.com, website: www.dotinternational.net. 12-14.

SPE International Formation Damage Control Symposium & Exhibition, Lafayette, (972) 952-9393, (972) 952-9435 (fax), e-mail: spedal@spe.org, website: www.spe.org. 13-15.

Alternative Fuels Technology Conference, Prague, +44 (0) 20 7357 8394, +44 (0) 20 7357 8395 (fax), e-mail: Conferences@EuroPetro.com. website: www.europetro.com. 18.

IP Week, London, +44 (0)20 7467 7100, +44 (0)20 8561 0131 (fax), e-mail: events@energyinst.org.uk, website: www.ipweek.co.uk. 18-21.

International Catalyst Technology Conference, Prague, +44 (0) 20 7357 8394, +44 (0) 20 7357 8395 (fax), e-mail: Conferences@EuroPetro.com. website: www.europetro.com.19-20.

Pipe Line Contractors Association Annual Conference (PLCA), Maui, (214) 969-2700, (214) 969-2705 (fax), e-mail: plca@plca.org, website: www.plca.org. 20-24.

International Petrochemicals & Gas Technology Conference & Exhibition, Prague, +44 (0) 20 7357 8394, +44 (0) 20 7357 8395 (fax), e-mail: Conferences@EuroPetro.com. website: www.europetro.com. 21-22.

AAPG Southwest Section Meeting, Abilene, Tex., (918) 560-2679, (918) 560-2684 (fax), e-mail: convene@aapg.org, website: www.aapg.org. 24-27.

Laurance Reid Gas Conditioning Conference, Norman, Okla., (405) 325-3136, (405) 325-7329 (fax), e-mail: bettyk@ou.edu, website: www.lrgcc.org. 24-27.

Middle East Refining Conference & Annual Meeting, Abu Dhabi, +44 (0) 1242 529 090, +44 (0) 1242 529 060 (fax), e-mail: wra@theenergyexchange.co.uk, website: www.wraconferences.com. 25-26.

CERI Natural Gas Conference, Calgary, Alta., (403) 220-2380, (403) 284-4181 (fax), e-mail: jstaple@ceri.ca, website: www.ceri.ca. 25-26.

SPE Intelligent Energy Conference & Exhibition, Amsterdam, (972) 952-9393, (972) 952-9435 (fax), e-mail: spedal@spe.org, website: www.spe.org. 25-27.

IADC Drilling HSE Asia Pacific Conference & Exhibition, Kuala Lumpur, (713) 292-1945, (713) 292-1946 (fax), e-mail: conferences@iadc.org, website: www.iadc.org. 26-27.

Middle East Fuels Symposium, Abu Dhabi, +44 (0) 1242 529 090, +44 (0) 1242 529 060 (fax), e-mail: wra@theenergyexchange.co.uk, website: www.wraconferences.com. 27-28.

MARCH

GPA Annual Convention, Grapevine, Tex., (918) 493-3872, (918) 493-3875 (fax), e-mail: pmirkin@gasprocessors.com, website: www.gasprocessors.com. 2-5.

GEO Middle East Geosciences Conference & Exhibition, Bahrain, +44 20 7840 2139, +44 20 7840 2119 (fax), (fax), e-mail: geo@oesallworld.com, website: www.allworldexhibitions.com. 3-5.

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

NPRA Security Conference, The Woodlands, Tex., (202) 457-0480, (202) 457-0486 (fax), e-mail: info@npra.org, website: www.npradc.org. 4-5.

ARTC Annual Meeting, Bangkok, +44 1737 365100, +44 1737 365101 (fax), e-mail: events@gtforum.com, website: www.gtforum.com. 4-6.

Global Petrochemicals Annual Meeting, Dusseldorf, +44 (0) 1242 529 090, +44 (0) 1242 529 060 (fax), e-mail: wra@theenergyexchange.co.uk, website: www.wraconferences.com. 4-6.

IADC/SPE Drilling Conference & Exhibition, Orlando, (713) 292-1945, (713) 292-1946 (fax); e-mail: conferences@iadc.org, website: www.iadc.org. 4-6.

SPE Indian Oil & Gas Technical Conference & Exhibition, Mumbai, (972) 952-9393, (972) 952-9435 (fax), e-mail: spedal@spe.org, website: www.spe.org. 4-6.

Annual Middle East Gas Summit, Doha, +971 4 336 2992, +971 4 336 0116 (fax), e-mail: sarita.singh@ibc-gulf.com, website: www.ibcgulfconferences.com. 5-6.

NPRA Annual Meeting, San Diego, (202) 457-0480, (202) 457-0486 (fax), e-mail: info@npra.org, website: www.npradc.org. 9-11.

World Heavy Oil Congress, Edmonton, Alta., (403) 209-3555, (403) 245-8649 (fax), website: www.petroleumshow.com. 10-12.

New Zealand Petroleum Conference, Auckland, +64 3 962 6179, +64 4 471 0187 (fax), e-mail: crown.minerals@med.govt.nz, website: www.crownminerals.govt.nz. 10-12.

Calendar

Gastech International Conference & Exhibition, Bangkok, +44 (0) 1737 855005, +44 (0) 1737 855482 (fax), e-mail: tonystephenson@dmgworldmedia.com, website: www.gastech.co.uk. 10-13.

API Spring Petroleum Measurement Standards Meeting, Dallas, (202) 682-8000, (202) 682-8222 (fax), website: www.api.org/events. 10-14.

European Fuels Conference & Annual Meeting, Paris, +44 (0) 1242 529 090, +44 (0) 1242 529 060 (fax), e-mail: wra@theenergyexchange.co.uk, website: www.wraconferences.com. 11-12.

IADC International Deepwater Drilling Conference & Exhibition, Rio de Janeiro, (713) 292-1945, (713) 292-1946 (fax); e-mail: conferences@iadc.org, website: www.iadc.org. 11-12.

SPE North Africa Technical Conference & Exhibition, Marrakech, (972) 952-9393, (972) 952-9435 (fax), e-mail: spedal@spe.org, website: www.spe.org. 12-14.

NACE International Conference & Expo, New Orleans, (281) 228-6200, (281) 228-6300 (fax), website: www.nace.org. 16-20.

Offshore Asia Conference & Exhibition, Kuala Lumpur, (918) 831-9160, (918) 831-9161 (fax), e-mail: registration@pennwell.com, website: www.offshoreasiaevent.com. 17-19.

Sub-Saharan Oil, Gas & Petrochemical Exhibition & Conference, Cape Town, +27 21 713 3360, +27 21 713 3366 (fax), e-mail: expo@fairconsultants.com, website: www.fairconsultants.com. 17-19.

Turoge and Black Sea Oil & Gas Exhibition & Conference, Ankara, +44 207 596 5016, e-mail: oilgas@ite-exhibitions.com, website: www.ite-exhibitions.com/og. 18-20.

AAPG Prospect & Property Expo (APPEX), London, (918) 560-2679, (918) 560-2684 (fax), e-mail: convene@aapg.org, website: www.aapg.org. 24-26.

AAPG Pacific Section Meeting, Bakersfield, Calif., (918) 560-2679, (918) 560-2684 (fax), e-mail: convene@aapg.org, website: www.aapg.org. Mar. 29-Apr. 2.

NPRA International Petrochemical Conference, San Antonio, (202) 457-0480, (202) 457-0486 (fax), e-mail: info@npra.org, website: www.npradc.org. Mar. 30-Apr. 1.

SPE Middle East Petroleum Engineering Colloquium, Dubai, (972) 952-9393, (972) 952-9435 (fax), e-mail: spedal@spe.org, website: www.spe.org. Mar. 30-Apr. 2.

PIRA Understanding Global Oil Markets Conference, Tokyo, (212) 686-6808, (212) 686-6628 (fax), e-mail: sales@pira.com, website: www.pira.com. Mar. 31-Apr. 1.

ERTC Sustainable Refining Conference, Brussels, +44 1737 365100, +44 1737 365101 (fax), e-mail: events@gtforum.com, website: www.gtforum.com. Mar. 31–Apr. 2.

APRIL

SPE/ICoTA Coiled Tubing & Well Intervention Conference & Exhibition, The Woodlands, Tex., (972) 952-9393, (972) 952-9435 (fax), e-mail: spedal@spe.org, website: www.spe.org. 1-2.

ERTC Biofuels+ Conference, Brussels, +44 1737 365100, +44 1737 365101 (fax), e-mail: events@gtforum.com, website: www.gtforum.com. 2-4.

GIOGIE Georgian International Oil & Gas Conference & Showcase, Tbilisi, +44 207 596 5016, e-mail: oilgas@ite-exhibitions.com, website: www.ite-exhibitions.com/og. 3-4.

Middle East Petroleum & Gas Conference, Doha, +65 6222 0230, +65 6222 0121 (fax), e-mail: mpgc@cconnection.org, website: www.cconnection.org. 6-8.

ACS National Meeting & Exposition, New Orleans, 1 (800) 227-5558, e-mail: natlmtgs@acs.org, website: www.acs.org. 6-10.

American Institute of Chemical Engineers (AIChE) Spring National Meeting, New Orleans, (212) 591-8100, (212) 591-8888 (fax), website: www.aiche.org. 6-10.

CIOGE China International Oil & Gas Conference, Beijing, + (44) 020 7596 5000, + (44) 020 7596 5111 (fax), e-mail: oilgas@ite-exhibitions.com, website: www.ite-exhibitions.com/og. 7-8.

API Pipeline Conference & Cybernetics Symposium, Orlando, (202) 682-8000, (202) 682-8222 (fax), website: www.api.org/events. 7-10.

EAGE Saint Petersburg International Conference & Exhibition, Saint Petersburg, +7 495 9308452, +7 495 9308452 (fax), e-mail: eage@eage.ru, website: www.eage.nl. 7-10.

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

ENTELEC Annual Conference & Expo, Houston, (888) 503-8700, website: www.entelec.org. 9-11.

North Caspian Regional Atyrau Oil & Gas Exhibition & Petroleum Technology Conference, Atyrau, +44 207 596 5016, e-mail: oilgas@ite-exhibitions.com, website: www.ite-exhibitions.com/og. 9-11.

API Spring Refining & Equipment Standards Meeting, New Orleans, (202) 682-8000, (202) 682-8222 (fax), website: www.api.org/events. 14-16.

API/NPRA Spring Operating Practices Symposium, New Orleans, (202) 682-8000, (202) 682-8222 (fax), website: www.api.org/events. 15.

SPE Gas Technology Symposium, Calgary, Alta., (972) 952-9393, (972) 952-9435 (fax), e-mail: spedal@spe.org, website: www.spe.org. 15-17.

SPE International Health, Safety & Environment Conference, Nice, (972) 952-9393, (972) 952-9435 (fax), e-mail: spedal@spe.org, website: www.spe.org. 15-17.

GPA Midcontinent Annual Meeting, Okla. City, (918) 493-3872, (918) 493-3875 (fax), e-mail: pmirkin@gasprocessors.com, website: www.gasprocessors.com. 17.

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

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

ERTC Coking & Gasification Conference, Rome, +44 1737 365100, +44 1737 365101 (fax), e-mail: events@gtforum.com, website: www.gtforum.com. 21-23.

WestAsia Oil, Gas, Refining, & Petrochemicals Exhibition & Conference, Oman, +968 24790333, +968 24706276 (fax), e-mail: clemento@omanexpo.com, website: www.ogwaexpo.com. 21-23.

International Pump Users Symposium, Houston, (979) 845-7417, (979) 847-9500 (fax), website: http://turbolab.tamu.edu. 21-24.

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

MAY

IOGCC Midyear Meeting, Calgary, Alta., (405) 525-3556, (405) 525-3592 (fax), e-mail: iogcc@iogcc.state.ok.us, website: www.iogcc.state.ok.us. 4-6.

PIRA Canadian Energy Conference, Calgary, (212) 686-6808, (212) 686-6628 (fax), e-mail: sales@pira.com, website: www.pira.com. 5.

API International Oil Spill Conference, Savannah, Ga., (202) 682-8000, (202) 682-8222 (fax), website: www.api.org/events. 5-8.

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Injecting nanosensors

Guntis Moritis
Production Editor

A newly formed consortium aims to develop nanotechnologies that can characterize oil and gas reservoirs more comprehensively than the current means that rely largely on collecting near wellbore data.

The consortium envisions the oil and gas industry eventually having intelligent sensors with a size less than the width of a human hair, or in other words, sensor dimensions that range from hundreds of micrometers down to hundreds of nanometers.

Once injected in the reservoir, these sensors could collect and transmit data on the fluid and rock properties from any point in the pore space of a reservoir, and thereby facilitate additional hydrocarbon recovery.

The consortium

Scott W. Tinker, director of the Bureau of Economic Geology (BEG) at the University of Texas at Austin's Jackson School of Geosciences, told OGJ that he has been working on forming the Advanced Energy Consortium (AEC) for the last 3 years and last August one of the last hurdles was overcome when the US Department of Justice's antitrust division announced that it did not oppose the venture's formation.

AEC plans to develop but not commercialize the technology.

Tinker said, "The consortium provides a vehicle for this critical precompetitive research and sends a great message to young people that the industry is investing substantially and for the long term."

Current members include BP America Inc., Baker Hughes Inc., ConocoPhillips, Halliburton Energy Services Inc., Marathon Oil Corp., Occidental Oil & Gas Corp., and Schlumberger Technology Corp. Tinker said each company made a 3-year, $3 million commitment to the consortium. The consortium does not receive any government funding.

BEG will manage the Houston-based AEC, while the Richard E. Smalley Institute for Nanoscale Science and Technology at Rice University, which has extensive nanotechnology expertise, will be a collaborative technical partner.

The consortium held its first workshop at Rice University on Jan. 8-9 at which materials scientists and electrical engineers discussed nanotechnology sensor and materials advances with petroleum engineers and geoscientists. AEC plans to hold the next meeting in March. With these and other meetings, AEC expects to develop a technology roadmap that will provide more specific targets and further narrow the focus of subsequent project solicitations.

AEC will solicit worldwide for competitive project proposals and will fund the most promising.

Sean Murphy, AEC manager, said in June the consortium may start soliciting Darpa-like (Defense Advanced Research Projects Agency) proposals for projects and expects to begin awarding competitive and international grants for the projects in September.

Murphy said AEC offers a low overhead because of its leverage with the University of Texas and BEG.

The consortium plans to focus its collaboration on projects with universities, national laboratories, other consortia such as Sematech, private companies, and the state of Texas.

Technology needed

As noted on a Rice University web site: "Research in nanoscience has advanced in the last decade because of the intellectual allure of constructing matter and molecules one atom at a time, and because the new technical capabilities permit creation of materials and devices with significant societal impact."

The research has been in areas such as surface microscopy, silicon fabrication, biochemistry, physical chemistry, and computational engineering.

In the case of AEC, its primary focus will be on funding projects that propose nanosensors with a long development time. These research efforts would have to address communication, power, sensing, deployment, retrieval, and construction requirements.

AEC's secondary focus is on projects that develop nanomaterials with near-term potential for enhancing hydrocarbon recovery. AEC says these proposals would leverage existing and new materials under development for other technologies such as biomedical, health, telecommunications, military, and national security. It notes that the petroleum industry already uses nanomaterials to strengthen and harden drilling equipment and as drilling fluid additives.

There remain many hurdles to surmount before nanosensors can effectively provide new insights on reservoirs. AEC says some of these include providing a power supply for the devices, device size, material durability in harsh environments (such as brines and clays), determination of sensor location in the reservoir, manufacturing scalability, reasonable costs, and overall economics.

The hurdles are many, but this step-change in technology may help recover the estimated 60% of the oil left in the ground using current technology. ✦

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Editorial

Energy and economic woes

Political responses to economic problems can do more harm than good. The US government is now rushing together a political fix for an economy unraveling at surprising speed. A $140 billion package of rebates to taxpayers and short-term incentives for business investment seems likely. At issue are eligibility and size of the rebate, the nature of the incentives, and immunization of the initiative against the special-interest leeches that attach themselves to fast-moving legislation when no one is looking.

Debate so far has avoided the contribution of US energy policy to economic distress. National leaders, after all, don't like talking about their mistakes. But the silence is regrettable. Urgent concern about the economy should give the nation a chance to focus serious attention on energy, maybe even to correct historic errors and avoid new ones.

Poor record

The energy-policy record is poor, the consequences evident. Recent energy mistakes, for example, are pushing up costs of food and fuel while the economy struggles with problems in financial markets and the growing disquiet of consumers. The combination is dangerous. The stresses come while a weakening dollar signals an inevitable rebalancing of international accounts, US deficits in which became unsustainable in part because the country imports more oil than it should have to.

Legitimately prominent in recent news has been fuel ethanol's multiple blows against consumer interests. While diluting vehicle fuel mileage and tapping federal and state treasuries, the mandated gasoline additive is levitating food costs as farmers cash in on corn at the expense of other food crops such as wheat and soybeans. The pain will worsen. To win political favor in farm states, Congress last month passed, and President George W. Bush signed, a law sharply increasing the fuel ethanol requirement. A quick way to boost a reeling economy would be to rescind that mistake. The Iowa caucuses are over.

The costly and unjustified ethanol mandate is just the most recent energy blunder in the US. Energy consumers now bear the costs of an embedded tendency to err on the side of strictest possible environmental regulation. Even as statutory air pollutants fall, for example, the Environmental Protection Agency ponders toughened standards that would expand requirements for reformulated gasoline and possibly raise costs of making the fuel. Costs of making diesel fuel similarly have risen recently as refiners meet sulfur standards stricter than they need to be. In a reversal of the historic pattern, the retail price of diesel now exceeds that of gasoline most of the time.

The argument here is not against environmental performance standards for vehicle fuels; the country needs them, and they obviously work. The dispute here is with standards that raise fuel costs without producing commensurate environmental gains. A review of past and proposed fuel standards, with adjustments as warranted, is in order. Environmentalists, who think regulation should be as strict as possible in all cases, whatever the cost, would complain about "turning back the clock." They're wrong. Rationalization of fuel specifications would in fact retune the economy and, by association, environmental progress.

Rethinking leasing

An economic downturn also should prompt the US to rethink its longstanding refusal to assess oil and gas resources on federal acreage off the East and West Coasts and on the Arctic National Wildlife Refuge coastal plain. Refusal even to allow leasing of these promising expanses makes no sense except in the cost-blind framework of environmental obstructionism. With its recalcitrance on leasing, the US is forswearing jobs, taxable incomes, federal bonus and royal receipts, and supplies of oil and gas that now must be imported. Rapidly developing economic jeopardy makes that position look not just untenable but manifestly ridiculous. A long-needed change wouldn't pay off immediately, of course. But it would be a welcome sign that the US is serious about its economic future.

Rebates and short-term business incentives might help an economy with problems that seem to worsen by the day. They'll hurt, however, if they serve as excuses for the country to avoid making the structural changes it needs—many of them involving energy. ✦

Did Caspian summit share the sea or Iran's oil riches?

Mansour Kashfi
Kashex International Consulting
Dallas

COMMENT

The Iranian oil and gas industry—although about a century old—has never been so derelict, poorly managed, and near bankruptcy as it is today. Russian President Vladimir Putin has recognized the deterioration of the Iranian petroleum industry as an opportunity for exploitation. In particular, he has manipulated the Islamic regime's leadership through deception and false promises of the "benefits" of cooperation with Russian companies in the oil and gas sectors.

Isolated and under extensive and serious sanctions by western countries, the Islamic Republic of Iran has looked to the north and has seen Russia as a country that follows the same path and goals as the Islamic fundamentalists in Tehran—that of challenging the American presence in the region. Russia has opposed the US's pushing for tougher sanctions against Iran and has called for open dialogue with Tehran and lighter sanctions against Iran.

Caspian Sea conference

When the 2-day summit of the Caspian Sea's five littoral states—Russia, Kazakhstan, Turkmenistan, Iran, and Azerbaijan—was held in Tehran in mid-October 2007, a large Russian delegation with an extensive list of demands accompanied the president of Russia to Tehran. Putin, in order to save the Islamic regime from ever-increasing isolation, not only traveled to Tehran but also invited Islamic Republic President Mahmoud Ahmadinejad to Moscow.

Since the collapse of the former Soviet Union, the status of the inland sea has been a source of long-term disagreement among the five littoral countries. The Caspian Sea, under the 1921 and 1940 treaties, originally was divided between Imperial Iran and the former Soviet Union. Currently, Kazakhstan, Azerbaijan, and Russia have so far agreed to divide the upper portion of the Caspian seabed according to national sectors along the so-called modified median line, leaving the sea itself for common use. This has enabled the three states to agree upon the delimitation of the Caspian seabed on adjacent parts and conclude bilateral agreements to exercise sovereign rights on the use of mineral resources. However, Turkmenistan and Iran apparently are not happy with these divisions and are struggling to have a bigger share of the sea than they now have (see map).

Considering the statements made by Kazakhstan President Norsultan Nazarbajev upon his arrival in Tehran, the early treaties dictating the sharing of the Caspian Sea between the Soviet Union and the Iranian government now are null and void. Evidently, the summit was not about the Caspian issue. Rather, the Russian president has pushed for control and hegemony of both the natural resources of Iran and the riches of the whole region.

The summit produced aggressive comments by the nondemocratic leaders of Iran and Russia who, deeply wary of American influence, are admonishing against outside interference by increasingly assertive resource-rich countries in the Caspian Sea area.

Sharing Iran's oil, gas

Ahmadinejad and Putin, under a treaty signed in Tehran, have agreed to the initial participation of two Russian companies in the development of oil and gas deposits in Iran. They are OAO Lukoil in the oil sector and OAO Gasprom in Iran's South Pars gas field. This provision has been included in the joint statement by the presidents of both countries.

Apparently, the two sides agreed to develop direct contact between oil and gas companies of the two countries aimed at concluding concrete, mutually beneficial commercial agreements on joint work in all segments of the oil and gas industry. Particular attention was

given to cooperation in the exploration, production, and transportation of oil and gas.

In light of the near collapse of the Iranian petroleum industry as a result of sanctions and the lack of investments by the West, the "coordination of marketing policy" stressed by the document can be interpreted as the controlling and managing of Iranian oil and gas by the Russian companies, from exploration to exporting terminals and marketing.

PROPOSED CASPIAN SEA DIVISION

Pipeline vs. environment

Putin is eager to maintain his country's dominance over the delivery routes of oil and gas to the West from Central Asian producers and the Caspian's eastern shore. Therefore, in the Tehran summit he warned that energy pipelines from the region should be built only if all five nations that border the inland Caspian Sea support them.

The Russian leader also proposed building a canal as soon as possible to connect the Caspian Sea with the Black Sea to establish an East-West transport corridor for the obvious reason of challenging and rivaling the Baku-Tbilisi-Ceyhan pipeline, which has been endorsed and financed by western oil companies and financial organizations.

He also desired to undermine the notion of transporting oil and gas from Kazakhstan and Turkmenistan by pipeline from the eastern shore of the sea to the western shore for export. The issue of transporting oil and gas and laying pipelines under the Caspian Sea has always been a point of contention among energy producing nations in the region, mainly Kazakhstan and Azerbaijan.

At the summit, the Russian leader simply demanded that major energy projects having environmental risks for the Caspian should be discussed with all five Caspian nations and approved by consensus. Putin added that environmental security must become a yardstick for measuring the safety of all projects, especially in the tapping and transporting of energy resources. Putin also emphasized that the condition of the Caspian natural environment and its sturgeon population demands immediate measures to prevent environmental damage. Certainly, Putin has gained an additional argument in support of his position regarding the elimination of the Trans-Caspian pipelines.

In Tehran Putin said, "Projects that may inflict serious environmental damage to the region cannot be implemented without prior discussion by all five Caspian countries," ostensibly suggesting that each country, including Russia, should have a virtual veto on energy transport across the sea. Although protection of sturgeon, other fish, and caviar is a legitimate concern, critics believe Russians have too often used Putin's "concerns about the environment" as a convenient pretext to squeeze international companies working in Russia out of oil and gas agreements. Further, the statement by the Russian leader translates as a pretext to increase western worries about Moscow's increasing use of its energy as a tool for blackmailing the West.

Meanwhile, a week before Putin's arrival in Tehran, ministers from three East European countries—Ukraine, Lithuania, and Poland—along with Azerbaijan and Georgia, signed an agreement for the construction of an oil pipeline connecting the Black and Baltic seas (OGJ, Oct. 22, 2007, p. 34). The agreement was aimed at implementing regional energy security while reducing dependence on Russian crude oil and transportation. Russia has consistently wielded its oil and gas resources as a diplomatic weapon, hence punishing the former Soviet Union satellite nations for not toeing the Kremlin line. Therefore, the recent agreement signed by these five countries is considered to be a victory mainly for Eastern European countries.

Furthermore, the three former Soviet republics (Azerbaijan, Kazakhstan, and Turkmenistan), together with the European Union and the US, have made inroads in gaining access to Caspian Sea energy reserves, with major projects in Azerbaijan's rich deposits. The US and Europe want new pipelines to carry oil and gas across the Caspian from Kazakhstan and Turkmenistan to Baku in Azerbaijan and farther west, bypassing Russian soil. However, Putin in Tehran underlined his strong opposition to such efforts to bypass Russia and thus diminish its control.

A joint naval force

Among priority spheres for cooperation, Putin highlighted comprehensive security and stability in the region, including—with emphasis—the protection of oil and gas production facilities. The Russian leader said he is interested in a firm security program in the Caspian Sea and proposed that the five littoral states set up a joint naval force, to be called Caspian Forces, for strategic cooperation on the Caspian Sea. Apparently, cooperation under the project could be coordinated within the framework of the Shanghai Cooperation Organization.

Summit host Ahmadinejad also

emphasized the firm policy and urgent need to keep westerners out of the region. And Putin emphasized that no Caspian nation under any circumstances should offer or allow its soil to third powers for use of force or military aggression against any Caspian nation. The Caspian states should prohibit the use of their territories by any outside powers for military force against any country in the region—an obvious reference to longstanding rumors that the US has been planning to use Azerbaijan soil as a base for possible military attacks against Iran. Putin and Ahmadinejad have consistently pushed for the inclusion of this provision in Tehran declarations.

Sea issues unresolved

However, the five Caspian nations appeared no closer to resolving the border and other legal issues of the sea, which have been in limbo since the Soviet Union collapsed. The absence of transparency has led to conflicting claims to seabed oil and gas deposits, including a dispute between Turkmenistan and Azerbaijan, and also between Iran and Azerbaijan on their offshore borders. However, as mentioned before, Azerbaijan, Kazakhstan, and Russia have signed their own bilateral deals dividing about 64% of the sea among them.

Except for the accomplishment of selling out the Iranian oil and gas industry, the summit could well be described as a summit of postponed problems, including no common agreement among the five littoral countries regarding the legal issues involving the Caspian Sea. ✦

The author

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Bodman: Global energy security will need massive investment

Nick Snow
Washington Editor

Billions of dollars in investments will be required annually to achieve global energy security by diversifying supplies, suppliers, and supply routes, US Secretary of Energy Samuel W. Bodman told business leaders in Saudi Arabia.

"These three elements are the key to enhancing global security. To achieve them is, perhaps, one of the most significant challenges of our time. And to address them in a timely manner, we will need literally billions of dollars annually, over many years," he said in prepared remarks that were released Jan. 19.

The International Energy Agency estimates that $22 trillion of investment will be needed between now and 2030 if the world is to meet expected energy demand, Bodman said in his breakfast address in Riyadh. "This investment must be global, in developed and developing nations alike, and at all stages in the energy cycle," he said.

Government and business leaders also should recognize that greater environmental responsibility is required in all energy cycle phases, he said. This means harnessing scientific and technological resources, as Saudi Arabia is doing at its King Abdul Aziz City for Science and Technology and soon at the King Abdullah University of Science and Technology to develop cleaner energy sources and technologies, Bodman said.

"That's not even the whole picture. We must also consider the impact energy prices have on our economies. The tremendous economic growth in China and India and their growing demand for more and more energy has received much attention. What has not been as widely discussed is the impact high prices have on smaller and developing countries," he said.

Economic impacts

Bodman said he doesn't consider it an overstatement to suggest that high oil prices can hurt a country's economic health. They can restrict development in ways that keep businesses from growing, inhibit improvements in health care and other critical areas, and generally prevent rises in living standards, he said. Both consuming and producing nations must act responsibly to encourage economic growth worldwide, raise global living standards, and improve environmental health, he said.

Achieving this goal will require many different efforts in several different areas, Bodman said. "We must start by asking: Will the necessary investments be made to bring sufficient hydrocarbons to market? Is the investment climate in producing countries conducive to inviting such capital flows? Are large consuming nations having the right type of discussions and collaborations with producing nations? If not, why not? And are we adequately investing in ways to produce fossil energy more cleanly and efficiently?"

Bodman suggested that it is time to stop taking what he termed "purposeful market distortions" that clearly won't help, such as restricting supplies, reducing production, and creating price floors and ceilings. "I can't stress this enough: The global oil market must be allowed to function in a predictable and transparent way," he declared.

The world also requires new energy options beyond hydrocarbons, Bod-

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man said. "Everyone—governments included—has an important role to play in the development of alternative fuels and advanced energy technologies. But the private sector cannot do it alone. We need a new way of thinking about how we can work with the private sector. Even our research priorities must be developed with substantial input from corporations, utilities and universities. And research needs to be conducted in a coordinated way."

Governments should commit

To that end, Bodman has challenged many countries' governments to publicly commit to increase investment in research and development necessary to achieve the necessary alternative fuels and energy efficiency breakthroughs, and to achieve the right balance between energy security and environmental stewardship. "This requires significant public and private global investments. But it's worth it," he said.

Increased investment in energy research and development also would help meet another global challenge: the shortage of qualified engineers and technical staff needed to meet the demand for rapid innovation, Bodman said.

"We need to invest in the next generation of leaders to steer us through the energy challenge, and we must get beneficial technologies into the marketplace more quickly. That means sharing the risk that capital markets and the private sector are not yet ready to take on," said Bodman.

One example is a new technology commercialization and development fund that DOE is developing at several of its national laboratories, he said. The fund will permit the labs to use prototype development, demonstration projects, market research, and other deployment activities to move clean energy technologies that have moved beyond the research stage toward commercial viability, he said.

"We must leverage the power of private equity, as we are doing in the example I just cited. We must make smart public funding and regulatory decisions and unleash the world's best scientists and engineers on the problem of developing cost-effective, market-ready advanced energy technologies," said Bodman.

"Without sustained global investments, and without a new global commitment to invest in new sources of energy and breakthrough technologies, we will not achieve the innovations we must have to solve the world's critical energy problems," he warned. ✦

GAO: US should improve oil product supply system

Nick Snow
Washington Editor

The US petroleum product distribution system is constrained in key areas and will likely become more so without timely investments, the US Government Accountability Office warned in a Jan. 18 report.

"Industry and federal agency officials report a systemic lack of pipeline capacity in the supply infrastructure system in key states, including Arizona, California, Colorado, and Nevada, and note [that] the existing supply infrastructure is insufficient to carry the commensurate volume of petroleum products and crude oil needed to meet growing demand there," GAO said.

It noted that in 2006, the US Department of Transportation proposed—and Congress approved—legislation requiring the US energy and transportation secretaries to periodically analyze where unplanned product pipeline outages or insufficient pipeline capacity increase prices, and whether regulations are adequate to minimize the potential for unplanned pipeline capacity losses.

"While there is widespread recognition that a study is needed to fully identify the extent of infrastructure inadequacy and the impact on prices, to date no such analysis has been undertaken," GAO said in a cover letter to the two US senators who requested the study: Commerce, Science, and Transportation Committee Chairman Daniel K. Inouye (D-Hi.) and committee member Maria Cantwell (D-Wash.).

The senators asked GAO to evaluate trends in the international trading of products, refining capacity and its use internationally and domestically, international and domestic crude and product inventories, and the domestic supply infrastructure to better understand how changes in markets have affected prices, the service said.

Funds weren't allocated

US Department of Energy and DOT officials said the product supply systems study was not undertaken because Congress did not allocate funds specifically for that purpose, according to the report. The departments did not reallocate other funds for such a study, "although DOE told us it has met with DOT to discuss how this work could be approached." The cover letter said, "However, given that the study has not begun, it seems highly unlikely that agencies will be able to meet their June 2008 deadline for reporting to Congress."

GAO noted that there are many private sector plans to expand the domestic oil and product supply distribution system and that such plans could significantly relieve stresses on the system if they are implemented quickly. "However, a complex permitting and siting process involving as many as 11 federal agencies and numerous stake and local stakeholders has slowed or impeded the expansion and construction of new pipelines," it said.

It added that the permitting process for building interstate gas pipelines and associated facilities is easier because the

Federal Energy Regulatory Commission has been designated the lead federal agency to streamline that process. "No such lead federal agency exists to facilitate permitting of crude oil or petroleum product pipeline construction or upgrading," GAO observed.

The report made several recommendations aimed at improving the functioning of US product markets. They included a suggestion that the energy and transportation secretaries coordinate with other agencies to encourage more uniform biofuels and petroleum product blending practices in addition to studying whether the domestic oil and product distribution system is adequate and whether a lead agency could be assigned to coordinate pipeline construction permitting.

FERC chairman responds

In a response to the study, FERC Chairman Joseph T. Kelliher generally agreed with its recommendations. He said, while the commission does not have petroleum pipeline construction siting authority, it has encouraged and supported building new and expanded crude and product lines through its issuances of orders on pipeline petitions for declaratory orders.

"The commission has approved certain rate methodologies and granted other rate assurances prior to construction in order to reduce the uncertainty and risk inherent with these large infrastructure projects," Kelliher wrote GAO.

FERC's responsibility for siting US interstate gas pipelines has given it extensive experience in issues surrounding pipeline construction and operation, which it has used to assist other agencies, Kelliher said. He cited assistance that FERC supplied the US Department of State in its environmental review of the proposed TransCanada Keystone pipeline project, an oil pipeline crossing from Canada into the US. "I believe our assistance with this project ultimately will provide for an expeditious, but thorough, review and facilitate needed infrastructure for the oil industry," Kelliher said.

"Finally, the report recommends that several agencies, including the commission, work together to evaluate the feasibility and desirability of designating a lead agency with eminent domain authority in order to streamline the process for siting oil and product pipelines, Kelliher said, adding, "The suggested use of the commission's role in the siting of gas pipelines as a model will help to expedite the deliberations of the agencies. Further, the active participation of the commission will help facilitate a decision on the lead agency designation." ✦

API: Rising oil prices, falling stocks constrain demand

Nick Snow
Washington Editor

Rising oil prices combined with falling inventories to keep US petroleum product demand essentially flat during 2007, the American Petroleum Institute said on Jan. 17.

Demand, which API measures in products supplied, grew by 9,000 b/d to an average 20.696 million b/d this past year from 20.687 million b/d in 2006, API said in its yearend statistical review.

Demand was strongest early in 2007 when crude prices were about $50/bbl and regular grade gasoline retailed for about $2/gal, API Chief Economist John C. Felmy told reporters. Demand pulled back by yearend, when crude prices approached $100/bbl and gasoline retailed for $3/gal, he said.

API's figures showed that December's total product deliveries fell 0.6% to an average 20.7 million b/d in 2007 from 20.8 million b/d in 2006. "Consumers appear to be responding to the higher prices at the margin," Felmy observed.

Meanwhile, domestic crude inventories, which had reached their highest level since 1991 of 355 million bbl at mid-2007, fell by more than 60 million bbl to end the year at 294 million bbl—their lowest level since January 2005, but still roughly in line with the 5-year average for December.

Crude production rises

It was the most rapid 6-month crude inventory drawdown in more than 5 years, according to Ronald J. Planting, information and analysis manager in API's statistics department. "Domestic crude oil production rose for the first time since 1991, but this was at least in part a recovery from below-trend production in 2006, when it had been slowed by the aftermath of hurricanes and by pipeline repairs," he said.

Domestic crude and condensate production grew 1.1% to an average of nearly 5.2 million b/d in 2007 from slightly more than 5.1 million b/d in 2006, according to the statistics. They also showed that natural gas liquids production climbed 1.7% year-to-year to an average of nearly 1.8 million b/d from more than 1.7 million b/d. Increases were concentrated in the Rocky Mountains and the Midwest as oil well completions reached their highest level in decades, API said.

Planting said the combination of recovering crude production, flat domestic demand, and the heavy domestic inventory drawdown reduced petroleum imports during 2007 from the previous year's levels, although they still accounted for about 65% of total domestic deliveries.

The statistics said that total imports fell 1.9% to an average 13.4 million b/d in 2007 from 13.7 million b/d in 2006. Crude imports, excluding purchases for the US Strategic Petroleum Reserve, declined by 1% year-to-year to an average 10 million b/d from 10.1 million b/d, while product imports dropped 4.5% to 3.4 million b/d from 3.6 million b/d during the same period.

Record product output

"Meanwhile, in 2007, the industry exceeded past records for the production of gasoline and distillate fuel oil, Planting said. "It also was the 11th straight year of increases in US refining capacity," he said. Most of the distillate which was refined was "clean diesel," which was introduced in 2006 to help improve air quality.

Gasoline produced during 2007 contained a record amount of ethanol, which accounted for nearly 5% of all gasoline sold. "The industry used some 2 billion gal more ethanol than the government required," Planting said.

Refining capacity grew by 0.4% during 2007 to an average 17.5 million b/d from 17.4 million b/d in 2006, according to the statistics. Capacity utilization rates retreated 1.2 percentage points to an average 88.5% in 2007 from 89.7% in 2006 as a result but still remained well above rates for US industries as a whole. "Despite high oil prices, the industry worked hard to meet the needs of consumers by producing record amounts of fuel," Felmy said. "These rollercoaster changes are a huge challenge. In order to properly supply consumers, the industry must anticipate demand, and that has been very difficult given changing conditions. Nevertheless, it has responded by producing fuel and importing additional supplies as required," he said. ✦

Congressman seeks delay for Alaska Chukchi Sea lease sale

Nick Snow
Washington Editor

US Rep. Edward J. Markey (D-Mass.) has urged Secretary of the Interior Dirk A. Kempthorne to postpone the Minerals Management Service's sale of leases in the Chukchi Sea off Alaska for a year until the Fish and Wildlife Service (FWS) decides whether to list the polar bear as an endangered species. Otherwise, Markey threatened, he would introduce legislation to compel the administration of President George W. Bush to do just that.

Markey's remarks came during a hearing on possible Arctic offshore oil development impacts on polar bears by the House Select Committee on Energy Independence and Global Warming, which he chairs. He called it after FWS

said on Jan. 7 that it would not announce its decision until after the Feb. 6 lease sale. FWS said the delay was necessary because the agency reopened and extended the comment period after US Geological Survey scientists submitted new studies and data in September.

FWS Director H. Dale Hall testified that oil and gas development would not threaten polar bears but said a delay was needed to fully review the thousands of comments received.

Ranking Minority Member F. James Sensenbrunner (R-Wis.) said the polar bear already is protected under the Marine Mammal Protection Act.

Inslee said it would not be possible for MMS to withdraw leases or modify terms if the bear goes on the endangered species list after the sale and expressed concern over the lease sale's environmental impact statement, which said there was a 31-53% chance of a 1,000 bbl oil spill if leasing takes place in the Chukchi Sea.

MMS Alaska Regional Director John Gall said the agency expects no significant spills within the sale area, saying the last spill from an oil platform was in 1980. "We've been very successful in preventing oil spills since them."

MMS Director Randall Luthi said the agency requires lessees to supply detailed information about mitigation and monitoring programs for protected species before any drilling begins. Leaseholders also must obtain permits from the Environmental Protection Agency and other regulators and ensure that their plans are consistent with the Alaska coastal zone management program, he added.

"The MMS also has a robust regulatory system designed to prevent accidents and oil spills from occurring. This includes redundant well control equipment, emergency plans for ice conditions, production safety systems, and much more. In Alaska, an MMS inspector is onboard drilling rigs 24 hours a day, 7 days a week during critical drilling operations," Luthi said in his written statement.

Steven Amstrup, who leads the polar bear team at USGS, said he expects negative impacts on the animal from sea ice destruction to continue but that more research is needed. Others noted that the polar ice cap is melting more quickly than originally estimated and has shrunk by 20% since the 1970s.

The Center for Biological Diversity submitted the original petition to list the polar bear as endangered in 2005. A panel of witnesses said the decision has been repeatedly delayed despite an increasingly obvious threat to polar bears from global warming in general and oil and gas development in particular. ✦

CERA-IHS: Global oil field decline rate at 4.5%/year

The aggregate global decline rate for producing oil fields is 4.5%/year rather than the 8%/year sometimes cited in other studies, said Cambridge Energy Research Associates (CERA) and IHS Inc. in a report entitled "Finding the Critical Numbers."

The CERA-IHS analysis was based on production characteristics of 811 oil fields that account for about two thirds of current global production and half of the total estimated proved and probable conventional oil reserves base. The report was released Jan. 17.

Annual field decline rates are not increasing with time, said Peter M. Jackson, CERA oil industry activity director and report author. This finding "provides the basis for more confidence about the future availability of oil," he said.

"Decline rates are a function of reservoir physics and investment strategies," Jackson said. "There is a general historical trend toward lower decline rates in recent years, which may be due to better reservoir management practices and the impact of new technology. In addition, because reservoir physics is only one of the key drivers, we would not expect to see a very rapid change in average decline rates in the future without a step change in technology or field development strategies."

Field life cycles

CERA analyzed oil fields during the production build-up, plateau, and decline stages. Its findings include:

- Only 41% of production is from fields in the database that are beyond the plateau stage and into the decline phase of their production lives.
- Annual field decline rates are not increasing. As a result of increased investment, improved planning, and technology, production can be maintained at low decline rates in many fields for prolonged periods. Field life is often longer than originally forecast.
- Individual offshore fields are declining at a 10%/year rate compared with 6%/year for onshore fields. Deepwater fields decline at 18%/year compared with 10%/year for shallow-water fields. Offshore fields held by producers outside the Organization of Petroleum Exporting Countries decline 5%/year compared with 12%/year for offshore fields belonging to OPEC members.

CERA said the study reinforced its global liquids capacity model showing that liquids capacity of about 91 million b/d in 2007 could climb to 112 million b/d by 2017.

"This outlook is supported by a key conclusion of this study: There is no evidence that oil field decline rates will increase suddenly," Jackson said. "It is important, though, to continue to research and understand evolving decline trends." ✦

EIA gas projections to 2030 identify market changes

This energy outlook for natural gas to 2030 was developed by the US Energy Information Administration and focuses on a short-term reference case, Annual Energy Outlook 2008 (AEO2008), which it compares with the Annual Energy Outlook 2007 (AEO2007) reference case.

This early release version does not include consideration of HR 6, the Energy Independence and Security Act of 2007, that was signed into law on Dec. 19, 2007. EIA said a revised reference case, to be released later, will include the impacts of HR 6.

Meanwhile, this reference case assumes that current policies affecting the energy sector remain unchanged throughout the projection period. Policy changes—such as the adoption of policies to reduce greenhouse gas emissions—could change the projections.

While some current laws and regulations will change, and new ones will be created over the next 25 years, no one knows the specifics of what they will be or when they will be enacted. Consequently, this reference case provides a basis against which the impacts of new proposed policies and regulations can be compared.

Trends in energy supply and demand are affected by difficult-to-predict factors: energy prices, US and worldwide economic growth, advances in technologies, and future public policy decisions in the US and in other countries.

Energy markets are changing in response to factors such as the higher energy prices experienced since about 2000, the greater influence of developing countries on worldwide energy requirements, recently enacted legislation and regulations in the US, and changing public perceptions on issues related to the use of alternative fuels, emissions of air pollutants and greenhouse gases, and the acceptability of various energy technologies, among others. The AEO2008 reference case makes several important changes from earlier AEOs to better reflect trends that are expected to persist in the economy and energy markets. The projection for US economic growth, a key determinant of US energy demand, has been lowered, reflecting an updated projection of productivity improvement. Key energy market changes EIA analysts have identified include:

- Higher oil and gas prices.
- Higher delivered energy prices, reflecting both higher wellhead prices and transportation and distribution costs.
- Slower projected growth in energy demand, especially for gas.

• Faster projected growth in the use of (nonhydroelectric) renewable energy forms.

• Higher domestic oil production in the near term.

• Slower projected growth in gas imports.

• Slower projected growth in energy-related emissions of carbon dioxide.

These important adjustments, however, have limited implications for some parts of the overall energy outlook, and US energy consumption will continue to be met predominantly by traditional fossil fuels, with coal, liquid fuel (excluding biofuels included in liquids), and natural gas meeting 83% of total US primary energy supply requirements in 2030—down only slightly from an 85% share in 2006 despite higher energy prices, lower total energy demand, and increased use of renewable energy compared with AEO2007.

Economic growth

The AEO2008 reference case reflects reduced expectations for economic growth. US gross domestic product increases at an average rate of 2.6%/year during 2006-30, about 0.3 percentage points slower than the rate in the AEO2007 reference case over the same period.

The price of natural gas is higher in the AEO2008 reference case. The real wellhead price of natural gas (in 2006 dollars) declines from current levels through 2017, as new supplies enter the market. After 2017, real natural gas prices rise to $6.60/Mcf ($10.40/Mcf in nominal dollars) in 2030. The higher prices in the AEO2008 reference case reflect an increase in production costs. Higher natural gas prices will be supported by higher oil prices.

Energy consumption

In 2030, the levels of consumption projected for gas is lower in the AEO2008 reference case. Among the more important factors resulting in lower total energy demand will be lower economic growth, higher energy prices, greater use of more-efficient appliances, and slower growth in energy-intensive industries.

Higher delivered energy prices and slower growth in commercial square footage will lead to slower growth in commercial energy consumption. Delivered commercial energy consumption will rise 11.5 quadrillion btu (quads) in 2030 from 8.4 quads in 2006, but almost 1 quad less than in AEO2007.

Since 1997, delivered energy consumption in the US industrial sector has trended downward, falling from about 27 quads in 1997 to 25 quads in 2006. Factors implicit in reducing industrial

WATCHING GOVERNMENT

Nick Snow, Washington Editor

US trade groups expand reach

US oil and gas trade associations may seem to have their hands full with domestic issues. But they're still expanding their reach overseas, several of their Washington executives revealed last month.

"At our members' direction, we deal with only a piece of the overall pie. We work with the federal government to increase opportunities to show the flag in parts of the world where resources are an important issue," American Petroleum Institute Pres. Red Cavaney said.

He was particularly pleased that the administration of President George W. Bush had appointed an assistant secretary of state with a background in energy. API regularly participates in background briefings there, and works with other oil and gas groups to promote transparency and oppose unilateral sanctions, Cavaney said.

"We also see increasing interest globally in the manpower issue. It transcends borders," he said.

API had just opened its first international office when I spoke to Cavaney. Beyond advocacy, the Beijing office's focus is to develop standards and other special programs, he said. "We now have more certification customers in China than in the United States," Cavaney noted.

Law of the Sea treaty

Other associations would like to see the Senate ratify US participation in the Law of the Sea Treaty. "We're a long-time supporter. Nearly everyone seems to like it, although one group has objected because of sovereignty issues it sees," said National Ocean Industries Association Pres. Tom Fry.

"It's been reported out of committee four times now, but there's a virulent right-wing machine that opposes it. We support it because it would significantly extend Outer Continental Shelf jurisdiction for the United States and, inherently, its oil and gas authority," said Brian T. Petty, senior vice-president, government affairs, for the International Association of Drilling Contractors.

Petty said he did not expect a bill to reach the Senate floor until after February's presidential primaries, but added that time could be of the essence.

"Other countries which have acceded to the treaty already are staking their claims. We're not even at the table. It's all about oil and gas. Some of the first decisions are going to be made in mid-2009," Petty said.

Other overseas issues

IADC also is pushing for a worldwide offshore regulatory model and adoption of uniform standards and practices. Its members, as well as producers they work for, have encountered access and regulatory problems overseas similar to what they have experienced domestically, particularly in countries that are members of the European Union, according to Petty.

IADC is the only US oil and gas association that has observer status on the International Seabed Authority, which was created by the United Nations' Law of the Sea convention.

"It's because we're an international association, and it puts us ahead of the US government," Petty said. ✦

energy consumption include economic weakness during 2000-03, the hurricanes of 2005 that reduced activity in some subsectors, and rising energy prices.

Total industrial energy consumption in AEO2008 will include strong growth in nontraditional fuels, such as coal-to-liquids and biofuels.

Gas consumption in the AEO2008 reference case is projected sharply lower than in AEO2007 as gas consumption increases to 24.3 tcf in 2016 from 21.8 tcf in 2006, then declines to 23.4 tcf in 2030. Consumption is lower in all areas, particularly in industrial and electric power.

Industrial gas use is 1.3 tcf lower in 2030 in the AEO2008 reference case (8.5 tcf compared with 9.8 tcf in the AEO2007 reference case) because of higher delivered natural gas prices, lower economic growth, and a reassessment of gas use in energy-intensive industries. In 2030, electricity generation accounts for 5.1 tcf of gas use, compared with 5.9 tcf in the AEO2007 prognosis. The lower level of consumption in AEO2008 results from higher gas prices and slower growth in electricity demand.

Electricity generation

In AEO2008, electricity generation from gas-fired power plants is seen increasing sharply to 2007 from 2006 then remaining relatively flat for the next 5 years, before rising slowly through 2016.

The gas share of electricity generation remains 20-21% through 2018, before falling to 14% in 2030. Given the assumed continuation of current energy and environmental policies in the reference case, carbon capture and sequestration (CCS) technology does not come into use during the projection period.

Total electricity generation from nuclear power plants will grow to 949 billion kw-hr in 2030 from 787 billion kw-hr in 2006 in the AEO2008 case, accounting for about 17% of total generation in 2030.

The use of renewable technologies

for electricity generation also is stimulated by improved technology, higher fossil fuel prices, and extension of the tax credits in EPACT 2005 legislation.

Gas production, imports

Total domestic gas production, including supplemental gas supplies, will increase to 20.2 tcf in 2021 from 18.6 tcf in 2006 before declining to 19.9 tcf in 2030, EIA predicts. The projections are lower, primarily because of the higher costs associated with exploration and development and, in the last decade of the projection, lower gas demand.

In the AEO2008 case, Lower 48 offshore gas production shows a pattern similar to that in the AEO2007 case, growing to a peak of 4.5 tcf in 2019 from 3 tcf in 2006 as new resources come online in the Gulf of Mexico. Beyond 2019, Lower 48 offshore production will decline to 3.5 tcf in 2030. After a small, near-term increase, onshore conventional gas production will decline steadily, as it did previously.

Onshore production of unconventional gas is expected to be a major contributor to growth in US supply, increasing to 9.5 tcf in 2030 from 8.5 tcf in 2006. As in AEO2007, most of the increase in unconventional production is projected to come from gas shale, which more than doubles over the projection, to 2.3 tcf in 2030 from 1 tcf in 2006.

The Alaska gas pipeline is expected to be completed in 2020, 2 years later than in the AEO2007 reference case because of delays in the resolution of issues between Alaska's state government and industry participants.

After the pipeline goes into operation, Alaska's total gas production in the new reference case increases to 2 tcf in 2021 (from 0.4 tcf in 2006) and then to 2.4 tcf in 2030 as the result of a subsequent expansion. The pipeline connecting the MacKenzie Delta in Canada to the US is not constructed in the AEO2008 reference case, unlike in AEO2007, because cost estimates recently filed by the industry substantially exceed the estimates included in AEO2007, and the project is not economical with AEO2008 reference case prices.

Net pipeline imports of gas from Canada and Mexico, predominantly from Canada, fall to 0.5 tcf in 2030 from 2.9 tcf in 2006 (compared with 0.9 tcf in AEO2007). The difference between the projections for 2030 is largely a result of increased exports to Mexico.

The higher level of exports to Mexico will result from a lower assumed growth rate for Mexico's gas production than in AEO2007. Net imports from Canada also decline, reflecting resource depletion in Alberta and Canada's growing domestic demand, which are offset somewhat by increases in unconventional gas production from coal seams and tight formations.

Total net LNG imports to the US will increase to 2.9 tcf in 2030 from 0.5 tcf in 2006, compared with 4.5 tcf in 2030. The lower projection is attributable to higher costs throughout the LNG industry, especially in liquefaction, and decreased US gas consumption due to higher gas prices, slower economic growth, and expected greater competition for supplies within the global LNG market.

US LNG regasification capacity will increase to 5.2 tcf in 2009 from 1.5 tcf in 2006, with the addition of five new regasification facilities that currently are under construction (four along the Gulf Coast and one off the coast of New England). Given global LNG supply constraints, overall capacity utilization at US LNG import facilities is expected to remain under 35% through 2013, after which it is expected to increase to 57% in 2017 and remain in the range of 55-58% through 2030.

One of the key uncertainties in the AEO2008 reference case is the future direction of the global LNG market. With many new international players entering LNG markets, competition for the available supply is strong, and supplies available to the US may vary greatly year-to-year. The AEO2008 case has been updated to reflect current market dynamics, which could change considerably as worldwide LNG markets evolve.

Energy intensity

Energy intensity, measured as energy use in 1,000 btu/dollar of GDP (in 2000 dollars), is projected to decline at an average annual rate of 1.6% during 2006-30. Although energy use generally increases as the economy grows, continuing improvement in the energy efficiency of the US economy and a shift to less energy-intensive activities are projected to keep the rate of energy consumption growth lower than the rate of GDP growth.

Population influences demand for travel, housing, consumer goods, and services. Since 1990, population has increased by about 20% and energy consumption by a comparable18% in the US, with annual variations in energy use per capita resulting from variations in weather and economic factors.

The age, income, and geographic distribution of population affect energy consumption growth. The aging of the population, a gradual shift from the North to the South, and rising per-capita income will influence future trends. Overall, population in the reference case increases by 22% to 2030 over 2006.

Over the same period, energy consumption will increase by 24%. The result is an increase in energy consumption per capita at an annual rate of 0.1%/year during 2006-30—slightly slower than in the AEO2007 reference case. ✦

PERSONNEL MOVES AND PROMOTIONS

Oxy names Chazen president, chief financial officer

Occidental Petroleum Corp. has elected **Stephen I. Chazen** president and chief financial officer.

Chazen joined Oxy in 1994 as executive vice-president, corporate development. He was named chief financial officer in 1999.

Prior to joining Oxy, Chazen was a managing director in the investment banking group of Merrill Lynch & Co.

Upstream moves

Linn Energy LLC, Houston, appointed **Mark E. Ellis** president, succeeding **Michael C. Linn**. Ellis is also chief operating officer.

Linn will continue as chairman and chief executive officer.

Ellis, a 28-year veteran of the North American oil and gas industry, joined Linn Energy in 2006 as executive vice-president and chief operating officer. Before that he was senior vice-president of North American production for Burlington Resources Inc. and president of Burlington Canada Ltd.

Falcon Oil & Gas Ltd. appointed **Rod Wallis** chief operating officer. The company also announced **James Edwards** was named to a new position as senior vice-president, special projects.

Having been in the oil and gas industry for 22 years, Wallis has worked for Falcon since September 2007. Before that, he was senior exploration geologist for PetroHunter Energy Corp.

Falcon is a British Columbia oil and gas company having operations in Hungary through its wholly owned subsidiary TXM Oil & Gas Exploration LLC and in Romania through its wholly owned subsidiary JVX Energy Corp.

Circle Oil PLC has appointed **Adrian Burrows** and **Stuart Harker** as vice-presidents of geophysics and geology, respectively.

Burrows is a geophysicist with 27 years experience with major operators, including 8 years as chief geophysicist in international offices in Madagascar, the Netherlands, and Argentina, and later 7 years as a consultant in Aberdeen.

Harker is a petroleum geologist with cross disciplinary abilities and 31 years experience in exploration, development, well site operations, and project management with major oil companies.

Nuenco NL has appointed **Donald**

COMPANY NEWS

ConocoPhillips approves $14.3 billion capital budget

Oil and gas companies continue to report their capital spending plans for 2008. Some of the latest include:

• ConocoPhillips approved a 2008 capital budget of $14.3 billion, including cash capital expenditures and capitalized interest.

• Talisman Energy Inc. plans to spend $4.4 billion on exploration and development in 2008, down from an estimated $4.6 billion in 2007.

• Encore Acquisition Co. plans a $445 million capital budget for its 2008 drilling and development program compared with a $370 million drilling and development budget for 2007.

• TXCO Resources Inc. approved a $100-110 million capital expenditure budget and drilling program for 2008 compared with a $72.4 million budget for 2007.

In other recent company news:

• Gaz de France and Qatar Petroleum International signed a partnership agreement in Doha that lays out the development of cooperation between the two groups at an international level in exploration, production, LNG, gas storage, and downstream activities.

ConocoPhillips

ConocoPhillips's 2008 budget compares with a $12.3 billion for 2007, including $500,000 of capitalized interest.

Loans to affiliates and contributions to fund a heavy oil joint venture with EnCana Corp. added another $1 billion, bringing the total authorized 2008 capital program to $15.3 billion.

The exploration and production budget is expected to be $12 billion, including capitalized interest and loans to affiliates and contributions to the upstream venture with EnCana. Another $2.8 billion was allocated for refining and marketing.

Talisman

Talisman forecast 2008 production will average at least 435,000 boe/d. Production could be higher depending upon the completion of commissioning of Tweedsmuir oil field in the North Sea. Commissioning is under way.

Talisman said its 2008 budget involves more investment in Southeast Asia and Norway while it plans to reduce spending on UK development projects, reflecting the completion of a number of projects in 2007.

The company also plans to reduce

Boyd to the position of petroleum engineer. Boyd will be based at the company's Ohai, Calif., office, effective Feb. 21.

Boyd is a senior petroleum engineer with more than 40 years of experience in the US oil and gas industry. Previously he was manager of operations for drilling and completion of the US Department of the Interior's branch of oil and gas. He also served as a drilling manager in California and as a consultant for drilling projects and inline field engineering work to various companies, including Pan American Oil, Texaco Inc., and Exxon Corp.

Downstream moves

The National Petrochemical & Refiners Association has elected Executive Vice-Pres. **Charles T. Drevna** as the association's president.

Drevna has more than 35 years of technical, business, and public policy management experience in the refining, petrochemical, and coal industries. Prior to joining NPRA in May 2002, he served as director, state and federal government affairs for Tosco Corp. Previously, Drevna held a variety of government affairs and public policy positions with Sun Co. (now Sunoco) and its affiliates, including as vice-president of public affairs for Sun Coal Co.

Port Allen, La.-based Placid Refining Co. has promoted **Keith Passman** to general manager of the privately owned company's Port Allen refinery and **Joey Hagmann** to refinery manager.

Passman

Passman has served in several positions since joining Placid in 1978. Prior to this latest promotion, Passman served as director of planning and economics. Hagmann has worked in the oil industry for 29 years and has been with Placid for almost 11 years. Hagmann served as Placid's manager of engineering prior to this promotion. Passman and Hagmann will oversee the refinery's ongoing $300 million expansion that will result in increasing by 50% the facility's 55,100 b/cd refining capacity.

Hagmann

Holly Corp., Dallas, reported that **Gary B. Fuller** has joined the company as senior vice-president, refinery operations. Fuller joins Holly after a 26-year career with Placid Refining Co., where he held a number of managerial positions, including engineering manager, refining manager, and most recently, vice-president and general manager.

WATCHING THE WORLD

Eric Watkins, Senior Correspondent

Bearing up in the Arctic

The US Minerals Management Service has begun an evaluation of the environmental issues associated with future federal Outer Continental Shelf lease sales for oil and gas exploration in the Beaufort and Chukchi seas off Alaska.

That will really upset environmentalists around the world.

Ahead of any protests, MMS said it will prepare an environmental impact statement focusing on the potential environmental effects of the sales from exploration, development, and production of the area proposed for leasing.

The area to be evaluated for Beaufort Sea Sales 209 and 217, slated for 2009 and 2011 respectively, encompasses 33 million acres, 3 to 205 statute miles off Alaska's northern coast.

The area for sales proposed for the Chukchi Sea, Sales 212 and Sale 221 slated for 2010 and 2012 respectively, cover 40 million acres 25 to 275 miles off the coast.

Impacts anticipated?

"MMS will continue to work closely with the state of Alaska and local communities throughout the EIS process to ensure the document evaluates the potential impacts of the proposed sales," said MMS Alaska OCS Regional Director John Goll.

One of those impacts concerns wildlife, as the Chukchi Sea is home to one of two US polar bear populations.

"The chances for the continued survival of this icon of the Arctic will be greatly diminished if its last remaining critical habitat is turned into a vast oil and gas field," said Margaret Williams, managing director of World Wildlife Fund's Kamchatka and Bering Sea Program.

The directors of two Department of the Interior agencies said they were "confident" oil and gas exploration in the Chukchi Sea can proceed without threatening polar bears.

The officials appeared before a Congressional committee on global warming that is examining why the department is postponing a decision on whether to further protect polar bears even as it is proceeding with the oil lease sales in the Alaska Sea.

Proceed with caution

Other people took issue with their confident views.

If oil and gas development is allowed, said Rep. Edward Markey, the congressional committee chairman, "we will be accelerating the day when the polar bear will be extinct."

Steven Amstrup, a polar bear expert for the US Geological Survey, DOI's science arm, said if there is an oil spill, the impact on bears would be grave.

"The polar bears do not do well when they get into oil," Amstrup told the committee. If bears in the wild get in contact with oil it's likely to be fatal, he said.

We will not speculate here how the bears will fare in the debate. It is perhaps enough to note that a protest has been registered and that it will begin to resound around the world.

Who, after all, could imagine a world without snowy white polar bears? Very clearly, international oil companies will have to proceed with caution on this issue. ✦

spending in the US and Canada because of uncertainty in natural gas prices. But the US and Canada still will account for more than one third of total spending, Talisman said.

Encore Acquisition

This year Encore Acquisition plans to spend $347 million on drilling, $67 million on improved oil recovery and workovers, and $31 million on land, seismic, and other expenses.

The company, based in Fort Worth, plans to spend $164 million in the Rockies, $140 million in West Texas, $102 million in the Midcontinent, and $39 million in its New Mexico region.

Jon S. Brumley, EnCore Acquisition president and chief executive officer, said the 2008 budget represents lower risk than did the 2007 budget because the company has refined its focus on long-life oil field enhancement.

TXCO Resources

Formerly known as Exploration Co., TXCO of San Antonio noted that the budget could be revised based on drilling changes by partners, rig availability, drilling results, unanticipated transactions, and market fluctuations.

The Glen Rose formation, including the Maverick basin's prolific Porosity oil play, is slated to receive the largest share of the budget—about $40.7 million for 35 wells, including 10 reentries.

Texas Fort Trinidad field in East Texas is slated for $12.5 million for 10 wells targeting TXCO's Glen Rose B shoal gas play.

GDF, QPI deal

As the leading LNG importer in Europe, GDF is keen to enhance its presence in Qatar and develop cooperation "with the world's top LNG exporter," while Qatar wants to develop its access to different markets, particularly by investing in regasification terminals and gas storage sites.

With the forthcoming merger of GDF and Suez, Qatar will have access to a group that is among the leading LNG operators worldwide and, therefore, on a large number of markets. ✦

Trend surface residual anomaly mapping and well data may be underutilized combo

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Trend surface residual anomaly (TSRA) mapping techniques have been applied to three regions (Fig. 1) to demonstrate their use in the identification of blind structures and trends in areas with substantial well data and limited seismic data.

TSRA mapping is a fast, simple, and inexpensive technique that is capable of detecting individual faults, fault-related structures, structural trends, reef complexes, and sole horizons. It is commonly difficult to delineate these features in a standard structure contour map because they are masked by regional dip. Blind thrusts, decollements, and reefs are challenging to identify and delineate because of the inherent lack of surface information.

Typical exploration involves correlating available seismic and well data in conjunction with potential field and lineament data, but extrapolating trends or structures usually involves gathering more data or drilling. Decollements are especially difficult to identify in seismic and borehole data because the fault surface is parallel to bedding without marker offsets. Only when a decollement ramps up-section or splays can it be more easily identified, yet the associated structures will be localized and decrease up-section.[1-4]

Trend surface analysis is a traditional technique that has long been used by geologists for the analysis of geological data,[5,6] approximation of regional dip,[7-9] and general subsurface exploration.[9] The technique represents a methodology for approximating observed data, and serves as a graphical representation of the regression surface.

Trend surface and TSRA mapping have long been used in potential field mapping and modeling, but application of this technique to well data is uncommon. Well data are customarily presented as structure contour and isopach maps, along with well-to-well correlations.

In essentially flat-lying stratigraphy, low-amplitude targets may be impossible to properly identify using standard maps.[3] TSRA mapping, however, has been shown to detect or delineate individual fault(s), structures, structural trends, reef structures, and sole horizon(s).[3,4,9]

Trend surface analysis may also be incorrectly associated with surface fitting because of the shared methodology. Surface fitting is an attempt to ultimately mimic the observed data as best as possible. In this approach, residual values are assumed to represent undesirable errors or noise[10] and are filtered out. This article, however, uses trend surface analysis to enhance and utilize residual data.

Methodology

Trend surfaces are made by fitting a generated surface to the structure contour data using a regression matrix.[9] TSRA values are derived by subtracting the generated data (trend surface data) from the observed data (structure contour data).

First- and second-order residuals are commonly used in areas with small horizontal extent and horizontal stratigraphy or in larger areas with limited data. Third-order or higher residuals are usually used in regional mapping.

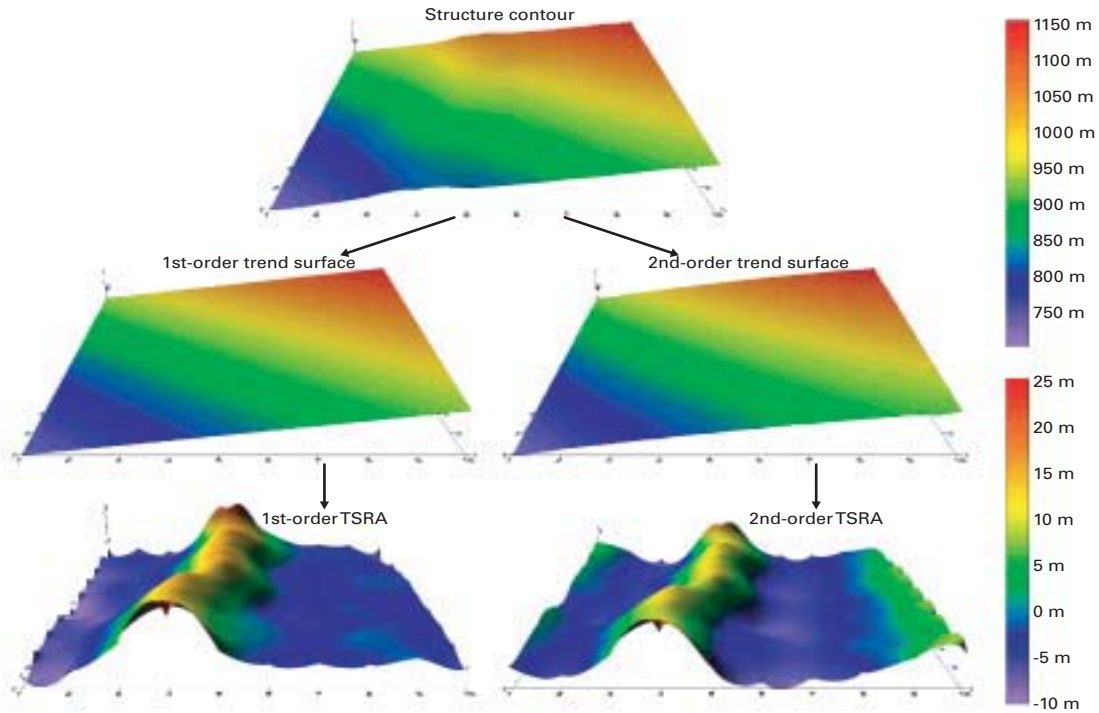
The order of the trend surface is mainly depen-

MAPPING CASE STUDY AREAS Fig. 1

Source:

BASIC TREND SURFACE RESIDUAL ANOMALY MAP FLOW CHART

Fig. 2



Notice the decreased residual values on the inferred anticlinal structure and the increase in edge effects in the 2nd-order TSRA map. Known data would help determine which order of TSRA would be more applicable.

Source: From Evenick, in press.

dent on correlations of known fault displacements or reef thicknesses with the residual anomaly values, but also to the amount of data and data spacing. In general, the less data or data coverage will require a lower order trend surface because higher-order trend surfaces will increase the amount of edge effects and contouring errors (Fig. 2).

Statistical tests may not be appropriate guides for the selection of degree of the residual anomalies because the targets are ultimately qualitatively chosen based on geologic correlations and not by "goodness of fit."[9 11] TSRA values below known displacements or thicknesses are undesirable and may negate the resulting map. A lower-order trend surface should be utilized until the generated values are slightly above observed or estimated fault displacements or reef thicknesses.

For example, a fault with 10 m of offset, identified in a geophysical well log, should ideally match the TSRA value or be slightly larger than the measured displacement. Therefore, if a TSRA value derived from a first-order trend surface was 12 m, then the map would be acceptable. If a second-order TSRA value was calculated to be 7 m, the map should be disregarded because the TSRA value was less than known fault displacement. Ideally multiple observed values should be used to tie the residual values and observed data.

This illustrates the subjective and iterative nature of TSRA mapping. However, statistical tests and knowledge of the regional geology can help minimize misinterpretations. After a TSRA map has been generated, it may be possible to identify potential structures or trends, but further in-depth well log correlations and seismic reflection data can then be used to define the detailed characteristics and possible origin of the feature.

It is also possible to create TSRA maps by creating synthetic datasets from digitizing paper structure contour maps. TSRA mapping does not have the ability to extrapolate or identify structures in areas with poor well coverage or in large data gaps.[9] Trends in these areas may be spatially-aliased edge effects or contouring artifacts (Fig. 3).[4]

TSRA maps, therefore, may be of limited use in exploratory areas with little well data. The implementation of this technique in mature basins or fields with large amounts of well data, however, could identify unknown or better delineate known petroleum traps that may below seismic resolution.

Case studies

Three case studies are presented that illustrate the varied uses of TSRA mapping in the Appalachian and Alberta basins.

Each region has a different tectonic setting and targeted geological feature, but they are approached using the same methodology. The order of the trend surfaces was based on known and estimated fault displacements or reef thicknesses. All interpretations were based on the understanding of the regional geology and stratigraphic architecture.

The targeted features were the Rome trough in the southern Appalachian basin, the Chautauqua anticline and a decollement in the northern Appalachian basin, and Devonian reef complexes in the Alberta basin.

Chautauqua anticline

The Chautauqua anticline (also known as the Bass Islands structural trend) in western New York is associated with small-displacement thrust faults splaying off the termination of a blind decollement soled in Silurian Salina

Group salts.[2 3 12 13]

The anticline has been extensively drilled for hydrocarbons for over 30 years and therefore serves as an ideal case study. It is difficult to delineate the structure using standard structure contour maps, but it is clearly identifiable in a TSRA map (Fig. 4). This open anticline has a limited surface expression[3 14] but tightens down-section.

The horizons chosen to illustrate this structure were the Dunkirk shale (Upper Devonian), Onondaga limestone (Middle Devonian), and Medina formation (Lower Silurian). Each horizon is separated by 1,000 ft (Fig. 5). The upper two horizons are above the decollement and delineate the Chautauqua anticline along with other structures.

The northwestern shift in the anticlines signature on the TSRA maps from the Onondaga limestone to the Dunkirk shale denotes the structure has a northwest vergence. In the Medina formation TSRA map the Chautauqua anticline is no long identifiable because the horizon is situated below the detachment. Hence, to bracket or validate the sole of a decollement, one must generate maps above and below the sole horizon in order to properly identify the changing deformational patterns.

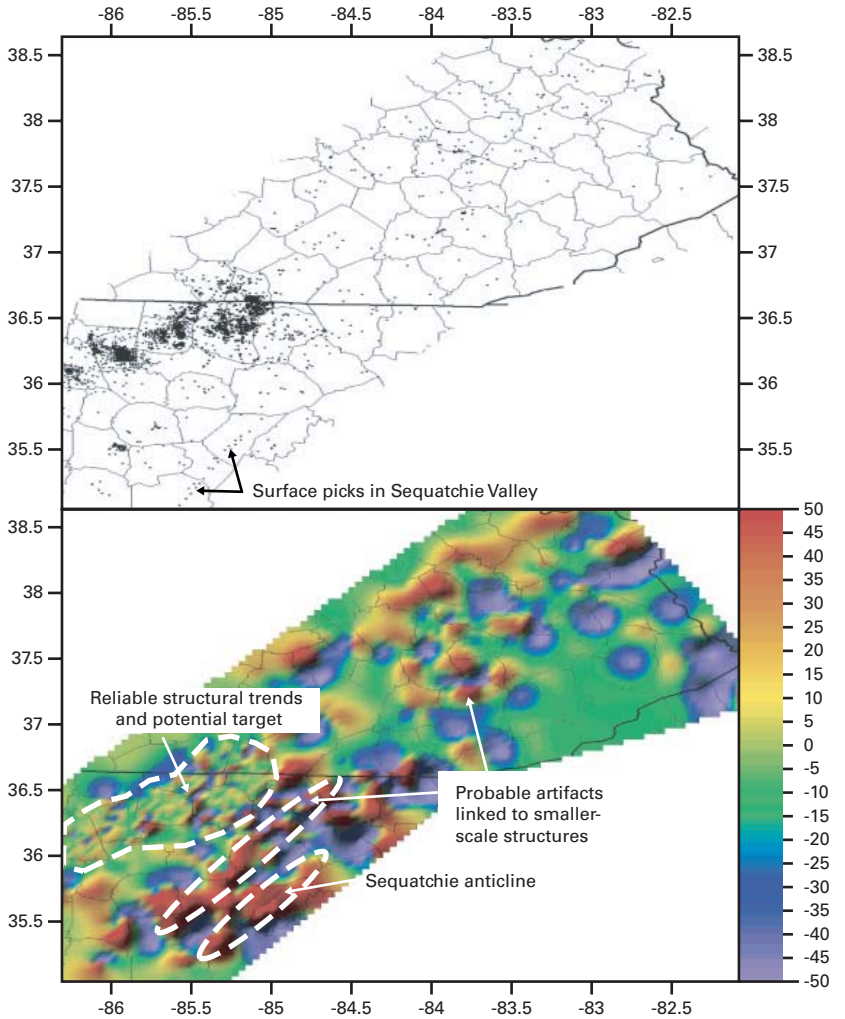
Other structures are also revealed in the TSRA maps. Notice that the Lakeshore anticline is still evident in the Medina formation TSRA map. The Medina formation is below the inferred master detachment, so this structure is probably associated with another unknown feature (i.e., a deeper decollement or basement structure).

Also, the NNW-SSE feature, increasingly evident in the lower horizons, is associated with the Dunkirk fault. It is interpreted as a reactivated basement fault.[3] The Sheridan anticline may also be related to the Dunkirk fault as they are parallel and the anticline is on the inferred hanging wall.

Rome trough

The Rome trough is a northeast-trending aulacogen related to Iapetian rifting during the Cambrian.

TSRA AND WELL LOCATION MAPS FOR TOP OF KNOX GROUP Fig. 3



In areas of good well coverage the small, but prominent linear high are related to known producing fields in Tennessee. In areas of increased data coverage, anomaly widths and amplitudes decrease indicating wide and isolated highs are probable artifacts.

In eastern Kentucky, the Rome trough (Fig. 6) is bounded on the west by the Lexington fault system, on the north by the Kentucky River fault system, and on the south by the Rockcastle River fault system.[15-17] The trough extends from New York to Tennessee but is poorly delineated near its distal ends due to limited data.[14 18]

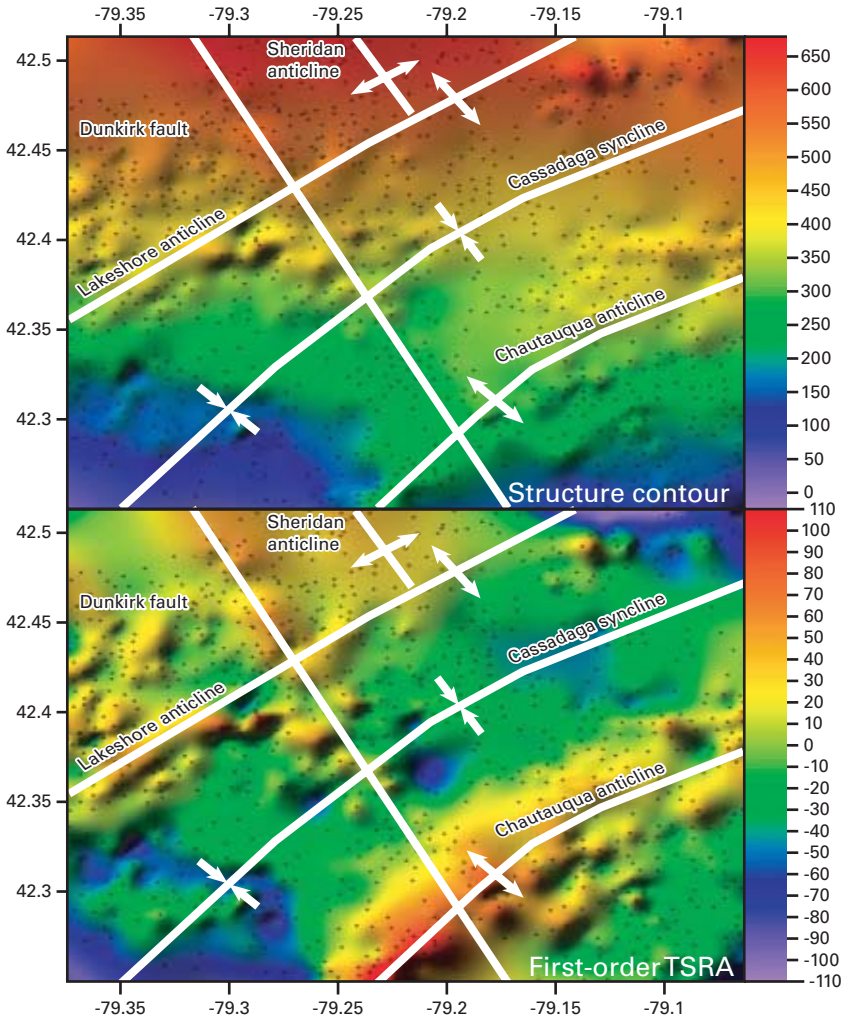
Sparse basement drilling and seismic reflection data in the region have hindered the delineation of the structure in Tennessee and Kentucky. Second-order TSRA values generated from well data were smaller than inferred fault displacements,[16 19 20] and therefore a first-order TSRA map was chosen to best delineate the rift system.

Ideally more data are needed to more accurately express the subsurface extent of the rift system. The basement structure contour map clearly shows the main segment of the Rome trough in eastern Kentucky; but the extent of the rift system is not obvious.

It is difficult to identify the Rockcastle River fault system, and the Floyd County channel is represented as a very large feature (due to regional dip masking the relatively small size of the feature). Even with a limited dataset and using a first-order TSRA map, the basement TSRA map can apparently identify all of the major rift systems and project

TSRA AND WELL LOCATION MAPS FOR TOP OF DUNKIRK SHALE

Fig. 4



The northeast-trending Chautauqua anticline was masked by the regional trend, but is prominently displayed in the residual anomaly map. Black circles represent data points.

the Rome trough into Tennessee.[4]

The Floyd County channel also is more pronounce and accurately depicted in TSRA map. Since the amount of data is sparse, the residual maps are ultimately not quantitative or correlatable with estimated fault displacements. Therefore, this map can only be used to generally illustrate fault system locations and provide relative displacement estimates.

Leduc reefs

The Alberta basin is a well known productive hydrocarbon basin. The main target horizons in the basin are the Lower Cretaceous section and the Upper Devonian carbonate reefs,[21] such as those in the Leduc formation (Fig. 7). Differential compaction of the overlying strata (i.e., the Ireton shale) over these reefs has created drape structures that become less evident in shallower horizons.[22-25]

A prominent southwestern regional dip and the localized nature of the differential compaction around the complexes make them difficult to identify and delineate in structure contour maps (Fig. 8). The reefs generally trend NNE and may be associated with basement topography or faults.[26] Prospective complexes can be identified by removing the prominent southwestern regional dip from shallower horizons[9] and correlating the TSRA values with the estimated amounts of differential compaction.

The first-order TSRA map reveals there is a regional anticlinal trend to the northwest superimposed on the prominent regional dip to the southwest. A second-order residual map proved to be more valuable because it notably delineates an anomalous trend that parallels known reefs and production.

The TSRA values also correlate well with differential compaction estimates and reef thicknesses. Note the dominant northeastern trending linear highs in both TSRA maps that may also be related to differential burial or isolated reefs.

It is important to emphasize the mapped horizon is above the reef complexes. This implies well data from nonprospective intervals are capable of yielding useful information about a potential target, and that sometimes is easier to identify a trend by scrutinizing linked surfaces.

Statistical testing

Trend surface statistical tests have been done by previous workers[10] to ascertain if particular contouring techniques were more dependable.

Most statistical tests focus on mean error, root mean squared error, and regression slope where a withheld data point is predicted using the remaining data. To produce more accurate results it is necessary to filter existing data because adding data is rarely an immediate option.

Data filtering usually includes deletion of outliner values and anomalous data that can not be validated. Mei[10] concluded that cross-validation was important, but statistics cannot distinctly indicate what contouring method is the most applicable.

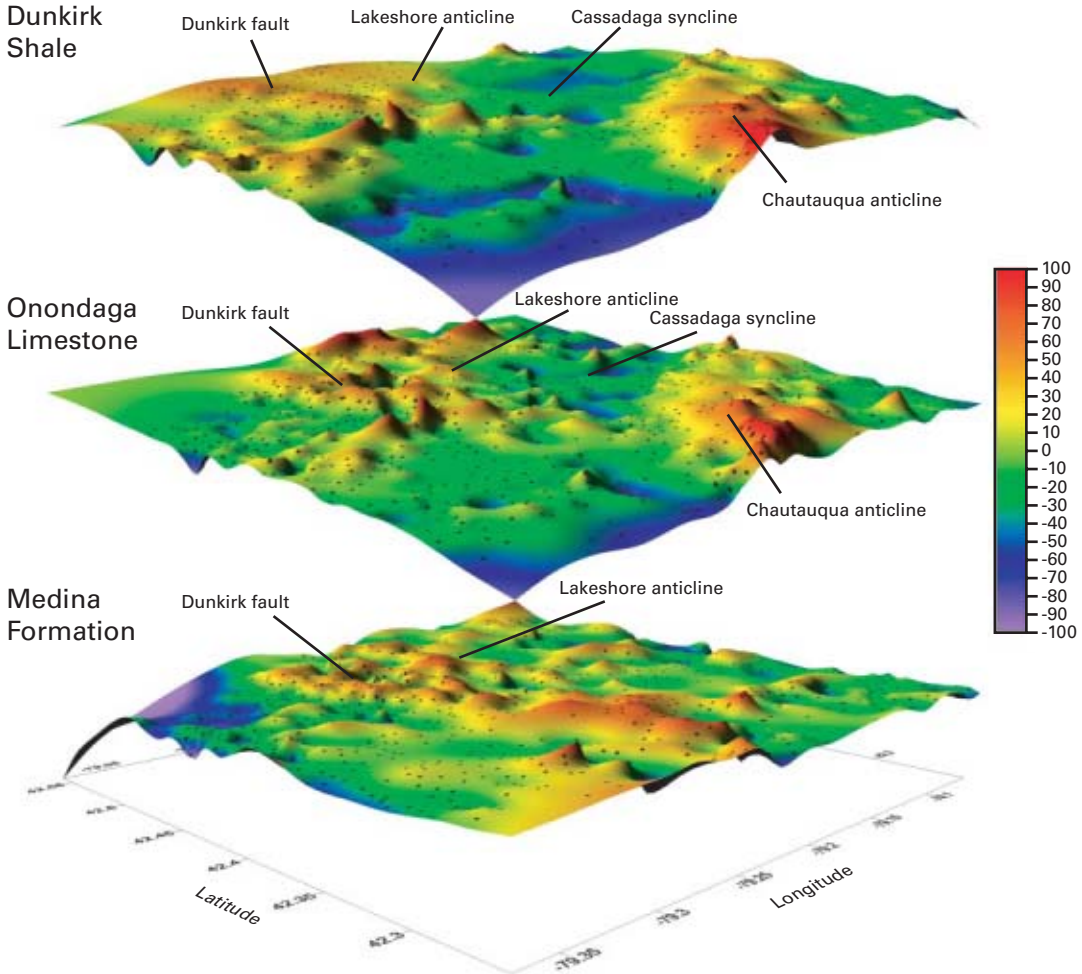
Standard trend surface analyses include goodness of fit, correlation coefficient, and overall variance.[9] These tests, however, yield numerical values that do not help validate a given trend

or map but will help determine if the generated map is reliable.

The problem still remains that the effective use of trend surfaces and residuals may not be a statistical problem, but rather dependent on interpreter's experience and toolkit (i.e., different types of contouring and trend surface algorithms), and dataset properties (i.e., amount of data, clustering, target size, boundary conditions, and numerous geologic factors). Further research into quantifiable tests of validity and geologic correlation is needed, but qualitative analysis should always be implemented whenever TSRA mapping is attempted.

TREND SURFACE RESIDUAL ANOMALY MAPS

Fig. 5



Note the northeastern-trending Chautauqua anticline is only evident in the top two horizons and not in the lowest. This distinction is to due to the sole of the decollement associated with the structure occurring between the horizons. Also note the prominence of the almost north-trending Dunkirk fault in the lower maps. Each horizon is separated by roughly 1,000 ft. Black circles represent data points.

Source: Modified from Evenick et al., 2005.

Acknowledgments

We thank Brandon Nuttall of the Kentucky Geological Survey and Elaine Foust of the Tennessee Division of Geology for help with their respective state well databases, and Shilong Mei of the Alberta Geological Survey for an earlier review of this manuscript. This project was funded by DOE grant DE-FC26-02NT15341 awarded to Robert D. Hatcher Jr. ✦

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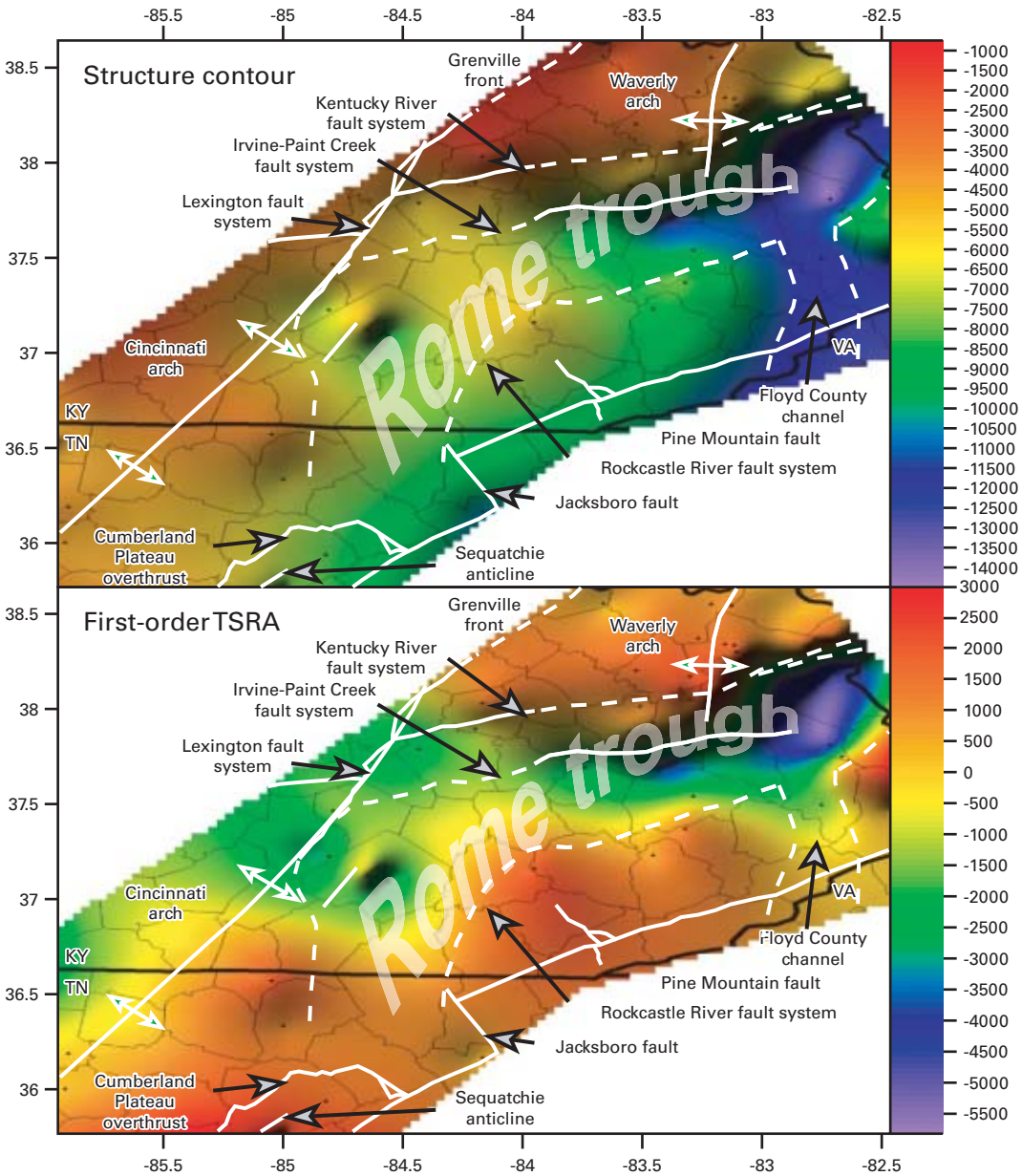
MAPS OF PRECAMBRIAN BASEMENT

Fig. 6



Note the good correlation of the TSRA map with regional surface (solid line) and subsurface (dashed line) structures. Also notice the better qualitative representation of the Rockcastle River fault system and Floyd County channel in the TSRA map as compared with the structure contour map. Black circles represent data points.

Source: Fault locations modified from Drahovzal and Noger, 1995.

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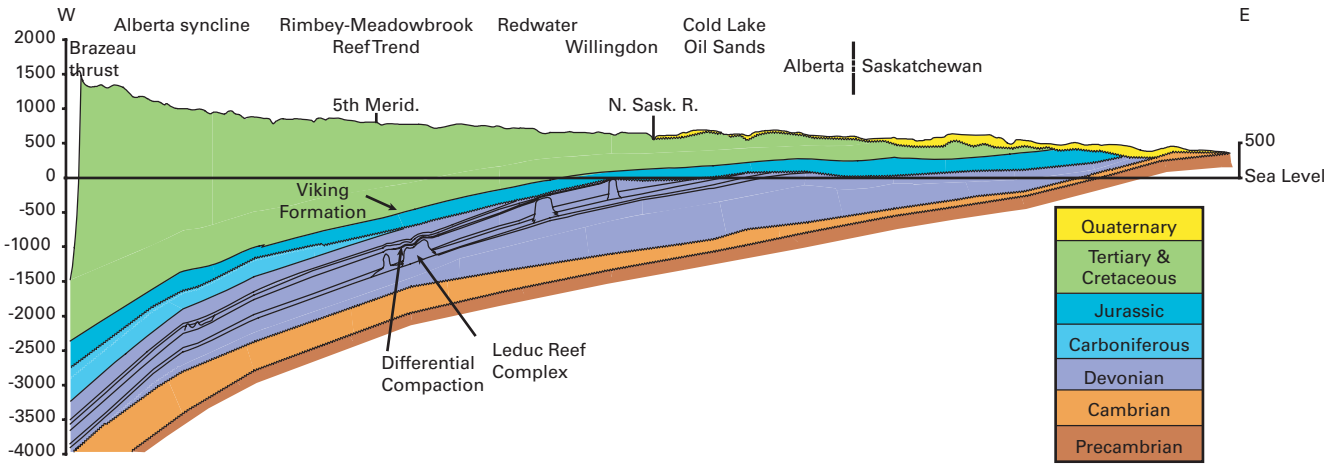
ALBERTA BASIN GENERALIZED CROSS SECTION SHOWING DIFFERENTIAL SHALE COMPACTION OVER A LEDUC REEF COMPLEX

Fig. 7



Source: Adapted from Wright et al., 1994.

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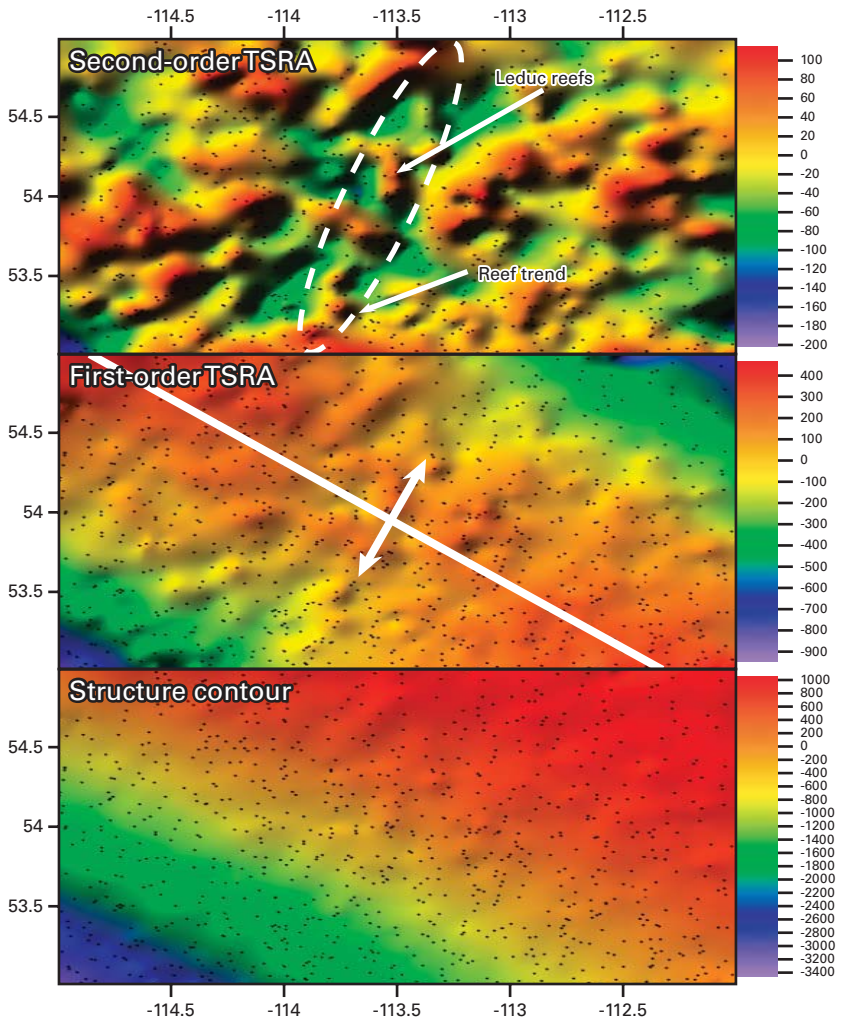
MAPS OF CRETACEOUS VIKING FM IN ALBERTA

Fig. 8



Differential compaction of the Ireton shale over the NNE-trending Leduc reefs has created drape structures that are identifiable in Viking formation maps (within the ellipse). The first-order trend reveals that there is a regional anticlinal trend to the northwest superimposed on the prominent regional dip to the southwest. Black circles represent data points.

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Romania

The Doina Sister well on the Midia Block in the Black Sea off Romania tested at stabilized rates up to 19.2 MMscfd in 4 hr from perforations at 1,139-68 m in the main Mio-Pliocene Doina reservoir, said operator Sterling Resources Ltd., Calgary.

After a 14-hr test at a fixed 16.5 MMscfd on a 48/64-in. choke with 1,160 psi stable wellhead flowing pressure, the well was shut-in for pressure buildup.

Equipment capacity constraints that limited the test rates also resulted in the decision not to perforate the lower 12-m net pay interval.

Sterling said, "Performance of the Doina Sister well during test indicates that it has superior reservoir qualities compared to the original Doina well, as expected from the electric open hole log data, and this will be quantified on recovery of the pressure gauges."

The well will be suspended for future reentry, the Prometeu jack up released, and a 2008 drilling program discussed.

Sweden

The Swedish Mining Inspector granted an application by Tethys Oil AB, Stockholm, to explore a 133,400-acre license on northern Gotland Island in the Baltic Sea south of Stockholm.

Sweden has no commercial oil or gas production, but oil was previously produced from Ordovician reefs on Gotland, which the company called "the country's only proven oil region."

Tethys Oil said historic data and further work using gravimetry and radar techniques could improve understanding of the distribution of the reefs, several of which have been mapped and drilled. Surface geochemical surveys may be run later, possibly leading to seismic surveys and drilling.

Gulf of Mexico

Log-while-drilling tools at the second well at Flatrock field on South Marsh Island Block 212 off Louisiana indicated three resistive zones 198 ft thick on a 315-ft gross Rob-L section, said McMoRan Exploration Co., New Orleans.

The well, drilled to 15,400 ft about a mile northwest of the Flatrock discovery well, is to be deepened to 18,100 ft to evaluate other Rob-L and Operc targets. The discovery well, expected on line in the first quarter of 2008 using the nearby Tiger Shoal field facilities, flowed 71 MMcfd of gas and 739 b/d of condensate from the Operc section in October 2007. Drilled to TD 18,400 ft, it cut 260 net ft of hydrocarbon-bearing sands in a 637-ft gross interval, five in Rob-L and three in Operc.

Alaska

Brooks Range Petroleum Corp. reentered the North Shore-1 well on Jan. 10 to evaluate an oil accumulation initially tested in 1974.

Drilled to TD 13,319 ft measured depth and cased to 12,500 ft MD in 2007, the well is to be deepened 1,000 ft for tests of the Jurassic-Triassic Sag River and Ivishak formations. The rig will then move to the Tofkat-1 well in the Titania prospect area just east of Niuqsut east of the Colville River. The joint venture consists of Brooks Range, TG World Energy Inc., Bow Valley Alaska Corp., and Ramshorn Investments Inc.

Texas

West

SandRidge Energy Inc., Oklahoma City, identified seven exploration targets to drill in the West Texas Overthrust after processing less than 20% of an anticipated 1,400-sq-mile 3D seismic survey.

The company controls almost all the land and production infrastructure around the projects, which are several miles from its Pinon gas field development.

SandRidge plans to drill 440 wells in 2008 in a $1.25 billion capital budget, of which $1.1 billion is for exploration and production. That covers $622 million for drilling in the WTO including Pinon field, $285 million for drilling outside the WTO, $33 million for PetroSource, and $151 million for land and seismic.

Technology advances continue to unlock additional resources

Guntis Moritis
Production Editor

Technology advances are allowing companies to extract more oil and gas from resources that in previous years were uneconomic to develop. These resources include gas found in tight sands, shales, and carbonates; extra heavy oil; and additional oil from mature fields that require enhanced or improved recovery techniques.

Various papers from the SPE Annual Technology, Nov. 11-14, 2007, provide insights into technologies that companies use or will use to facilitate recovery of these resources.

Gas

Hydraulic fracturing is a key technology for obtaining higher producing rates and recoveries from unconventional gas accumulations.

One problem has been that in some locations the height of the created hydraulic fracture may intersect water-bearing sands. A potential solution for this problem, as described in a paper by D.L. Fairhurst and others,[1] is to fracture the sands with carbon dioxide contained in a viscoelastic fracture fluid. The method, according to the paper, will minimize fracture growth to prevent fracturing water sands while attaining sufficient fracture length in the gas sand.

The paper describes an optimization study on South Texas tight gas sands that were 20-50 ft away from the water sands. The laminated sand and shale sequences in this South Texas area contain gas sands with 0.05-0.8 md permeability at a 4,500 ft depth while the thicker water-bearing sands have 0.1-2.0 md permeability.

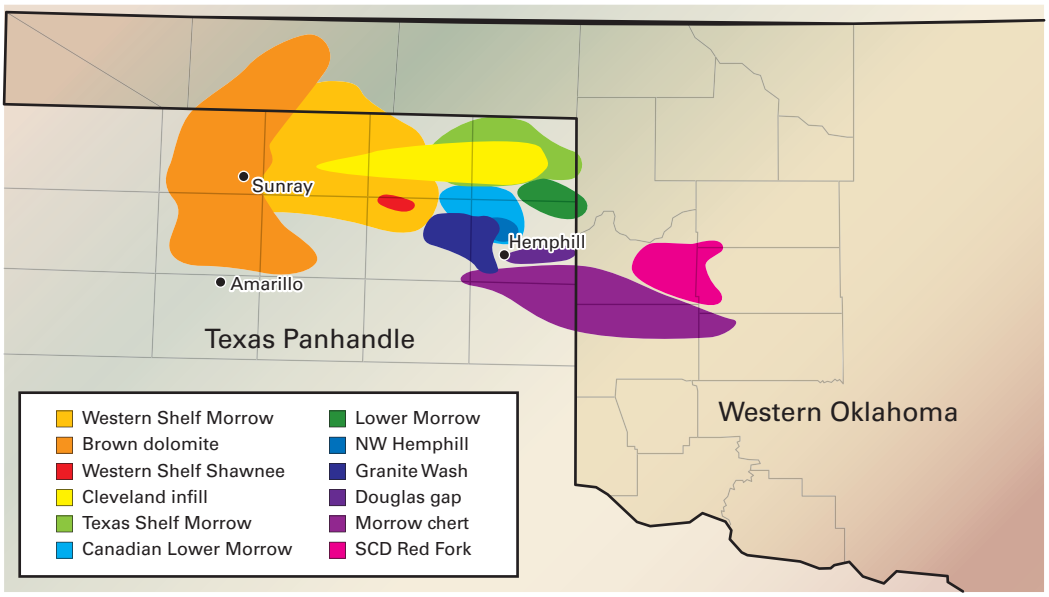
Another tight gas formation, 0.003-0.015 md permeability, in which technology has helped redevelop is the Cleveland formation that lies at 6,500-8,200 ft depths in northeastern Texas Panhandle and Oklahoma (Fig. 1). The formation is an interbedded sequence of sand with thin shale laminations and fine-grained sandstone. A paper by Neil C. Decker and others describes the success of operators such as BP PLC in drilling infill horizontal wells in the Cleveland.[2]

The Cleveland formation was discovered in the late 1950s and originally developed with vertical wells on 640-acre spacing and later infill drilled so that wells now have mostly 160-acre spacing. The paper stresses that the success of the infill wells has resulted from acquiring and analyzing data to optimize horizontal well configuration and completion type. The data used come from extensive subsurface mapping, core analysis, openhole logging, microseismic acquired during hydraulic fracturing, injection fall-off tests, and production-decline analysis.

The newer horizontal completions in the Cleveland typically include openhole multiple packers and sliding-sleeve ports to allow fracturing one interval at a time, and studies show that a fraced

CLEVELAND HORIZONTAL PLAYS

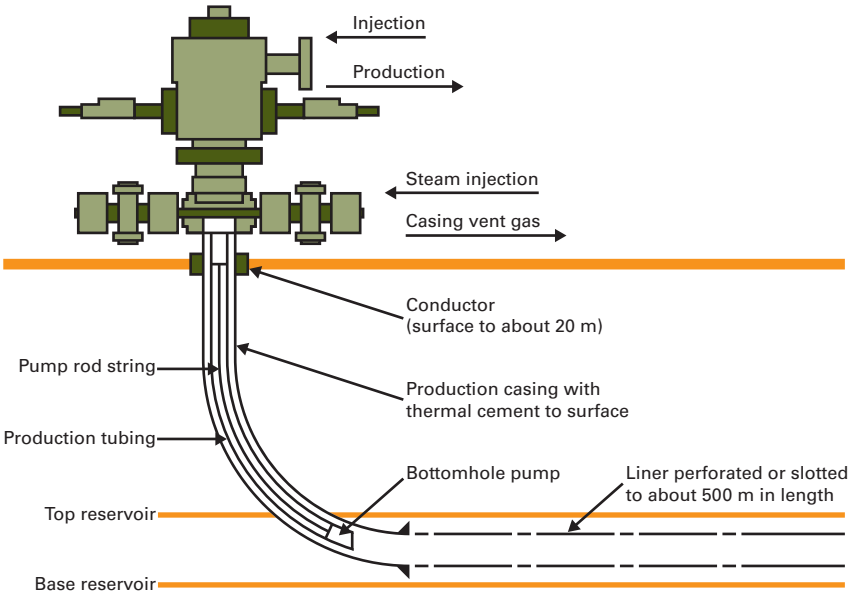
Fig. 1



Source: Melvin, J., "BP Coiled Tubing Drilling Experiences," PTTP Workshop, Aug. 17, 2005, Houston

PROPOSED HORIZONTAL CYCLIC-STEAM WELL

Fig. 2



Source: Application for Approval of the Carmon Creek Project, Volume 1: Project Description, Shell Canada Ltd., December 2006.

1,600-ft horizontal well may provide a 1.4-MMscfd initial production rate and an ultimate recovery of about 1.4 bcf, according to the paper.

New technologies have also been instrumental in accelerating development of Barnett shale gas in North Texas by cutting drilling days and reducing the days for wells to go on stream, according to a paper by Drew Jennings and others.[3] In the northern part of the field, the paper attributes the accelerated development pace to the use of polycrystalline diamond compact (PDC) bits, modified drillstrings, and new operating practices that have reduced drilling times by 62%.

In the south part of the field, the paper says, a new approach to critical failure analysis doubled drilling performance through the curved section with new roller cone bits.

The paper explains that in the northern section during a 6-month period, only one PDC bit run was required to drill the 8¾-in. vertical section in 23 of 30 wells, cutting costs by $150,000 and reducing drilling time by 62%. In the south, new roller cone bits increased the rate of penetration to 18.8 fph from 10.2 fph, saving $1.68 million over 15 wells.

Acid fracturing is improving gas recovery from the Strawn formation, a carbonate, in the Permian basin of West Texas, according to a paper by G. Zaeff and others.[4] The paper attributes the success of the treatments in Terrell County, Tex., wells to a new polymer-free self-diverting acid combined with an existing acid-oil emulsion.

The paper describes the typical treatment as consisting of a linear-gel pad fluid, raw 20% hydrochloric acid, acid-internal emulsion (AIE), linear-gel pad fluid, followed by the self-diverting acid based on a viscoelastic surfactant (SDVA). The ratio of AIE is about 3:1 and the volume of SDVA usually is 2,500-3,500 gal/stage.

Heavy oil

Exploitation of heavy oil and bitumen resources has gained momentum in recent years as demand for crude has increased and crude prices have

rethinking
RECOVERY METHODS

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By rethinking recovery methods, producers have brought to a hungry market gas from reservoirs once considered economically and technically impossible. Tight sands, shales, and coalbeds now represent large and growing sources of an essential form of clean energy.

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Suncor in its Firebag SAGD project in the oil sands of Alberta employs special high-temperature electric submersible pumps (Fig. 3). Photo from Suncor.

remained high. The Orinoco tar belt in Venezuela and the oil sands in northern Alberta are two of the areas with the most activity. These regions contain several trillion bbl of extra heavy, less than 10° gravity, oil in place, and various estimates place potential recovery at several hundred billion bbl.

In Venezuela, cold production recovers the heavy oil through long-reach highly deviated, horizontal, and multilateral wells. Recovery of Alberta's oil sands bitumen, on the other hand, mainly relies on mining and thermal processes. Mining currently accounts for about 750,000 bo/d, while cyclic steam production is about 250,000 bo/d and steam-assisted gravity drainage (SAGD) production accounts for another 200,000 bo/d.

Several mining projects being developed or proposed in Alberta may increase bitumen production by another 2 million bo/d and proposed thermal projects may add another 1.5 million bo/d during the next decade.

Cyclic-steam stimulation with horizontal and highly deviated wells is one option being evaluated by Shell Canada Ltd. in the Peace River area, according to a paper by Paul F. Koci and Junaid G. Mohiddin.[5] The paper notes that the Peace River Carmon Creek area holds about 3 billion bbl of 7° gravity oil in place and stimulation studies indicate that the optimum method to develop about half of these resources is through cyclic-steam simulation in horizontal or highly deviated wells (Fig. 2) at close well spacing of less than 75 m.

The paper notes that Shell also has tested various thermal recovery schemes in Peace River including in situ combustion, steam drive, SAGD, and cyclic steam injection but selected cyclic steam in horizontal wells for Carbon Creek.

Shell plans to develop Carbon Creek in two 50,000-bo/d phases, staged over the projects' 40-year life. If Shell obtains regulatory approval, construction of the project will start in 2008 for Phase 1 and 2011-15 for Phase 2.

Suncor Energy Inc. has an ongoing SAGD project in the oil sands of Alberta (Fig. 3), but the high steam temperature required it to install special designed downhole pumps. In a paper, F. Gaviria and others say that Suncor installed electric submersible pumps (ESPs) in its Firebag SAGD project that could withstand bottomhole temperatures of 180-209° C. compared with standard ESPs that are rated for 149° C. bottomhole operating conditions.[6]

The paper notes that the pumps have reduced the downhole pressures thereby improving the steam/oil ratio, which in turn has reduced operating expenses by several million dollars as a result of reducing the amount of water treated and the fuel used to generate the steam.

The paper says, Suncor is experiencing 500-day run times with the ESPs. Since first installation of an ESP in June 2005, the size and capacity of the pumps installed have increased to 2,500 cu m/day from 1,000 cu m/day. Pump horsepower has increased to 250 hp, up from 150 hp in the initial installations.

Suncor has also changed the intake configuration from a straight intake to a bottom-feeder gas separator (BFGS), then to an advanced gas handler (AGH), and now to a combination of the BFGS and AGH.

The company lands the pumps in the

horizontal lateral at a 450-700 m measured depth. The first 21 installations have average ESP run times of 311 days, with the longest being 658 days and the shortest 29 days, according to the paper.

IOR

A novel ceramic coating on the rotors along with an optimized interference fit between the rotor and stator and adjusted elastomer rigidity in progressing-cavity pumps (PCPs) have improved downhole pump run times in the alkaline-surfactant-polymer (ASP) flood portions of Daqing oil field in northern China, according to a paper by C. Gang and others.[7]

Because of the injected alkali lye reaction with the formation, the flood experiences severe scale near the wellbore, on the surface of downhole equipment, and in pipe IDs. The paper described the scale as an amorphous state silicon dioxide, hexagonal-spherical calcite, and conventional calcite, along with minor minerals.

Since 2003, 43 PCPs with ceramic-coated rotors averaged 416-day run times with the longest being 512 days, according to the paper. The paper also noted that since 2005, four pumps with the ceramic-coated rotor, optimized interference fit, and adjusted elastomer rigidity had a 178-day average run time with the longest run time of 649 days.

A large electric oven will vulcanize the Swellfix swelling elastomers on the standard tubulars (Fig. 4). Photo from Shell.

Polymer flooding is another enhanced oil recovery used in the Daqing oil field. A paper by D. Wang and others says that at yearend 2006, more than 63 million bbl/year of oil production, sustained for 5 years, is attributed to polymer flooding.[8]

Since it was started 12 years ago, the paper attributes the success of the polymer floods to:

- Recognizing when profile modification is needed before injecting polymer and when zonal isolation is needed during polymer injection.
- Establishing an optimum polymer formulation, injection rate, and individual well production allocation.
- Understanding the time-dependent variation of the polymer molecular weight in the injected slugs.

The paper describes the polymers used at Daqing as having 12-38 million Dalton molecular weights that are designed and supplied to meet the various reservoir conditions. It says the optimum polymer-injection volume varies but is about 0.7 pore volume, depending on the water cut of an area. Other design criteria it lists are a 1,000 mg/l. average concentration that can be more at individual injection stations and a 0.2 pore volume/year injection rate.

In another part of the world, redevelopment of Daleel oil field in Block 5 in northern Oman will entail use of horizontal water-injection wells. A paper by L. Zhang and others summarizes the positive response obtained with horizontal injection well in several pilot test at Daleel.[9]

Production from Daleel is from a Shuaiba carbonate formation at 1,500-1,610 m depth that came on stream in 1990 and produces a 38° gravity oil with 0.85 cp viscosity. Before Daleel Petroleum LLC acquired the field from Japex Oman in 2002, it had been depleted with vertical and horizontal wells.

The paper notes that recovery factors in similar fields have increased to 35-40% with waterflooding compared with on 15-20% with primary.

With a 35% recovery factor, ultimate oil recovery in Daleel will be 196 million bbl, according to the paper.

In other fields in Oman, Petroleum Development Oman (PDO) has had success in reducing unwanted water production in horizontal wells through use of swelling elastomers, according to a paper by Majid A. Mahrooqi and others.[10]

These elastomers swell when water contacts them, thereby isolating the water producing zone. The paper explains that the water-based elastomers are wrapped around normal casing joints and vulcanized together (Fig. 4). An osmosis process swells the elastomer when bottomhole temperatures are 50-90° C.

PDO targets the elastomers to isolate fractures, faults, and thief zones and not water influx from the matrix unless the matrix zone is confined and obvious.

The paper notes that PDO has deployed these elastomers in more than 100 horizontal wells and to March 2007 is attributing a recovery of 2.4 million bbl of addition oil to the use of this technology. ✦

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Operators develop, implement new downhole technologies

Nina M. Rach
Drilling Editor

BP PLC and Shell are developing and integrating new downhole technologies in their worldwide exploration and development projects.

BP's in-house "Pushing Reservoir Limits" program is developing new methods to drain oil reservoirs more efficiently by decreasing conventional oil saturation and increasing reservoir sweep. PRL technology director Andrew Cockin says the program's objective is to "provide several additional billion barrels of resources over 20 years."[1] BP and Nalco chemists developed a new polymer, "Bright Water," that may improve water flood performance.

Last month at the company's Woodcreek office in Houston, Shell's global wells technology manager, Lance Cook, told industry media that "the easy oil and gas is gone—new technology is needed for a new age." The company's size and geographic spread, he said, allows it to develop certain technologies in-house and test in a variety of different conditions. Cook said the ability to implement globally helps to differentiate Shell from its peers.

Shell engineers are working to reduce costs by drilling smaller diameter wells and smaller logging tools. The company is testing expandable tubulars to increase the reach and through-bit logging tools to evaluate reservoirs. Cook said that maintaining the maximum hole size with expandable monodiameter tubulars should maximize potential production. The company is also using swellable elastomers for selective isolation within wellbores, a less expensive alternative to solid packers.

Expandable tubulars

The concept of expandable tubulars arose in the early 1990s and the Shell research center in Rijswijk developed variations on expandable slotted tubulars, expandable solid tubulars, and swellable elastomers.[2]

Shell Technology Ventures invests in step-change technologies. STV founded Enventure Global Technology in 1998; its primary technology is solid expandable tubulars. Enventure's first monodiamter well was drilled in Starr County in South Texas. In 2002, natural gas producer Nederlandse Aardolie Maatschappij BV, Shell International Exploration and Production BV, and Enventure installed the world's first corrosion-resistant alloy (13Cr) solid expandable tubular system in a well in the Netherlands.

Shell is now running expandable casing in the Gulf of Mexico, North Sea, Oman, and Southeast Asia. Through the end of 2006, Shell ran:

- 632 solid expandable jobs with Enventure SET.
- 448 expandable sand screens with Weatherford ESS.
- 24 Poroflex jpbs with Halliburton.
- 18 EXPress jobs with Baker Oil Tools ES system.

Shell projects accounted for 18% of the industry's Enventure SET footage, according to Peter J. Sharpe, Shell wells vice-president and chief well engineer .

In 2007, BP completed a technology-collaboration agreement with Weatherford International Ltd. to develop its monobore solid expandable system. BP successfully tested four sizes of Weatherford MetalSkin open-hole liner system: 5½-in. expanded to 7-in.; 7⅝-in. expanded to 9⅝-in.; and 11¾-in. to 13⅜-in.

BP also supported a development program for expandable sand screens with Weatherford, Baker Hughes, and Schlumberger.[3]

New elastomers

Swellable elastomers—elastic materials that swell in fluids—are used to create openhole zonal isolation systems. Their simplest form is a swellable rubber sleeve outside a casing joint. The synthetic rubber compounds swell when they come in contact with formation fluids.

Base rubber can be customized with additives to respond to immersion in either oil (solvent swelling) or water (immersion swelling). Oil-swelling elastomers have low swelling capability in heavy oil and at lower temperatures but higher swelling ability in light oil

and higher temperatures. Water-swelling elastomers have low swelling capability in high-salinity water and low temperatures, and higher swelling ability in low-salinity water and higher temperatures.[2]

Elastomers can swell 600% (volume) and 100% (thickness), but "there is a tradeoff between swell ratio and pressure sealing capability," according to Swellfix Chief Executive Officer John Dewar.[2]

Shell developed its swelling elastomer technology in its Wells research lab in the early 2000s.[2] The company is using swellable elastomers instead of cement, solid packers, or external casing packers (inflated with cement) to isolate zones and to prevent fluid influx. Using swellable packers can eliminate extra trips for cleaning or perforating and can result in a more effective seal, according to … .

Dubai Petroleum Exploration runs a water-swelling E-ZIP external packer in Rashid field, off Dubai. DPE ran 25 of these packers in the Fateh, SW Fateh, and Rashid fields, April-May 2006. Photo from Swellfix.

The system consists of compliant annular seals; each seal consists of several swellable elastomer sections mounted on a standard API or expandable pipe joint. Sections can be combined to form the necessary length. Base rubber is compounded with additives, applied to the pipe, then vulcanized in an autoclave.

Shell formed Swellfix at the beginning of 2006; headquarters are in Aberdeen. Among the company's products are full-joint seal sections; short pup-joint versions with denser rubber banding; an expandable version, based on Enventure expandable technology; and a scab-liner that can be run inside an existing liner. Swellfix also developed swellable elastomer products for hydraulic fracture work, high-pressure, high-temperature environments, and through-tubing rigless operations.

Shell and Petroleum Development Oman (PDO) first used swelling elastomer seals on expandable pipe in Oman in mid-2001 to reduce water and shut off fractures, according to Swellfix. PDO has since installed about 55 open-hole clads and liners with swellable elastomer seals, each containing 8-10 joints.

In the heavy oil fields of South Oman, PDO began using swelling elastomer seals on standard pipe in late 2003. Since then, it has installed more than 100 completions of 5-6 joints each, at about one installation/week. In addition to shutting off permeable zones and fractures, the seals also segment the well, creating the possibility for remedial action if water breaks through one of the segments.

Other Shell companies around the world using swellable elastomers downhole include:

- Shell Frontier Oil & Gas (Colorado).
- Pecten Cameroon Co.
- Shell Todd Oil Services Ltd. (New Zealand).
- Brunei Shell Petroleum.
- Salym Petroleum Development (Russia).
- Shell UK Ltd.
- Shell Canada.
- Shell Petroleum Dev. Co. (Nigeria).
- Sabah Shell Petroleum Co. (Malaysia).

In addition to Shell companies, Danish NOC Dansk Olie & Natural Gas AS and Schlumberger Overseas SA (Sudan) are using swellable elastomers, according to various company reports.

Polymer popcorn

BP's Jim Morgan and Harry Framp-

ton developed the idea for a specialized molecule that could be used in more effective waterfloods in 1997.[3] Tightly bound, long-chain polymer molecules could be injected downhole in relatively cool fluid and designed to pop open–expand—and plug pores at certain elevated temperatures. The cool particles are less than 1/1,000 of a mm in diameter but expand to more than ten times when they reach a specific warmer temperature in porous zones surrounding reservoirs.

Morgan and Frampton took the idea to the MoBPTeCh research consortium, supported by Mobil, BP, Texaco, and Chevron (now disbanded). From there, the chemical giant Nalco Co. joined the effort, and Nalco's K T Chang helped develop the molecule into the "Bright Water" product.

The first field trial took place at a Chevron-operated field in Indonesia, followed by trials in two BP-operated fields in Alaska: Milne Point and Prudhoe Bay, in 2004-05. The new polymer was tested in Argentina in 2006-07, in fields operated by Pan American Energy (BP 60%, Bridas Corp. 40%). It was also tested in Pakistan in 2007.

Nalco, BP, and Chevron continue to test the new chemical. ✦

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Asset-performance management helps US refiners comply with Baker Report

Roy Whitt
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To be successful, refiners must be profitable while maintaining safety performance that is more than just acceptable.

This article shows how a top-down approach to managing the performance and reliability of assets can help refiners effectively respond to the findings and recommendations of the Baker Report.

Baker Report

Norms in the industrial world have evolved to the point that workplace injuries are unacceptable, and companies have learned that better safety leads to greater efficiency and production.

Manufacturers have also learned that emphasis on process safety will lead to better personal safety but the reverse is not necessarily true. Yet many companies still struggle to achieve the level of safety and production to which they aspire.

This struggle also puts negative pressure on safety performance in these plants, as evinced by the incident at BP's Texas City refinery on Mar. 23, 2005, in which 15 people died.

The January 2007 report of the BP US Refineries Independent Safety Review Panel ("Baker Report") emphasizes the key difference between personal and process safety: "Personal or occupational safety hazards give rise to incidents that primarily affect one individual worker for each occurrence. Process safety hazards can give rise to major accidents involving the release of potentially dangerous materials, the release of energy (such as fires and explosions), or both."

Fundamentally, the Baker Report concluded that BP had placed too much emphasis on personal safety to the detriment of process safety. The review panel and subsequent recommendations, therefore "focused on deficiencies relating to corporate safety culture, process safety management systems, and performance evaluation, corrective action and corporate oversight."

Safety, production

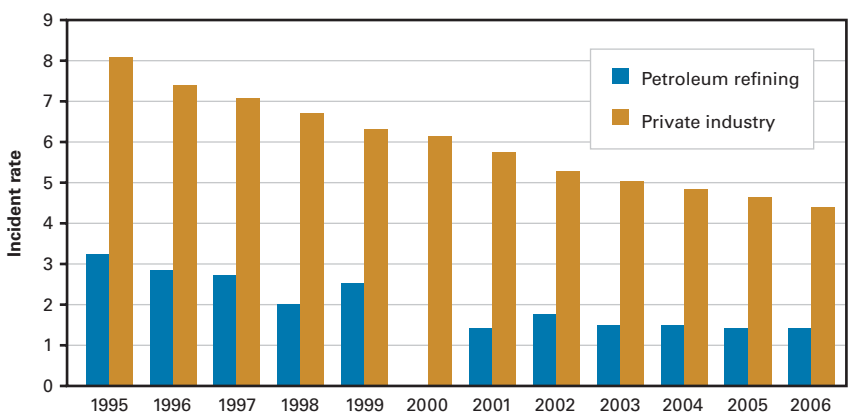
Productivity in manufacturing has steadily improved for decades, placing demands on the industry to compete by increasing production at lower costs and with fewer people.

But there is an inherent, positive link between safety and production. One solution is better asset performance management (APM) that addresses three areas through process safety—leadership, management processes and systems, and expertise.

Leadership sets the stage for direction and expectations. Without it, programs are destined to fail because of insufficient funding, lack of consistency, failure to persist through difficult financial times, and inability to find and retain the right

US INJURY, ILLNESS RATES

Fig. 1



Source: US Department of Labor, Bureau of Labor Statistics

expertise to get the job done.

Management processes and systems provide the necessary record keeping, risk analysis of alternative solutions, and tracking to produce results in a manufacturing setting. People with the necessary knowledge and expertise ensure positive results and program success.

Refining safety

Fig. 1 shows that the US refining industry had much better safety performance than all private industry during the last decade. In the 1970s and 1980s many operators, particularly industry leaders, had good personal safety programs and a strong safety culture. But the prevalent attitude among some refinery workers and management was that workplace injuries were a natural part of the business.

Getting the job done and keeping units operating and production rates up required doing "whatever it takes." Only a few documented procedures were readily available and, therefore, successful operations largely depended on the memories of the most experienced hands in the company, at the site, or on a given shift. Often those individuals and others in leadership felt their presence during unit start-up or shutdown was absolutely necessary for a successful operation. It was common for a process to reach a critical stage while these key individuals were completing 24, 36, or more continuous hr of work.

Although many factors affect the safety results of a manufacturing site, this mentality and the failure to take time to document good procedures (then insist that people follow them) were undoubtedly contributors to the poor safety record of these facilities.

Manufacturing safety pioneers like E.I. du Pont de Nemours & Co. led the way for US industries to embrace the concept of an injury-free workplace.[1]

Early forms of safety initiatives were largely based in negative motivation with punitive measures for failure to comply with safety rules. Although it was common for corporate safety programs to include some incentives in the form of recognition and inexpensive gifts, these initiatives were less successful than later philosophies with emphasis on overall behavioral safety.[2]

MANUFACTURING LICENSE TO OPERATE Fig. 2

Workers could accept the notion that a company was in business to make money; however, they were not motivated to alter their behaviors because they did not believe their own management put a priority on safety. The real motivator for employees was for management to demonstrate that its commitment to worker safety was as great as that for profits.

This 20-year period also saw a severe rationalization of the number of refineries in the US. Those that survived did so because of acceptable financial performance and much-improved safety records.

Improved personal safety

For decades, manufacturing plants struggled with balancing plant safety against meeting cost and profit demands.

As recently as the 1990s, annual injury rates per 200,000 hr worked were reported to be in the high teens for some refineries, and "days away from work" rates were commonly in the 4-5 range. Fatalities were simply too many.

In 1995, all private industry in the US experienced an average injury and illness incident rate of 8.1 with petroleum refining at 3.2 and chemicals and allied products at 5.5 (Fig. 1.) Workplace injuries accounted for 92% of these incidents.

By 2005, the overall US rate had dropped to 4.6 (a drop of almost 50%), while the portion due to injury had risen to 94%. Refining's incidence rate dropped by more than half to 1.4 and the chemical manufacturing sector improved at the same rate.[3] The US manufacturing industry (in particular, the hydrocarbon processing industry) has made vast improvements in the last decade.

Many, however, recognized the need for a deeper commitment to safely operating facilities with highly hazardous chemicals. This recognition is represented in the US Department of Labor, Occupational Safety & Health Administration's (OSHA) promulgation of regulation number 1910.119: Process safety management of highly hazardous chemicals (PSM) in June 1992.

Although industry's performance in personal safety has improved, some recent safety-related incidents show the need for improved process safety. To accomplish this, the Baker Report challenged other US processing industries to heed their findings and recommendations.[4]

Companies that implement APM or asset optimization initiatives have experienced a simultaneous increase in production uptime and improved safety performance while reducing spending.[5]

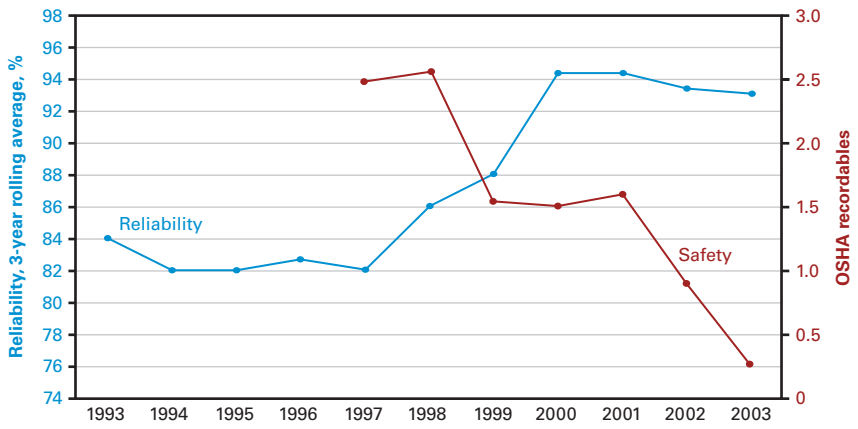
Better process safety

Process plant operators were already trying to ensure the safety of their employees and those around their facilities before the BP Texas City tragedy of 2005. The incident and subsequent recommendations from the US Chemical Safety and Hazard Investigation Board and the Baker Report accelerated the changes in approach and standards as well as enforcement of those standards.

API also initiated an immediate review of its facility-siting standard, with an emphasis on temporary build-

RELIABILITY, SAFETY PERFORMANCE AT A SITE

Fig. 3



Source: Reference 10.

ings. API and National Petrochemical & Refiners Association members reviewed their compliance with existing PSM regulations. OSHA stepped up its review and enforcement of the PSM law.[6]

The underlying message of the Baker Report is that companies can focus on circumstances and conditions that result in fewer employees being injured in the workplace but can still leave a host of potential mechanical failures ready to occur and cause great harm to many people and much damage to equipment. The solution to this problem (or correction of the inherent issues that create the potential for disaster) is embodied in the proper application of OSHA's PSM regulation.

The Baker Report summarizes this point: "The Panel believes that as process safety is embedded in all aspects of corporate culture, management systems, and operations relating to US refineries [the] refining business will benefit."

The Baker Report supports three keys to successful, safe production: leadership, management processes and systems, and people.

Leadership

The report contains a wealth of information about what should be looked at and emphasized in an organization's quest for better process safety. But the report leaves it to industry and its operators to decide how to achieve those objectives.

The Baker Report indicates that to demonstrate leadership in process safety, a high-level reliability and process safety position should be established and employee perspective of PSM elevated. The position and subject must both be viewed as one of great importance to the company.

Executive management should conduct frequent, periodic reviews (at least annually) of key results that reflect the effectiveness of the PSM program. Reviews should include third-party audits that have measured a large percentage of the company's assets for PSM performance annually.

PSM coordinators at company sites must be given authority to ensure compliance with the many requirements in the regulation and should have deep expertise related to maintenance, operations, engineering, or reliability. These coordinators must become more than recommendation monitors; they should be integrally involved with the plant management team in reviewing equipment reliability and recommending changes for mechanical integrity improvement.

Management, executive, and board-level leaders should be kept informed of both the existence and effectiveness of the company's PSM program.

Moving toward better process safety requires a commitment from the highest levels in an organization, but that commitment must be expressed in terms of day-to-day, ongoing operational goals and expectations.

Short-term profits and return on capital may look quite attractive. This approach, however, is almost certainly destined to fail in the long run. A much better model, used by Marathon Petroleum Corp., acknowledges an implied "manufacturing license to operate," which a plant and corporation must earn as a prerequisite for conducting a profitable business (Fig. 2).

Costs and production must then be optimized to determine if the business is viable and profitable enough to satisfy all the stakeholders. The University of British Columbia, Applied Ecosystem Services, Inc., and others developed and refined the concept of a license to operate.[7 8]

The license to operate includes providing a safe work place for employees, being a responsible corporate citizen, and clearly meeting (with a comfortable margin for error) all the regulatory and compliance requirements. It is only after each of these prerequisites is met that a refiner can generate profits in an ongoing, sustainable way.

Although the other two are important, only the first element of the license (a safe work place) is directly addressed in this article.

Many key factors influence the success of the manufacturing process: personnel, raw materials, equipment efficiency, and the nature of the marketplace. More importantly, company culture will govern the degree of success in safety performance.

Actions, more so than words, of leaders determine the results. In the case of the BP Texas City incident, BP's executive management believed profits never superseded spending on safety, but some employees surveyed felt that safety programs were underfunded.

The Baker Report noted that, even though BP Texas City reduced maintenance and capital spending during

1992-98, another 25% cost-reduction target was set by BP management after its takeover of the refinery from Amoco in 2000.[9] There were also indications that employees and managers received conflicting messages that had a negative impact on their safety culture.

One successful approach (used by Marathon Refining to achieve safe, profitable manufacturing results) is "design it right, operate it right, maintain it right." This article stresses this philosophy and describes how one can apply it in concert with the Baker Report, which emphasizes the need to have the right corporate safety culture that leads to better process safety.

The emphasis in this article is on the "maintain it right" principle.

Applying an asset optimization program is key to increased effectiveness due to improved reliability, which results in major gains in corporate profitability. Companies can maintain and reliably operate well-designed equipment by:

- Operating within its defined physical capabilities.
- Performing maintenance recommended by manufacturer's guidelines.
- Identifying good maintenance strategies using advanced, risk and statistical-based analytical techniques, or other proven methods.

An effective APM program ensures that every piece of equipment is operated and maintained within prescribed limits. With the right information (statistically derived and risk-adjusted), one can make informed decisions about the production plan. The resultant equipment and unit reliability ensures safety of the process.

Processes, systems

Many processes are needed to achieve equipment reliability in a plant effectively. Key to managing a facility is knowing the status of the organization in terms of process maturity.

In today's business environment, every US operator of a hydrocarbon processing facility has a PSM system of some kind. The rigor with which that system is capable of monitoring the equipment, generating maintenance strategies, and managing them will dictate the system's effectiveness.

With any asset-intensive business, it is also vitally important to track the equipment data and history.

Using multiple software packages to collect disparate data (from enterprise asset management or computerized maintenance management systems) is difficult to coordinate, represents a large training problem, increases administrative costs, and may suboptimize the solution. The obvious approach is to have an integrated enterprise APM system reinforced with good work practices that allows organization, analysis, and presentation of the right data and results to the right people at the right time.

Comprehensive programs also must be in place to monitor and maintain fixed and rotating equipment, power systems, and instrumentation. In multiple-site companies and in large facilities, it is unreasonable to attempt to manage such a detailed information system with manual data collection and analysis.

These systems will include life-cycle design criteria, positive material identification of existing and new components, rigorous piping and vessel inspection routines, a corrosion-under-insulation program, safety instrumented systems compliance, instrument calibration monitoring, vibration programs for rotating equipment, and power management programs.

The critical nature of instruments in process safety has been assumed for quite some time. Because the Baker Report highlighted the fact that a number of failed instruments contributed to the BP incident in 2005, it is even more apparent that companies must emphasize instruments by installing an instrumentation performance management (IPM) system, a critical component of any comprehensive reliability program.

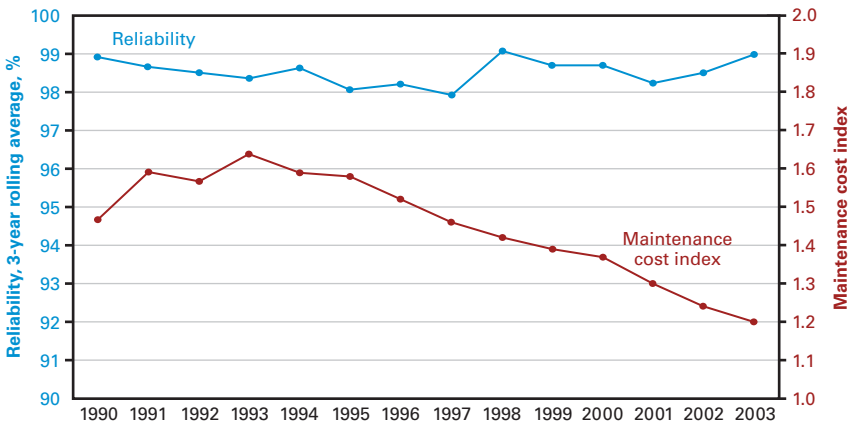
IPM is a system for managing and improving the performance of process instrumentation as well as safety instrumented systems through the integration of tools, processes, and workflows for calibration management, safety instrumented system life cycle management, and reliability management tools.

Figs. 3 and 4 show the results for one company with an efficient, effective APM system, but are typical for many plants.

In a generally profitable business, it is difficult for a modestly capable manager to spend more on safety than a site would return in productivity and gross revenue. If, however, leaders were to find themselves in such a situation, the conclusion should be to cease operations rather than compromise

Reliability, cost performance at a site

Fig. 4



Source: Reference 10.

safety. The skill is to know the difference between a safe operation and one that has failed to achieve that necessary level of performance.

A system to ensure better equipment reliability and overall process safety is therefore needed in addition to programs that foster good personal safety. The most effective system will:

- Provide a solid foundation for gathering all pertinent asset information, keeping track of equipment data, and doing advanced analytics on the data.
- Make the organized data and maintenance strategy recommendations readily visible on a near-real time basis to all who need them.
- Conduct risk-based analysis via advanced analytical techniques that result in optimized maintenance strategies.
- Facilitate these principles across a plant and multiple sites.
- Ensure continuous improvement using current information from an integrated platform that provides an integral way to continuously improve asset strategies and keep them evergreen.

People

To maintain a safe, efficient, and profitable plant, companies must seek and retain personnel with the necessary knowledge and expertise to ensure success of the program and positive results. Equipping those people with the right tools and data is equally important.

Companies must collect in an easily retrievable place all the pertinent information about each piece of equipment and have the capability to analyze initial data as well as changes that routinely take place to create appropriate maintenance strategies for the equipment within a defined operating envelope.

Having the data and capability to analyze it will produce good results only if the organization includes individuals who are competent in using the information. Finding, hiring, and retaining people with the right skills in reliability and safety have always been difficult but will be even more so as the experienced work force in the US and other regions of the world ages and retires.

The Society of Petroleum Engineers estimates that the industry will experience a 44% attrition rate among petroleum engineers by 2010.[11] These attrition rates are common amongst professionals in all fields related to reliability and must be addressed through improved procedures and training.

Data storage media are readily available and affordable for capturing good procedures, but the work processes associated with retrieval of those data by the right person at the right time have yet to mature and become readily available to manufacturers. Many attempts have been made to come up with an effective knowledge-management system to address this need, but none has been widely accepted in the industry.

Most systems have approached the issue from the perspective of finding ways to move information from function to function in an organization, perhaps by establishing communities of practice.[12] Engineers, operators, and craftsmen, however, have more tasks to keep them busy in a work day than hours to complete the work.

The effort to communicate with a colleague is therefore usually relegated to slow times or lulls in the action, if at all. That colleague may be hard to find at just the right time. A search of documentation for the needed information may likewise turn out to be an exercise in futility as its location in the company's archives is probably not well known.

The success of this approach is better ensured by linking important or required information to individual pieces of equipment.

When applied well, these APM initiatives result in world-class reliability and the accompanying process safety.

Improved APM

Safely operating equipment in asset-intensive manufacturing settings is complicated. Whether that business is petrochemical, mining, power generation, or the manufacture of consumer goods, many of the problems are the same.

An intimate knowledge of each piece of equipment being operated—from conceptual design through construction, operation, maintenance, and redesign—gives an owner the opportunity to affect safe use and remain within mechanical limits of the equipment.

The Baker Report charged the refining and chemical industry to heed lessons learned from the 2005 BP incident. Implementing an APM system provides an effective approach to achieving world-class reliability based on enterprise-wide asset management concepts and practices.

These practices require exemplary executive leadership, establishment of comprehensive PSM systems with proper underlying work processes, and the capture, retention, and transferal of knowledge and expertise. ✦

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The author

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Industry ignoring potential of bidirectional LNG flows

John Meagher
Wood Mackenzie
Edinburgh

With record levels of LNG traveling in opposite directions through the Suez Canal, the economic rationale for swapping cargoes is growing stronger. The concept is simple: Instead of two ships embarking from different sides of the world and passing each other to supply remote markets, the parties involved agree to supply the markets closest to them, saving time, fuel, and money.

Paradoxically, however, we are seeing robust growth in bidirectional trade between the Atlantic and Pacific basins. Swappable volumes increased to 3.4 million tonnes/year (tpy) in 2006 from 0.3 million tpy in 2005 and will exceed 6.0 million tpy in 2007. Growth is being driven by Asia's thirst to soak up volumes to support buoyant gas demand and make up for shortfalls in supply from Indonesia and delays to new projects such as Sakhalin 2.

Business is booming but the new dynamic is exposing a major inefficiency in the LNG market—a reluctance to swap cargoes. What's the commercial incentive for doing so? The answer is an average saving of up to $4 million/swap ($2 million/cargo); the equivalent of $240 million in 2006 and potentially more than $400 million in 2007 based upon Wood Mackenzie estimates.

Numerous factors are currently inhibiting the free trade of LNG cargoes and limiting the amount of swap deals taking place. But what stands out most notably is a lack of cooperation across the industry. Suppliers recognize that they could enhance their returns by taking advantage of high prices and cost savings through swaps, but contractual constraints, issues around execution, and a lack of transparency across the industry currently limits their ability to do so.

As the market evolves and moves towards an increased level of short-term and spot activity, the opportunity to find swap counterparties will increase. Strategic partnerships between key players will help to facilitate swap deals but formation of a forum, or an "LNG Swap Club" involving suppliers and buyers within each basin, would expedite the process and offer wider benefits to the industry. Over time this could potentially evolve into an independent exchange to enable buyers and sellers to submit bids and offer cargoes.

Development of an LNG Swap Club would improve the operational efficiency of the industry and offer mutual benefits to suppliers and buyers. Whether the concept takes off will depend on how the cooperative is set up and the appetite of the various players to be involved. Either way, the pressing question being asked by many is not if swaps will happen, but when?

Flows between basins

LNG flows have moved through the Suez Canal for more than a decade, but until 2005 they were primarily in one direction—westwards from the Middle East and Pacific supply projects to meet demand in the Atlantic Basin. With large growth in Middle Eastern supply and greater dependency on LNG across Europe and North America, the level of traffic heading west should increase greatly.

Recent years, however, have seen a rapid rise in LNG flowing in the opposite direction. The occasional trickle of spot cargoes heading east has been replaced by a steady stream of deliveries into the Pacific Basin because of strong demand and higher prices in the Asian market (Fig. 1).

Growth in trade from the Atlantic to the Pacific has been staggering. Volumes increased to 3.4 million tpy in 2006 and are forecast to rise by 100% to reach 6.8 million tpy in 2007. As well as growing in size, the number of countries participating in the trade is also increasing. Egypt and Equatorial Guinea have joined Algeria, Nigeria, and Trinidad as key Atlantic basin suppliers. And China and India have joined Korea,

Japan, and Taiwan as key buyers in the Pacific basin.

Swap potential

The increase in flows from the Atlantic to the Pacific set against the larger tide of flows in the opposite direction highlights one of the LNG market's anomalies.

To the observer the emergence of bidirectional flows through the Suez is confusing and counterintuitive. Why are ships not being redirected to supply the markets in their own respective basins? Or put simply, why are ships going a "long way for a short-cut" when they could be going a 'short way' for a "large cut"? Surely it would be more prudent to share the savings from the reduced transport costs and thereby improve the profitability of each respective trade.

To look at the transbasin trade dynamics in more detail we have used 2006 as a case study (accompanying table). The flows on Fig. 2 clearly illustrate how swaps drastically reduce transit distances. While most of the eastbound cargoes transit the Suez Canal, some go via the Cape of Good Hope (46 and 14 assumed, respectively, in 2006). With the average toll for a return journey through the Suez amounting to $0.5 million, savings through swaps in canal fees alone would exceed $50 million.

As well as these cost savings, avoidance of the Suez Canal would reduce journey times, fuel consumption, and the risk of disruption by technical, operational, and geopolitical factors. The shortening of the supply chain would also improve the productivity of LNG assets and enable suppliers to respond more quickly and profitably to market opportunities. A more timely delivery cycle also reduces working capital and insurance expenses.

Based upon our analysis the savings are considerable. To put this into context, around 120 cargoes could have been swapped in 2006. Doing so would have saved more than 700,000 nautical miles, 1,900 days or 5 years' sailing time, 260,000 tonnes of fuel-oil equivalent, and around $240 million in costs (about $4 million/swap, $2 million/cargo).

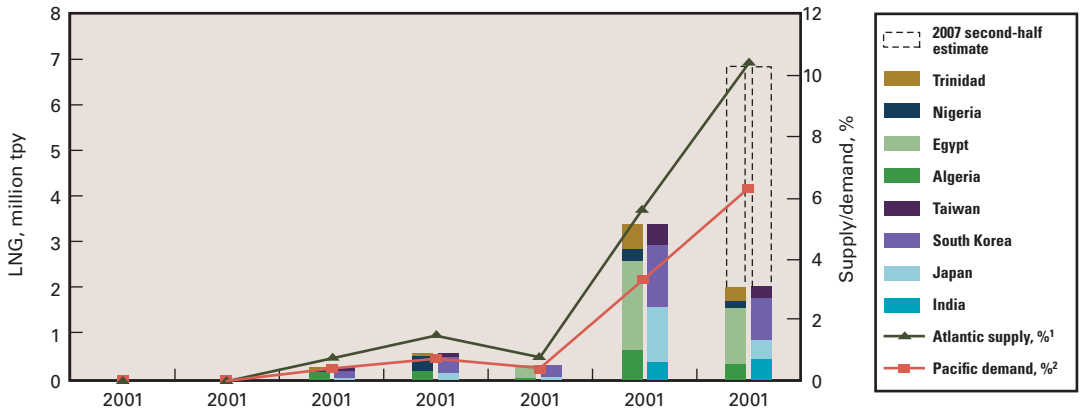
Environmental considerations provide a further impetus to swap. The reduced fuel oil and boiloff consumption would have reduced the industry's carbon footprint by 900,000 tonnes. Shipping is not currently subject to any international carbon regulations, but an equivalent reduction in the industrial sector in Europe would have generated carbon-cost savings of around $22 million, assuming a European Union emission trading scheme price of €20/tonne.

Potential savings for 2007 would be even greater. Using 2006 as a basis and applying growth in trade on a pro-rata basis would generate savings of more than $400 million for 2007. While the savings from canal fees, reduced fuel consumption, and other operating costs are valid, however, it is questionable whether the capital element of the savings would be redeployable. This will depend on the flexibility and schedule constraints of the shipowner or charterer.

Excluding the capital element of the shipping costs would reduce the potential savings during 2006 by about a third. Care should also be taken in considering the timeframe for the swaps. We have used 2006 as a single annual

ATLANTIC-SOURCED CARGOES IN PACIFIC BASIN

Fig. 1



[1]Atlantic supply indicates the proportion of Atlantic supply going into the Pacific Basin–based on supply from Algeria, Egypt, Equatorial Guinea, Nigeria, and Trinidad. [2]Pacific demand indicates the proportion of Pacific Basin imports from the Atlantic Basin–based on imports into China, India, Japan, South Korea, and Taiwan.

SUMMARY OF TRANS-BASIN LNG FLOWS: 2006[1]

Flow	Fig. 2 key	Volume, million tpy[2]	No. of cargoes	Distance, nautical miles[2]	Time, days[2]	Fuel consumption, tonnes fuel-oil equivalent[2]	Cost, million $[2]
Pacific ➤ Atlantic	Blue dotted	5.3	89	838,498	2,389	313,414	296
Pacific ➤ Atlantic (swapable[3])	Blue dotted	3.4	60	575,242	1,636	214,972	201
Atlantic ➤ Pacific	Green solid	3.4	60	1,006,386	2,540	370,978	285
Swaps	Red dashed	3.4	120	866,100	2,289	327,041	246
Savings				715,528	1,887	258,908	240

[1]See shipping assumptions section for assumptions used. FOE = fuel-oil equivalent; figure includes an assumption for fuel oil consumed and boiloff in transit converted to a FOE figure. [2]Based on estimated figures only. Tonnes of FOE based upon fuel oil consumed in transit and assumed boiloff of LNG converted to FOE. [3]Swappable amount is constrained by the smallest directional flow.

Shipping assumptions

In reality, several to additional factors would need to be considered accurately to assess the opportunity value in swapping out cargoes between the Atlantic and Pacific basins. For the purposes of this analysis, we have made a number of simplifying assumptions to show a general directional trend and an estimate of the potential benefit in swapping out cargoes.

These include:

- Shipping journeys for each cargo are based on return journeys from and to the supply project.
- Trade benefits based on a simple annual calculation. Different figures would be generated for swaps on a monthly resolution.
- The maximum swappable volume is based on the lower of the two flows between the two basins. The trade from the Atlantic to the Pacific is the smaller of the two. This figure amounted to 3.4 million tpy (7. 8 million cu m) LNG in 2006.
- An equivalent number of journeys is undertaken, i.e., the estimated 60 Atlantic to Pacific basin shipments during 2006 are swapped for 60 Atlantic to Atlantic journeys. Similarly an equivalent of 60 Pacific to Atlantic journeys are swapped out for 60 Pacific to Pacific Basin journeys.
- Shipping costs are based on a 145,000-cu m vessel size.

Although swaps can generate substantial savings in transport costs, a full appreciation of the extent of benefits would require consideration of what value the freed-up shipping capacity constitutes.

Today's LNG shipping market is characterized by surplus capacity, and therefore the improved productivity of ships as a result of swap activity is unlikely to result in significant opportunity value. Indeed, capacity idleness may increase; in that case the associated costs incurred by the ship operators should be offset somewhat against the value derived from the swaps.

On the other hand, the surplus of shipping capacity has undoubtedly been a key factor in generating increased trade and long-haul movement of spot cargoes. If and when this spare capacity dissipates, the increased efficiencies of swaps should become even more pertinent.

increment to assess the swap potential. In reality, closer scrutiny would be required of the figures on a monthly or weekly basis. (For more detail, see the discussion of shipping assumptions above.)

The transbasin trade dynamic highlights a wider issue across the global gas industry: a reluctance to swap cargoes. Consider the potential savings from transatlantic swaps and a scenario in which global LNG flows are optimized by geographical proximity and the savings would amount to billions. Factor in LNG for piped gas swaps potential and the figure would be even greater.

Regional gas markets, once virtually separate from each other, are now becoming increasingly interconnected, and with that trend a new global dynamic is evolving. This subject warrants a thesis in itself and can be explored in more detail with Wood Mackenzie's Global Gas Model.

Why not more common?

If the concept of swapping is simple and the returns attractive, why are cargoes rarely being swapped? Numerous factors are currently inhibiting the free trade of LNG cargoes and limiting the amount of swap deals taking place, including:

- *LNG specification.* Several sources—Libya, Nigeria, and Oman, for examples—currently produce LNG with a heat content too rich to be accepted by certain markets. Some import terminals can accept rich LNG because the downstream market can accommodate gas with a high calorific value or because those terminals have blending to reduce the calorific value of the gas.
- *Ship, port compatibility.* Incompatibility at the ship-shore interface has traditionally been an impediment to the redirection of cargoes. Most fleets were designed for specific terminals. An increasing number of ships, however, are being built or modified for flexible trading.

Technological innovation in cargo-handling equipment and jetty infrastructure is also leading to new and upgraded terminal facilities being more adaptable to ships of various sizes and designs. Storage capacity would be the main limiting factor for ships larger than 200,000 cu m participating in swaps, although terminal owners are beginning to realize advantages of being able to accommodate this size.

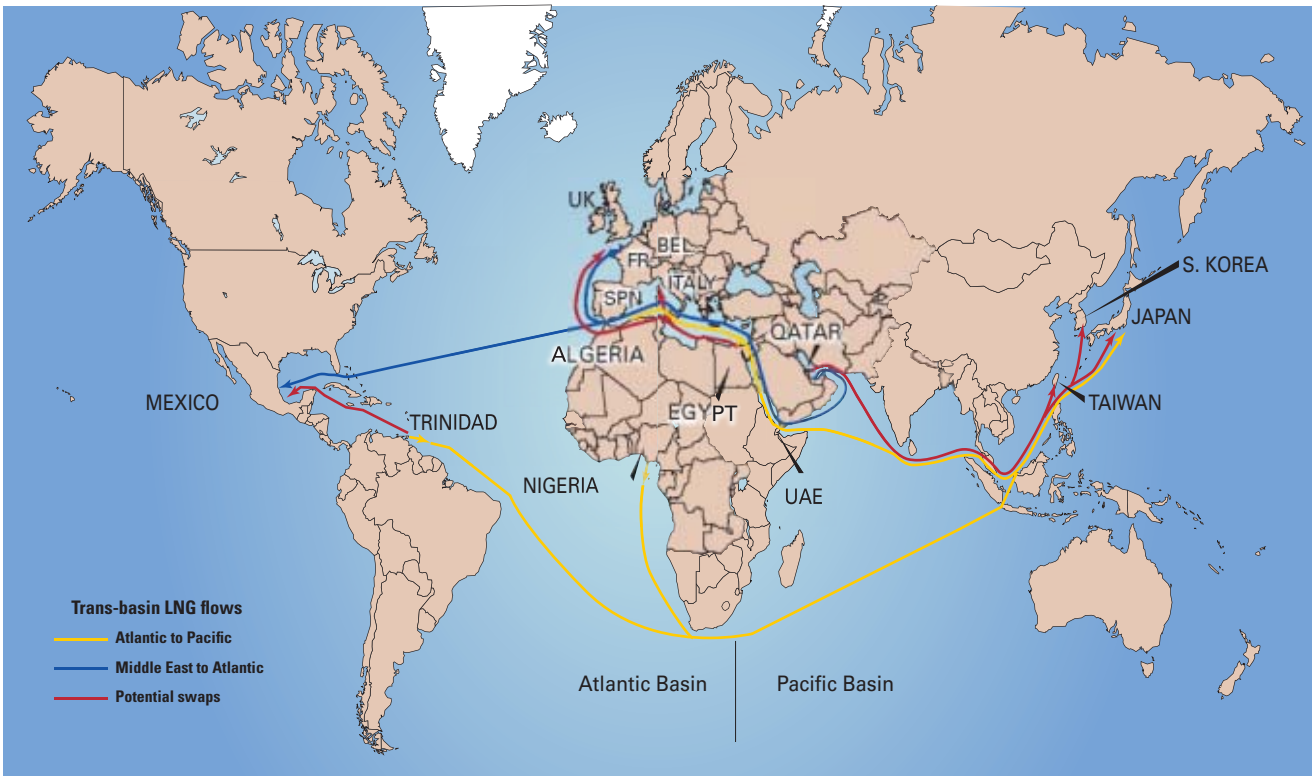
Ships older than 20 years may also constitute an impediment to swapping of cargoes. Provided the ships have gained sufficient Condition Assessment Programme (CAP) and Class Survey approvals, however, and absent of any technical incompatibility, operators and terminals are unlikely to reject a ship for spot-cargo movements.

- *Security of supply.* Traditionally a large proportion of LNG supply has been traded under inflexible long-term contracts to underwrite the significant capital investment along the LNG value chain and assure buyers that they can meet the demands of their own customer bases. Many of the established buyers have been reluctant to participate in swaps due to the perceived risk and threat to security of supply.
- *Contractual constraints.* Destination flexibility is becoming more common, particularly for volumes in the Atlantic Basin, but the structure of the more traditional contracts currently impedes the redirection of LNG to other markets. Many include clauses that prohibit the purchaser from redirecting or reselling LNG cargoes into alternative markets or restrict the use of facilities (e.g., project-dedicated ships) for alternative purposes. While some purchasers have successfully redirected cargoes, the clauses have undoubtedly curtailed some redirections.

The lack of a standardized contract for swap transactions also acts as a

TRANS-BASIN LNG FLOWS: 2006

Fig. 2



hindrance. Efforts by the Association of International Petroleum Negotiators (AIPN) to develop a standardized LNG sales and purchase agreement (SPA) for spot transactions have met mixed responses. The style and liabilities are in keeping with a traditional SPA, but the agreement is very different from what traders would use for buying and selling spot cargoes.

• *Profit split, shipping savings split.* Determining how profits will be split is often a thorny issue. Everybody involved will naturally seek a share of profits and other benefits. Profit splits are used to describe the difference between the price and the cost to get it to market, divided by the number of parties involved.

The benefits associated with swapping cargos, however, are due to shipping-cost savings. Therefore, a more appropriate term to use would be shipping savings split (SSS). Swapping out two cargoes across the Suez might generate savings of $4 million.

The windfall looks attractive, but trying to get consensus on how it should be distributed is where the transaction becomes difficult. Who gets what will depend on several factors, including the number of parties involved and their respective roles and influence as a buyer or seller; contract terms (e.g., FOB/DES delivery point); and whether the swap is for a spot cargo or long-term contracted volume.

• *Timeliness issues.* The short-term nature of swap deals, as opposed to long-term contracts, naturally places a premium upon an expeditious negotiating process. The logistics involved, however, tend to be complex.

Swaps tend to involve several parties located in different parts of the world, creating communication obstacles. While the logistics of rescheduling and provisioning ships and ensuring terminal accessibility frequently complicate matters.

Quantifying and agreeing upon the allocation of costs and rewards of the swap deals are usually time-consuming and often difficult. Formulation of a series of standardized pro-forma agreements covering various scenarios and benchmark measures would go some way towards helping to address this issue.

• *Operational control, risk.* The long-term contractual nature of the LNG industry has nurtured a risk-averse culture and a desire for operational control. It has also given incumbents a strategic advantage and made it difficult for new players to enter the industry, although this in itself should not impede swaps.

Some suppliers have been reluctant to swap cargoes because they consider the operational risk too great and do not want to jeopardize their reputations as reliable exporters. If a cargo were swapped for another and something untoward happened, for instance, who would be liable for the ship, its contents, and any potential damage to the port facilities? Would relationships be undermined and what would be the impact on future delivery schedules?

Swapping cargoes also raises a dilemma for longer-term shipping capacity planning. Should companies contract shipping for their base commitments or for assumed swaps? Some players could find themselves in a position with insufficient capacity to deliver cargoes to their original counterparties if swap opportunities fail to materialize, a situation potentially remedied by procuring short-term capacity.

• *Desire for opacity.* While producers may be able to achieve cost reductions by using swaps, these savings may be outweighed by the additional revenues that they can realize through continued opacity around the commercial arrangements for LNG supply. Pricing arrangements for LNG trades, particularly spot cargoes, tend to be quite opaque and producers may worry that by engaging in swaps, they will have to reveal the terms of their arrangements to counter parties who might then arbitrage away some of their profits or somehow release this information into the market.

These constraints represent significant barriers in the short to medium term, but their significance is likely to diminish as the market evolves. Closer inspection of the bidirectional flows through the Suez suggests that some factors are more prevalent than others.

Most of the 5.3 million tpy flowing westwards through the Suez during 2006 was delivered into Spain under long-term agreements from Qatar and Oman. Consequently it is improbable that technical issues associated with LNG specification and ship-port compatibility hindered trade as the Pacific buyers already import significant volumes from the Middle East, and Spain has received regular deliveries from Atlantic suppliers in the past.

Other factors have played a part, but contractual constraints and operational control and risk factors appear to be the main barriers inhibiting potential swap trades. The contracted position (3 million tpy) of Spain's Gas Natural with Qatar illustrates this point.

Given its track record of diverting Trinidadian volumes between Europe and the US, the Spanish utility is not averse to trading out volumes to take advantage of arbitrage opportunities, but few of the Qatari cargoes are being switched for volumes in the Pacific. This may be due to strict destination clauses imposed by the Qataris or to commercial terms associated with the financing of the supply project that prohibit swaps from taking place.

As the primary source of the trans-Suez trade, Qatar stands to gain the most value by swapping volumes between the two basins. It is not doing so at present likely because of difficulties in negotiating swaps with equivalent counter parties in the Atlantic basin and some of the issues mentioned previously.

Arranging SSSs with Gas Natural may not be as lucrative as it could be in projects in which Qatar Petroleum has an integrated position along the value chain, for example, in Qatargas 2 where fewer parties would be involved in any SSS in the event of a swap. QP may in fact be biding its time and waiting until Qatargas 2 starts up before it takes advantage of the arbitrage opportunities between the two basins.

Competition, cooperation?

While it makes logistical sense to swap out volumes across the Suez, the major factor inhibiting it is the clash of two opposing forces—competition and cooperation.

Suppliers are competing with each other to get the highest price and best value for their cargoes. Similarly buyers are competing with one another to attract cargoes to their respective markets. Currently the margins generated from higher prices in Asia are far greater than the cost reductions from swaps. Hence, the reason for bidirectional flows between the two basins. But ultimately the most prudent strategy would be to take advantage of high prices and cost reductions via potential swaps.

How could this additional value be realized? In essence by removing the difficulties associated with executing swap deals and by improving cooperation across the industry. This could be initiated by a roundtable forum involving suppliers and buyers within each basin to discuss the issues in a more open format.

LNG Swap Club

The forum could be used to facilitate trade and create an LNG Swap Club. Over time the forum could become more sophisticated and potentially evolve into an independent exchange to enable buyers and sellers to submit bids and offer available cargoes. As well as facilitating swaps, the forum could be used to share information on ships' delivery schedules, identify obvious commercial opportunities, and improve the overall efficiency of the industry.

Setting up an exchange, however, is likely to be easier said than done. While openness would be appreciated by many, the lack of transparency in the current market benefits others. Suppliers may be reluctant to reveal the terms of their arrangements and share information with counter parties due to commercially sensitive contractual obligations and concerns.

Although these have traditionally been barriers, there are signs that things are starting to change. For example, there has already been a noticeable improvement in the amount of information more openly available over recent years and with new technologies evolving it is becoming easier to track cargo movements across the industry. ✦

The author

John Meagher (john.meagher@woodmac.com) has worked for Wood Mackenzie for more than 7 years and is an experienced member of the energy research team. He has primarily focused on LNG and currently manages Wood Mackenzie's Global LNG services. Before working on LNG, John was involved in analyzing energy markets across Europe, Latin America, and North America. Before joining Wood Mackenzie, John worked as a process engineer with Kvaerner on various international infrastructure projects in both a technical and commercial capacity. He holds a BEng (honors) in chemical engineering from the University of Edinburgh.

Equipment/Software/Literature

New web site lists Russian producers, service providers

New web site www.oil-gas.biz (http://www.oil-gas.biz/) is supported by the Russian Association of Oil & Gas Equipment Producers and it contains a listing of Russian companies that produce oil and gas equipment and-or offer services.

The site provides not only general information about the companies but also with details such as working experience, availability of service centers and certificates, performed projects, customer feedbacks and testimonials, and contacts.

There is daily updated news featuring oil and gas industry of Russia posted on the site. The company says it's one of the only online resources in Russia that daily posts English-language news about Russia's oil and gas equipment and services market.

Source: **Russian Oil & Gas Equipment & Services,** Box 50, Moscow, Russia.

New cement seals microleaks

New FUTUR active set-cement technology automatically seals microleaks in a cement sheath.

Pumped and placed as part of any primary cementing operation, the active components of the cement system remain dormant until exposed to hydrocarbons, such as those seeping through cracks or microannulae in the cement sheath. Upon activation by contact with hydrocarbons, the cement sheath will self-repair without intervention. This prevents the annular migration of fluids behind the casing between zones or the sustained casing pressure at surface.

The new technology can be mixed and pumped as a lead or tail system during any primary cement job. The properties of this system are comparable with those of conventional cements, meaning it can be pumped with standard cementing equipment, the firm notes.

Once in place, FUTUR technology guards against hydrocarbon leakage and extends the life of the well. Even microscale leaks caused by subsidence, pressure-temperature cycling, or tectonic activity will be sealed, the company says. The reaction within the matrix to the exposure to hydrocarbons is spontaneous and is completed rapidly. The system retains its reactivity over time and will continue to seal any subsequent leaks that may occur over the well's productive life, or even after abandonment.

Source: **Schlumberger,** 110 Schlumberger Drive, Sugar Land, TX 77478.

Coating project gets under way

Industrial Nanotech Inc., Naples, Fla., has started work with pipeline-coating company Socotherm SPA, Vicenza, Italy, on applications for Industrial Nanotech's Nansulate product line of patented thermally insulating, corrosion and chemical resistant coatings. Nansulate specialty coatings contain a nanotechnology based material that provides thermal insulation, prevents corrosion, and resists mold.

Source: **Industrial Nanotech Inc.,** 801 Laurel Oak Drive, Suite 702, Naples, FL 34108.

Services/Suppliers


Lindsay


Hemmingsen


Rider


Hunt


Petty

International Association of Drilling Contractors,

Houston, has announced its officers for 2008. John Lindsay, executive vice-president, US and international operations, Helmerich & Payne International Drilling Co., was elected 2008 IADC chairman. In addition, Claus Hemmingsen, CEO, Maersk Contractors, was elected vice-chairman.

Other IADC 2008 officers are Secretary-Treasurer Phil Rider, assistant controller, accounting, reporting, and compliance, Transocean; Pres. Lee Hunt, IADC; Government Affairs Senior Vice-Pres. Brian Petty, IADC; Land Division Vice-Pres. David Russell, Rowan Cos. executive vice-president, drilling operations; Offshore Division Vice-Pres. Tim Juran, Seadrill senior vice-president, deepwater units Americas; Drilling Services Division Vice-Pres. Steve Richards, Key Energy Services vice-president, operations support.

IADC, founded in 1940, exclusively represents the worldwide oil and natural gas drilling industry.

IDM Group,

Cyprus, has named Byron Dunn CEO. Previously, Dunn was senior vice-president, corporate development, for Harvest Natural Resources Co. and chairman of Harvest's Russian and Chinese subsidiaries. Prior to that, he was vice-president of National Oilwell Inc., chairing the National Oilwell-Varco integration team. Dunn will initially be based in Houston.

IDM Group provides complete land rig packages and rig equipment to the oil and gas industry from its primary facilities in Houston and Stryi, Ukraine.

Enventure Global Technology LLC,

Houston, named Jolene Chipiuk technical sales representative in Calgary. She will lead Enventure's advancement of solid expandable technology (SET) in Canada. Chipiuk previously was in a business development role for a major service provider in Calgary, specializing in prospecting and delivery of high-tech components for smart wells, reservoir monitoring, and fiber optics systems.

Enventure is the world's leading provider of SET solutions for the oil and gas industry.

Imports of crude and products

	Districts 1-4 1-11 2008	Districts 1-4 1-4 2008	District 5 1-11 2008	District 5 1-4 2008	Total US 1-11 2008	Total US 1-4 2008	Total US *1-12 2007
	1,000 b/d						
Total motor gasoline	938	916	—	104	938	1,020	1,035
Mo. gas. blending comp.	501	462	—	58	501	520	610
Distillate	290	131	19	—	309	131	277
Residual	215	361	—	20	215	381	504
Jet fuel-kerosine	85	37	—	129	85	166	137
Propane-propylene	186	110	27	19	213	129	239
Other	774	760	114	–9	888	751	465
Total products	**2,989**	**2,777**	**160**	**321**	**3,149**	**3,098**	**3,267**
Total crude	**9,189**	**8,486**	**1,200**	**1,320**	**10,389**	**9,806**	**11,057**
Total imports	**12,178**	**11,263**	**1,360**	**1,641**	**13,538**	**12,904**	**14,324**

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

Purvin & Gertz LNG netbacks—Jan. 18, 2008

Receiving terminal	Liquefaction plant: Algeria	Malaysia	Nigeria	Austr. NW Shelf	Qatar	Trinidad
	$/MMbtu					
Barcelona	7.17	4.97	6.30	4.86	5.61	6.21
Everett	6.64	4.36	6.24	4.43	5.00	6.96
Isle of Grain	9.80	7.35	9.23	7.22	8.04	9.10
Lake Charles	5.52	3.40	5.27	3.59	3.90	6.20
Sodegaura	5.97	8.35	6.22	8.02	7.27	5.24
Zeebrugge	7.48	5.31	6.79	5.21	5.84	6.79

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

Crude and product stocks

District	Crude oil	Motor gasoline: Total	Motor gasoline: Blending comp.[1]	Jet fuel, kerosine	Fuel oils: Distillate	Fuel oils: Residual	Propane-propylene
	1,000 bbl						
PADD 1	14,522	57,916	30,036	8,508	50,831	14,058	4,251
PADD 2	61,818	51,104	17,277	8,280	29,819	1,239	18,743
PADD 3	144,125	65,397	30,136	12,603	30,448	16,391	23,660
PADD 4	13,235	6,529	2,078	602	3,179	437	[1]2,073
PADD 5	53,400	34,310	26,656	10,059	15,568	5,777	—
Jan. 11, 2008	**287,100**	**215,256**	**106,183**	**40,052**	**129,845**	**37,902**	**48,727**
Jan. 4, 2008	**282,841**	**213,063**	**105,252**	**39,716**	**128,693**	**37,374**	**51,223**
Jan. 12, 2007[2]	**321,454**	**216,786**	**96,024**	**40,186**	**141,875**	**46,079**	**57,528**

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

Refinery report—Jan. 11, 2008

District	Refinery operations: Gross inputs	Refinery operations: Crude oil inputs	Refinery output: Total motor gasoline	Refinery output: Jet fuel, kerosine	Refinery output: Fuel oils: Distillate	Refinery output: Fuel oils: Residual	Refinery output: Propane-propylene
	1,000 b/d		1,000 b/d				
PADD 1	1,519	1,518	1,705	95	547	118	59
PADD 2	3,175	3,147	2,314	195	953	51	225
PADD 3	7,158	7,066	3,245	775	1,991	316	685
PADD 4	521	515	317	28	166	17	[1]145
PADD 5	2,814	2,765	1,397	487	600	143	—
Jan. 11, 2008	**15,187**	**15,011**	**8,978**	**1,580**	**4,257**	**645**	**1,114**
Jan. 4, 2008	**15,921**	**15,771**	**9,116**	**1,511**	**4,489**	**587**	**1,203**
Jan. 12, 2007[2]	**15,296**	**15,101**	**9,113**	**1,524**	**4,001**	**652**	**1,054**
	17,436 operable capacity		**87.1% utilization rate**				

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

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

OIL&GAS JOURNAL online research center

OGJ crack spread

	*1-18-08	*1-19-07	Change $/bbl	Change, %
SPOT PRICES				
Product value	99.85	58.25	41.60	71.4
Brent crude	91.52	51.29	40.23	78.4
Crack spread	8.33	6.96	1.37	19.7
FUTURES MARKET PRICES				
One month				
Product value	100.67	59.71	40.96	68.6
Light sweet crude	91.53	51.68	39.85	77.1
Crack spread	9.14	8.03	1.11	13.8
Six month				
Product value	103.20	67.23	35.98	53.5
Light sweet crude	89.68	55.00	34.68	63.1
Crack spread	13.52	12.22	1.30	10.6

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

OGJ GASOLINE PRICES

	Price ex tax 1-16-08	Pump price* 1-16-08	Pump price 1-17-07
	¢/gal		
(Approx. prices for self-service unleaded gasoline)			
Atlanta	271.5	311.2	220.9
Baltimore	267.2	309.1	224.5
Boston	270.0	311.9	226.7
Buffalo	261.0	321.1	245.6
Miami	268.9	319.2	236.0
Newark	274.8	307.7	219.7
New York	250.8	310.9	235.3
Norfolk	277.0	314.6	214.8
Philadelphia	257.5	308.2	248.1
Pittsburgh	260.4	311.1	230.8
Wash., DC	270.6	309.0	235.1
PAD I avg.	266.3	312.2	230.7
Chicago	293.6	344.5	233.8
Cleveland	258.8	305.2	211.1
Des Moines	261.6	302.0	206.8
Detroit	254.5	303.7	205.4
Indianapolis	260.2	305.2	204.9
Kansas City	257.1	293.1	202.1
Louisville	265.2	302.1	209.0
Memphis	263.3	303.1	212.9
Milwaukee	253.6	304.9	220.4
Minn.-St. Paul	261.5	301.9	205.0
Oklahoma City	246.9	282.3	196.7
Omaha	246.6	293.0	209.8
St. Louis	266.1	302.1	204.7
Tulsa	259.6	295.0	202.9
Wichita	246.8	290.2	200.0
PAD II avg.	259.7	301.9	208.4
Albuquerque	264.0	300.4	212.7
Birmingham	254.6	293.3	215.7
Dallas-Fort Worth	249.9	288.3	217.8
Houston	250.9	289.3	211.2
Little Rock	253.2	293.4	213.8
New Orleans	263.8	302.2	216.6
San Antonio	252.6	291.0	213.6
PAD III avg.	255.6	294.0	214.5
Cheyenne	254.0	286.4	205.7
Denver	257.1	297.5	212.0
Salt Lake City	252.3	295.2	224.1
PAD IV avg.	254.5	293.0	213.9
Los Angeles	272.2	330.7	257.7
Phoenix	254.6	292.0	236.0
Portland	269.7	313.0	266.2
San Diego	278.2	336.7	267.2
San Francisco	293.2	351.7	273.1
Seattle	267.3	319.7	270.7
PAD V avg.	272.5	324.0	261.8
Week's avg.	**262.2**	**305.8**	**223.3**
Dec. avg.	**257.0**	**300.6**	**228.5**
Nov. avg.	**264.0**	**307.6**	**223.7**
2008 to date	**262.1**	**305.7**	—
2007 to date	**183.9**	**227.5**	—

*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

	1-11-08 ¢/gal		1-11-08 ¢/gal
Spot market product prices			
Motor gasoline (Conventional-regular)		Heating oil No. 2	
New York Harbor	229.55	New York Harbor	252.63
Gulf Coast	225.30	Gulf Coast	246.75
Los Angeles	214.05	Gas oil	
Amsterdam-Rotterdam-Antwerp (ARA)	221.52	ARA	252.50
Singapore	238.10	Singapore	253.33
Motor gasoline (Reformulated-regular)		Residual fuel oil	
New York Harbor	227.93	New York Harbor	177.45
Gulf Coast	225.80	Gulf Coast	171.74
Los Angeles	216.05	Los Angeles	194.11
		ARA	193.29
		Singapore	175.09

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

BAKER HUGHES RIG COUNT

	1-18-08	1-19-07
Alabama	2	7
Alaska	8	9
Arkansas	46	39
California	41	34
Land	39	32
Offshore	2	2
Colorado	94	98
Florida	0	0
Illinois	0	0
Indiana	1	1
Kansas	14	14
Kentucky	8	10
Louisiana	147	190
N. Land	50	53
S. Inland waters	21	21
S. Land	28	49
Offshore	48	67
Maryland	1	0
Michigan	1	1
Mississippi	8	16
Montana	12	19
Nebraska	0	0
New Mexico	68	89
New York	4	9
North Dakota	49	35
Ohio	10	12
Oklahoma	187	171
Pennsylvania	20	15
South Dakota	1	0
Texas	854	808
Offshore	9	13
Inland waters	4	2
Dist. 1	14	17
Dist. 2	31	23
Dist. 3	68	60
Dist. 4	86	99
Dist. 5	186	144
Dist. 6	113	129
Dist. 7B	31	37
Dist. 7C	50	49
Dist. 8	122	105
Dist. 8A	19	27
Dist. 9	47	42
Dist. 10	74	61
Utah	39	45
West Virginia	30	32
Wyoming	74	82
Others—NV-3; TN-6; VA-4	13	9
Total US	**1,732**	**1,745**
Total Canada	**560**	**606**
Grand total	**2,292**	**2,351**
Oil rigs	323	275
Gas rigs	1,401	1,466
Total offshore	59	84
Total cum. avg. YTD	**1,750**	**1,719**

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	1-18-08 Rig count	1-18-08 Percent footage*	1-19-07 Rig count	1-19-07 Percent footage*
0-2,500	60	3.3	52	—
2,501-5,000	96	50.0	104	53.8
5,001-7,500	220	26.8	229	21.3
7,501-10,000	435	1.8	414	3.3
10,001-12,500	431	4.4	416	2.6
12,501-15,000	293	0.3	249	0.4
15,001-17,500	109	—	126	0.7
17,501-20,000	67	—	73	—
20,001-over	29	—	40	—
Total	**1,740**	**7.8**	**1,703**	**7.7**
INLAND	37		34	
LAND	1,652		1,610	
OFFSHORE	51		59	

*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]1-18-08	[2]1-19-07
	1,000 b/d	
(Crude oil and lease condensate)		
Alabama	14	19
Alaska	651	781
California	643	677
Colorado	48	58
Florida	5	6
Illinois	27	26
Kansas	90	93
Louisiana	1,355	1,333
Michigan	15	15
Mississippi	47	49
Montana	93	98
New Mexico	170	164
North Dakota	106	115
Oklahoma	164	172
Texas	1,340	1,318
Utah	42	51
Wyoming	143	146
All others	60	69
Total	**5,013**	**5,190**

[1]OGJ estimate. [2]Revised.

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

US CRUDE PRICES

$/bbl*	1-18-08
Alaska-North Slope 27°	87.07
South Louisiana Sweet	94.00
California-Kern River 13°	77.95
Lost Hills 30°	86.55
Southwest Wyoming Sweet	82.07
East Texas Sweet	86.50
West Texas Sour 34°	79.50
West Texas Intermediate	87.00
Oklahoma Sweet	87.00
Texas Upper Gulf Coast	83.50
Michigan Sour	80.00
Kansas Common	86.00
North Dakota Sweet	82.25

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

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

WORLD CRUDE PRICES

$/bbl[1]	1-11-08
United Kingdom-Brent 38°	97.82
Russia-Urals 32°	93.73
Saudi Light 34°	92.52
Dubai Fateh 32°	90.79
Algeria Saharan 44°	96.72
Nigeria-Bonny Light 37°	97.00
Indonesia-Minas 34°	99.18
Venezuela-Tia Juana Light 31°	91.66
Mexico-Isthmus 33°	91.55
OPEC basket	94.20
Total OPEC[2]	92.69
Total non-OPEC[2]	92.98
Total world[2]	92.82
US imports[3]	89.60

[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]

	1-11-08	1-4-08	1-11-07	Change, %
	bcf			
Producing region	858	864	916	–6.3
Consuming region east	1,482	1,511	1,667	–11.1
Consuming region west	351	375	365	–3.8
Total US	**2,691**	**2,750**	**2,948**	**–8.7**
	Oct. 07	**Oct. 06**	**Change, %**	
Total US[2]	**3,567**	**3,452**	**3.3**	

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

Statistics

World oil balance

	2007 3rd qtr.	2007 2nd qtr.	2007 1st qtr.	2006 4th qtr.	2006 3rd qtr.	2006 2nd qtr.
	Million b/d					
DEMAND						
OECD						
US & Territories	21.03	20.97	21.07	21.09	21.25	20.91
Canada	2.45	2.28	2.34	2.26	2.28	2.20
Mexico	1.98	2.07	2.05	2.00	1.96	1.98
Japan	4.67	4.61	5.39	5.29	4.75	4.72
South Korea	2.06	2.12	2.35	2.32	2.04	2.04
France	1.93	1.85	1.97	1.95	1.93	1.87
Italy	1.63	1.67	1.69	1.71	1.68	1.65
United Kingdom	1.75	1.78	1.80	1.81	1.78	1.82
Germany	2.56	2.40	2.39	2.71	2.75	2.59
Other OECD Europe	7.53	7.27	7.36	7.53	7.29	7.46
Australia & New Zealand	1.09	1.07	1.09	1.10	1.07	1.06
Total OECD	**48.68**	**48.09**	**49.50**	**49.77**	**48.78**	**48.30**
NON-OECD						
China	7.69	7.62	7.43	7.53	7.24	7.30
FSU	4.41	4.22	4.51	4.66	4.21	4.07
Non-OECD Europe	0.73	0.78	0.85	0.78	0.72	0.77
Other Asia	8.53	8.71	8.62	8.73	8.45	8.62
Other non-OECD	15.25	14.94	14.66	14.47	14.72	14.43
Total non-OECD	**36.61**	**36.27**	**36.07**	**36.17**	**35.34**	**35.19**
TOTAL DEMAND	**85.29**	**84.36**	**85.57**	**85.94**	**84.12**	**83.49**
SUPPLY						
OECD						
US	8.40	8.53	8.43	8.40	8.38	8.34
Canada	3.38	3.33	3.42	3.39	3.31	3.16
Mexico	3.46	3.61	3.59	3.52	3.71	3.79
North Sea	4.27	4.48	4.80	4.76	4.51	4.71
Other OECD	1.56	1.54	1.50	1.55	1.55	1.44
Total OECD	**21.07**	**21.49**	**21.74**	**21.62**	**21.46**	**21.44**
NON-OECD						
FSU	12.56	12.60	12.61	12.48	12.26	12.07
China	3.87	3.96	3.92	3.81	3.85	3.87
Other non-OECD	12.06	11.77	11.40	11.73	11.91	11.70
Total non-OECD, non-OPEC	**28.49**	**28.33**	**27.93**	**28.02**	**28.02**	**27.64**
OPEC*	**34.90**	**34.58**	**34.51**	**34.97**	**35.66**	**35.19**
TOTAL SUPPLY	**84.46**	**84.40**	**84.18**	**84.61**	**85.14**	**84.27**
Stock change	**–0.83**	**0.04**	**–1.39**	**–1.33**	**1.02**	**0.78**

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

OECD total net oil imports

	Sept. 2007	Aug. 2007	July 2007	Sept. 2006	Chg. vs. previous year Volume	Chg. vs. previous year %
	Million b/d					
Canada	–1,288	–1,177	–1,089	–1,159	–129	11.1
US	12,282	12,119	12,173	12,937	–655	–5.1
Mexico	–1,545	–1,406	–1,609	–1,817	272	–15.0
France	1,707	1,831	1,790	1,482	225	15.2
Germany	2,236	2,249	2,098	2,708	–472	–17.4
Italy	1,681	1,717	1,655	1,631	50	3.1
Netherlands	1,084	1,029	1,027	1,173	–89	–7.6
Spain	1,700	1,674	1,621	1,598	102	6.4
Other importers	4,149	3,989	3,979	4,397	–248	–5.6
Norway	–2,130	–2,332	–2,138	–2,496	366	–14.7
United Kingdom	251	465	–6	128	123	96.1
Total OECD Europe	**10,678**	**10,622**	**10,026**	**10,621**	**57**	**0.5**
Japan	4,503	4,933	4,917	4,802	–299	–6.2
South Korea	2,152	1,848	2,270	2,050	102	5.0
Other OECD	828	770	869	762	66	8.7
Total OECD	**27,610**	**27,709**	**27,557**	**28,196**	**–586**	**–2.1**

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

OECD* total gross imports from OPEC

	Sept. 2007	Aug. 2007	July 2007	Sept. 2006	Chg. vs. previous year Volume	Chg. vs. previous year %
	Million b/d					
Canada	574	500	439	454	120	26.4
US	6,250	6,106	5,727	6,520	–270	–4.1
Mexico	40	35	10	10	30	300.0
France	848	844	815	799	49	6.1
Germany	448	500	567	476	–28	–5.9
Italy	1,210	1,336	1,237	1,287	–77	–6.0
Netherlands	665	644	759	601	64	10.6
Spain	732	667	629	792	–60	–7.6
Other importers	1,233	1,269	1,100	1,489	–256	–17.2
United Kingdom	244	404	310	277	–33	–11.9
Total OECD Europe	**5,380**	**5,664**	**5,417**	**5,721**	**–341**	**–6.0**
Japan	3,927	4,229	4,233	4,457	–530	–11.9
South Korea	2,298	2,116	2,363	2,409	–111	–4.6
Other OECD	738	844	727	762	–24	–3.1
Total OECD	**19,207**	**19,494**	**18,916**	**20,333**	**–1,126**	**–5.5**

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

US petroleum imports from source country

	Sept. 2007	Aug. 2007	Average YTD 2007	Average YTD 2006	Chg. vs. previous year Volume	Chg. vs. previous year %
	1,000 b/d					
Algeria	702	827	732	660	72	10.9
Angola	591	412	544	526	18	3.4
Kuwait	170	139	192	172	20	11.6
Nigeria	1,181	1,208	1,085	1,138	–53	–4.7
Saudi Arabia	1,560	1,499	1,462	1,465	–3	–0.2
Venezuela	1,333	1,330	1,354	1,458	–104	–7.1
Other OPEC	713	691	648	166	482	290.4
Total OPEC	**6,250**	**6,106**	**6,017**	**5,585**	**432**	**7.7**
Canada	2,502	2,510	2,434	2,330	104	4.5
Mexico	1,454	1,474	1,565	1,763	–198	–11.2
Norway	105	112	152	203	–51	–25.1
United Kingdom	185	174	289	290	–1	–0.3
Virgin Islands	384	320	333	324	9	2.8
Other non-OPEC	2,759	2,904	2,798	3,446	–648	–18.8
Total non-OPEC	**7,389**	**7,494**	**7,571**	**8,356**	**–785**	**–9.4**
TOTAL IMPORTS	**13,639**	**13,600**	**13,588**	**13,941**	**–353**	**–2.5**

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

Oil stocks in OECD countries*

	Sept. 2007	Aug. 2007	July 2007	Sept. 2006	Chg. vs. previous year Volume	Chg. vs. previous year %
	Million bbl					
France	187	187	187	188	–1	–0.5
Germany	279	280	282	282	–3	–1.1
Italy	134	134	132	134	—	—
United Kingdom	99	104	102	97	2	2.1
Other OECD Europe	676	672	675	668	8	1.2
Total OECD Europe	**1,375**	**1,377**	**1,378**	**1,369**	**6**	**0.4**
Canada	199	199	189	179	20	11.2
US	1,719	1,718	1,735	1,785	–66	–3.7
Japan	630	641	632	649	–19	–2.9
South Korea	157	157	165	160	–3	–1.9
Other OECD	108	106	108	109	–1	–0.9
Total OECD	**4,188**	**4,198**	**4,207**	**4,251**	**–63**	**–1.5**

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

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Request for more oil highlights US contradictions

These thoughts might have occurred to Saudi Arabia's King Abdullah when US President George W. Bush, during a visit to the desert kingdom, requested an increase in oil production:

1. The world leader who famously described his country as "addicted to oil," and who thus turned US energy discourse into a riot of wishful thinking, now asks for more oil.

The Editor's Perspective

by Bob Tippee, Editor

2. Less than a month ago, while signing a US energy bill that does nothing to boost oil supply, Bush said, "One of the most serious long-term challenges facing our country is dependence on oil, especially oil from foreign lands." Yet here he is, asking a foreign land for more oil.

3. It's bizarre for Bush to seek more foreign oil on behalf of a country that leads the world in oil use yet refuses, with leasing and other restrictions, to produce all it can domestically.

4. Yes, Saudi Arabia can produce more oil—but to what purpose? It has committed to holding 1.5 million b/d in reserve to meet demand surges. According to the International Energy Agency, the kingdom has 250,000 b/d more spare production capacity than that. Although the oil, if produced, would be heavy, sour crude not greatly in demand, the increment could ease pressure on inventories. But it also would trim total spare capacity among members of the Organization of Petroleum Exporting Countries, excluding Iraq, to 2.43 million b/d. That's barely enough to cover the sudden loss of supply from hotspots like Nigeria and Venezuela. Oil traders know this. A production increase of the likely amount thus might not lower oil prices much and might even have the opposite effect. Any larger output hike, one that shrunk the 1.5 million b/d Saudi cushion, would legitimately spook the market.

5. How does Saudi Arabia respond to this tangle of contradiction? There's only one constructive approach. Acknowledge that Bush's appeal reflects an incendiary and ill-informed political climate, for which Bush himself deserves only part of the blame. Then answer with an obviously needed reminder that, with oil no less than with any other commodity, everything depends on the market.

(Online Jan. 18, 2008; author's e-mail: bobt@ogjonline.com)

Market Journal

by Sam Fletcher, Senior Writer

Crude futures price closes at 5-week low

The February crude contract fell 71¢ to $90.13/bbl Jan. 17 on the New York Mercantile Exchange—its lowest closing in 5 weeks—after Federal Reserve Chairman Ben Bernanke told the US House Budget Committee downside risks to US economic growth in 2008 were "more pronounced" than ever. Bernanke said he was "not forecasting a recession," although a US government report showed new home construction has slowed to its lowest pace in 6 years.

Nevertheless, the market continued to support crude prices at $90/bbl—"still a very high flat price level taking in consideration the overall gloom and doom, and the product cracks have been holding (which is to be expected when the refineries are shutting for maintenance)," said Olivier Jakob of Petromatrix GMBH, Zug, Switzerland. Having fallen for three sessions, the February crude contract climbed to $90.57/bbl Jan. 18 after the White House announced a tax package aimed at stimulating the troubled US economy. Investors had little faith in the stimulus package, but traders found lower price bargains. Energy prices fell earlier as the Energy Information Administration reported a larger-than-expected build in US crude inventories—the first gain in 9 weeks. Crude inventories increased 4.3 million bbl to 287.1 million bbl in the week ended Jan. 11. Gasoline stocks gained 2.2 million bbl to 215.3 million bbl and distillate fuel inventories were up 1.1 million bbl to 129.8 million bbl. "The market is signaling that the demand side of the energy equation is much more important than the supply side," said Raymond James & Associates Inc. "It does now look as if the long seasonal build in US crude oil inventories has finally started," said Paul Horsnell at Barclays Capital Inc., London. "The mechanics of the rebound in inventories in the latest data are fairly straightforward; refinery runs moved to a more-normal seasonal level in falling dramatically by 760,000 b/d, while imports rose by 580,000 b/d. That is a combined swing of a huge 1.34 million b/d, but despite that the patterns do not seem particularly abnormal." Cushing, Okla., crude inventories "fell from their already low levels, but should still rise seasonally, if erratically, from here without threatening to spearhead any move towards a significant contango," he said.

Jakob said, "The supportive strength of the US market in 2007 has not come from strong demand but from capacity constraints and especially from refineries having great difficulties restarting from their maintenance schedule. As we enter the US refinery maintenance cycle, crude oil stocks should start their seasonal rebuilding, but products will be exposed to the refinery restart risk." The market also apparently was influenced by President George W. Bush's recent visit to Saudi Arabia where he urged King Abdullah bin Abdulaziz al-Saud to increase oil production to ease energy prices. However, Horsnell said, "A ramping up of pressure on the Organization of Petroleum Exporting Countries from external leaders often tends not to facilitate decision making." OPEC members are scheduled to meet Feb. 1. Horsnell said, "The change in the information available to ministers since their last meeting Dec. 5 would not seem to justify an increase. In other words, if they could not sanction an increase before, it will be harder to sanction an increase this time."

Energy prices

UBS Securities LLC, New York, lowered its 2008 and 2009 composite spot natural gas forecasts to $7.25/MMbtu and $7.60/MMbtu, respectively, from $8/MMbtu and $8.25/MMbtu, respectively, based on the following:

- Stronger-than-expected US gas production growth [an estimated 2.5% in 2008], primarily from increased production from the Barnett shale in Texas.
- US gas storage volumes that are well above historical levels.
- Warmer-than-normal weather this winter.
- A slowdown in US economic growth.

"Canadian imports have held steady to date despite reduced drilling activity, adding to the storage surplus," said Ronald J. Barone, managing director of UBS Securities. "With half the winter behind us, weather has been 6.1% warmer than normal. The aggregate supply growth has been somewhat offset by stronger-than-expected demand, but it has not been enough to reduce the storage surplus to a level that will support a natural gas price in excess of $8/MMBtu. As always, weather remains a wildcard." UBS raised its 2008 and 2009 West Texas Intermediate crude price forecasts to $85/bbl from $74/bbl in 2008 and to $78/bbl from $73.25/bbl in 2009, however, as a result of greater-than-expected tightening of market fundamentals in the fourth quarter of 2007, "which drained crude oil inventories," and "a slower-than-expected economic deceleration in the US economy."

(Online Jan. 21, 2008; author's e-mail: samf@ogjonline.com)

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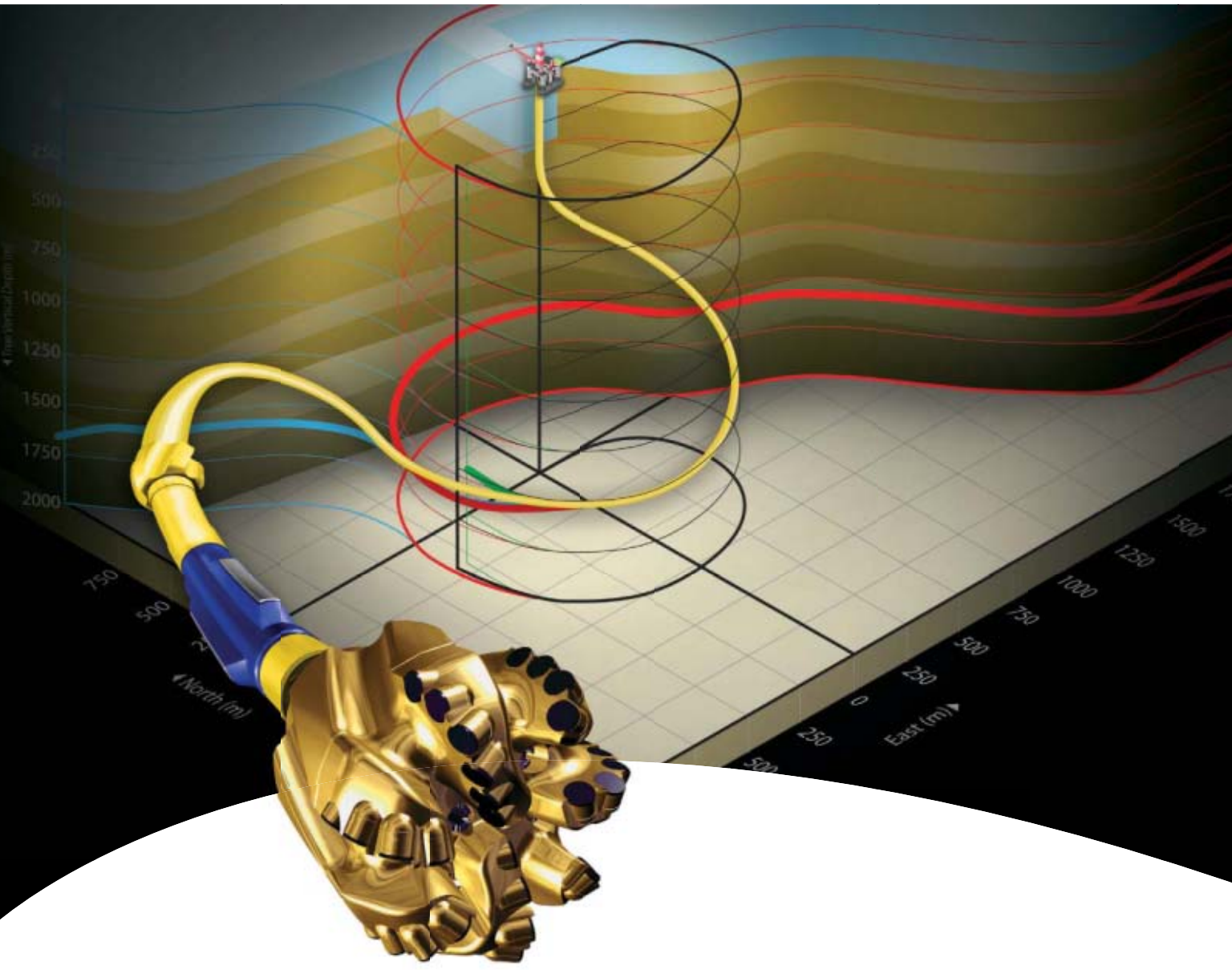

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