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Forecast & Review

PDVSA, Eni to form JVs to develop, refine Orinoco oil
Refrigeration helps recover NGL from CO_2-EOR gas
Statoil publishes Aasgard Blend assay
In-line EMAT expands IM capabilities

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Brandon Bethards
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Andy Inglis, Chief Executive, Exploration and Production, BP

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Jan. 18, 2010
Volume 108.2

FORECAST & REVIEW

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Marginally higher drilling in view in US, Canada 30
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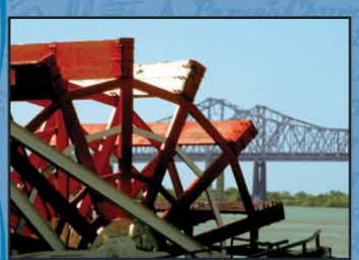
COVER

A pumping unit draws oil from deep below a cotton crop in East Texas. Oil production climbed last year in some states, including Texas, to give the US its first output gain since 1991. OGJ's annual Forecast & Review, starting on p. 20, looks at what's to come in supply and demand for oil and gas in 2010 and examines what took place in the market during 2009. Photo courtesy of Anadarko Petroleum Corp.

IADC/SPE Conference and Exhibition

drilling



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Jan. 18, 2010

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General Interest — Quick Takes

US senators support Iraq as EITI candidate

US Sens. Benjamin L. Cardin (D-Md.) and Richard G. Lugar (R-Ind.) expressed their strong support for Iraq's commitment to make its oil and gas industry more transparent following Iraq's Jan. 11 announcement that it plans to become an Extractive Industries Transparency Initiative candidate country.

EITI is an international coalition of governments, companies, and others that promotes good governance through publication of oil, gas, and mining revenues, the two Senate Foreign Relations Committee members noted on Jan. 12.

"Corruption remains a significant problem in Iraq," said Lugar, the committee's ranking minority member. "As oil and gas is the single largest source of revenue [there], it is important that the revenue generated benefit the people of Iraq and not just a handful of businessmen and officials. By committing to implement EITI, Iraq is creating a foundation for good governance in a sector critical to Iraq's future stability."

Cardin said, "This is a significant step toward a greater future for Iraq." The senator also has promoted EITI as chairman of the Commission on Security and Cooperation in Europe, more commonly known as the US-Helsinki Commission.

"The EITI process has proven to strengthen civil society and increase revenue transparency. By joining this coalition, Iraq's leaders are committing to transparency that will empower citizens to hold their government accountable," Cardin maintained.

Iraqi Prime Minister Noori al Malaki announced Jan. 11 that Iraq plans to become an EITI candidate country in February and would implement the initiative in May. With 11% of the world's total reserves, Iraq would become the largest oil-producing nation to implement the standards, EITI officials said.

At a conference launching Iraq's effort in Baghdad, Jonas Moberg, who heads EITI's secretariat, said the country's implementation of EITI would be important in driving Iraq's recovery and ensuring that its oil and gas wealth was managed for its citizens' benefit.

Lugar and Cardin, along with eight other cosponsors, recently introduced S 1700, the Energy Security Through Transparency Act, which aims to increase transparency through public disclosure of oil, gas, and mining payments, and encourage US participation in EITI.

Jakarta delays reshuffle of Pertamina board

The Indonesian government has delayed its planned announcement of a reshuffle of the board of directors of state-owned PT Pertamina until all candidates can be screened by an evaluation team and approved by the company president.

According to Indonesia's current minister of state for state-owned enterprise Mustafa Abubakar, the evaluation of new candidates by a team comprised of himself, the energy minister, the finance minister, and the chief economics minister is still underway.

"We expect the process to finish in the third week of January or at the end of the month at the latest," said Mustafa, who confirmed that Jakarta would keep Pertamina Pres. Director Karen Agustiawan, while removing the position of vice-president director now held by Omar S. Anwar.

The change is significant. When Agustiawan and Anwar were appointed last year, Indonesia's former minister of state for state enterprises Sofyan Djalil said the appointments represented a combination of business and technical expertise.

"Karen has expertise in technical aspects of the oil and gas industry, while Pak Omar has experience in business and finance," said Djalil. "I believe they are going to make a good combination for Pertamina," Djalil said (OGJ Online, Feb. 13, 2009).

In announcing the coming change, which includes reshuffling all of Pertamina's directors, Mustafa said Jakarta expects that "the new directors of Pertamina will support the company in bringing in more profit" than in previous years.

Mustafa said the new directors are expected to help the company earn 20-25 trillion rupiah ($2.16 billion) in profit during 2010. In 2008, Pertamina earned 30.2 trillion rupiah, up 54.8% from 2007, while it is predicted to earn 17.7 trillion rupiah in net profit in 2009. ✦

Exploration & Development — Quick Takes

Davy Jones cited as large gulf shelf discovery

An ultradeep exploratory well on the Davy Jones prospect could be one of the largest discoveries in decades on the Gulf of Mexico shelf, said operator McMoRan Exploration Co., New Orleans.

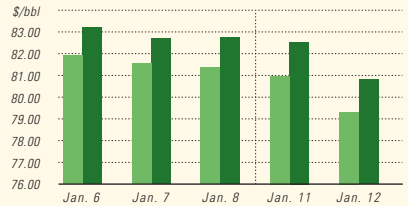
Wireline log results indicate a combined 135 net ft of hydrocarbon-bearing sands in four zones in Eocene-Paleocene Wilcox. All four zones are full to base, and two contained a combined 90 net ft of sands. The Wilcox suite logged below 27,300 ft "appears to be of exceptional quality," McMoRan said.

The Davy Jones well went to 28,263 ft measured depth in 20 ft of water on South Marsh Island Block 230. Pipe-conveyed wireline logs went as deep as 28,134 ft. McMoRan will deepen the well to 29,000 ft to test other objectives.

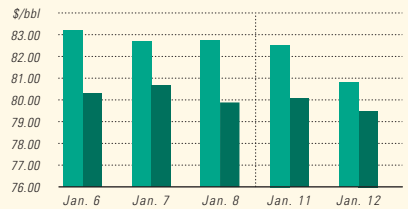
McMoRan said flow tests are required to confirm the ultimate hydrocarbon flow rates from the four separate zones. The resistivity log obtained Jan. 10 was the last information needed to con-

Industry Scoreboard

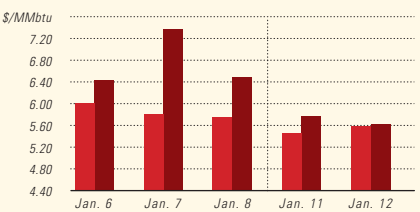
IPE BRENT / NYMEX LIGHT SWEET CRUDE



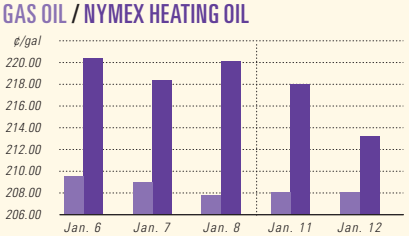
WTI CUSHING / BRENT SPOT



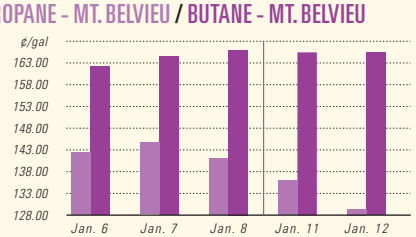
NYMEX NATURAL GAS / SPOT GAS - HENRY HUB



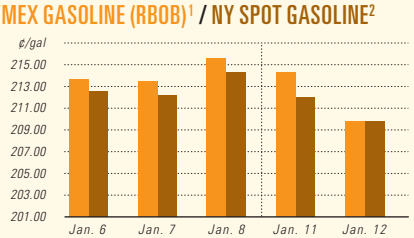
IPE GAS OIL / NYMEX HEATING OIL



PROPANE - MT. BELVIEU / BUTANE - MT. BELVIEU



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



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

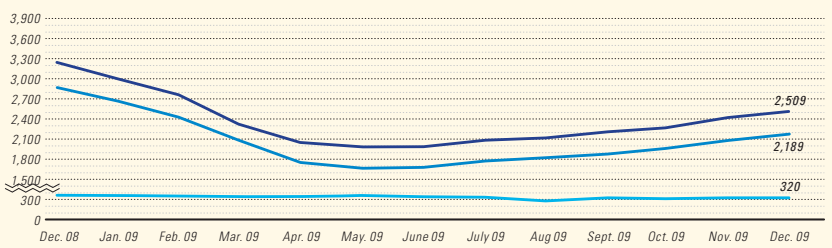
US INDUSTRY SCOREBOARD — 1/18

Latest week 1/1	4 wk. average	4 wk. avg. year ago[1]	Change, %	YTD average[1]	YTD avg. year ago[1]	Change, %
Demand, 1,000 b/d						
Motor gasoline	8,956	8,927	0.3	8,741	8,690	0.6
Distillate	3,746	3,783	–1.0	3,546	4,075	–13.0
Jet fuel	1,509	1,395	8.2	1,540	1,357	13.5
Residual	464	753	–38.4	498	700	–28.9
Other products	4,517	4,284	5.4	4,430	4,302	3.0
TOTAL DEMAND	19,192	19,142	0.3	18,755	19,124	–1.9
Supply, 1,000 b/d						
Crude production	5,517	5,056	9.1	5,507	5,246	5.0
NGL production[2]	2,039	1,786	14.2	2,039	1,797	13.5
Crude imports	7,965	9,419	–15.4	8,355	9,852	–15.2
Product imports	2,510	3,188	–21.3	2,597	3,321	–21.8
Other supply[3]	1,793	1,702	5.3	1,691	1,051	60.9
TOTAL SUPPLY	19,824	21,151	–6.3	20,189	21,266	–5.1
Refining, 1,000 b/d						
Crude runs to stills	13,820	14,360	–3.8	13,792	14,112	–2.3
Input to crude stills	14,160	14,778	–4.2	14,120	14,503	–2.6
% utilization	80.1	83.8	—	79.9	82.1	—

Latest week 1/1	Latest week	Previous week[1]	Change	Same week year ago[1]	Change	Change, %
Stocks, 1,000 bbl						
Crude oil	327,337	326,008	1,329	325,419	1,918	0.6
Motor gasoline	219,701	215,964	3,737	211,437	8,264	3.9
Distillate	159,048	159,281	–233	137,821	21,227	15.4
Jet fuel–kerosine	41,668	42,025	–357	37,374	4,294	11.5
Residual	37,181	37,180	1	33,878	3,303	9.7
Stock cover (days)[4]			Change, %		Change, %	
Crude	23.7	23.5	0.9	22.5	5.3	
Motor gasoline	24.5	23.9	2.5	23.4	4.7	
Distillate	42.5	43.2	–1.6	32.8	29.6	
Propane	31.6	34.7	–8.9	40.8	–22.5	
Futures prices[5] **12/25**			Change		Change	%
Light sweet crude ($/bbl)	82.37	79.07	3.30	42.50	39.87	93.8
Natural gas, $/MMbtu	5.82	5.77	0.05	5.90	–0.08	–1.4

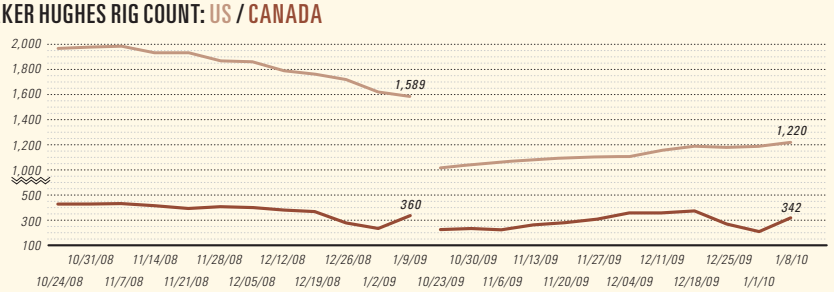
[1]Based on revised figures. [2]Includes adjustments for fuel ethanol and motor gasoline blending components. [3]Includes other hydrocarbons and alcohol, refinery processing gain, and unaccounted for crude oil. [4]Stocks divided by average daily product supplied for the prior 4 weeks. [5]Weekly average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

James R. Moffett, McMoRan co-chairman, said: "Davy Jones log results confirm our geologic model and indicate that the previously identified sands in the Wilcox section on this large ultradeep structure encompassing four OCS lease blocks (20,000 acres) provides significant additional development potential which, upon confirmation development drilling, could make Davy Jones one of the largest discoveries on the shelf of the Gulf of Mexico in decades.

"The geologic results from this well are important and are redefining the subsurface geologic landscape below 20,000 ft on the shelf of the Gulf of Mexico. The results from this well will be incorporated into our models as we continue to define the potential of this promising new exploration frontier."

McMoRan operates the Davy Jones prospect and is funding 25.7% of the exploratory costs. It holds a 32.7% working interest and 25.9% net revenue interest.

Other working interests owners include Plains Exploration & Production Co. 27.7%, Energy XXI Bermuda Ltd. 15.8%, Nippon Oil Exploration USA Ltd. 12%, W.A. "Tex" Moncrief Jr. 8.8%, and a private investor 3%.

Energy XXI is funding 14.1% of the exploratory costs to earn its 12.6% net revenue interest in the prospect.

Apache tests another discovery in Faghur basin

Houston-based Apache Corp.'s WKAL-A-2X discovery tested 5,085 b/d of oil and 130 Mcfd of gas, marking the fourth successful exploration test in West Kalabsha concession and the company's sixth discovery in the Faghur basin play in Egypt's far Western Desert near the Libyan border.

The WKAL-A-2X discovery is a 0.5 miles north of the Apache WKAL-A-1X discovery and 5 miles west of Apache's Phiops field. "With this latest discovery and other recent wells, we anticipate production from the Phiops-West Kalabsha area will double to 20,000 b/d as additional infrastructure is brought on line in the third quarter," said Rod Eichler, Apache's co-chief operating officer and president of international operations. "We estimate the discovered resource potential in the Phiops and Kalabsha areas exceeds 50 million boe."

Apache has identified several additional prospects and is acquiring more 3D seismic in the Faghur basin in hopes of extending its string of successes to the northeast and southwest of this most recent discovery. Eichler said, "The thickness of the sands and the stacked pay zones make this a very attractive area for further exploration."

Apache plans to drill seven additional exploration wells in the Faghur basin play this year.

The latest well was designed to test Cretaceous-age Alam El Buieb (AEB) formations in a new fault block in a structurally higher position than the WKAL-A-1X well. The WKAL-A-2X logged a total of 198 ft of pay in four AEB intervals including the 3G interval that was highly productive in a test of the WKAL-A-1X well. The latest well was perforated over the top 10 ft of a 29-ft section of the AEB-3C10 sand.

Apache has applied for a development lease with the Egyptian General Petroleum Co. for both discoveries. Apache operates the West Kalabsha concession and has 100% contractor interest.

InterOil makes improved test of Antelope-2

InterOil Corp., Cairns, said the Antelope-2 well in Papua New Guinea flowed at a stabilized rate of 11 MMcfd through a 48/64-in. choke in the last 7 hr of a second drill stem test, and the condensate-to-gas ratio (CGR) averaged 20.7 bbl/MMcf of natural gas.

This represents a 15% increase in CGR from the first drill stem test at the top of the reservoir, officials said.

Prior to the second test, casing was set to a depth of 7,290 ft, short of total depth of 7,415 ft due to an impassable ledge. The well subsequently was drilled an additional 213 ft, and the second test was made with a packer inside the casing shoe over the 338 ft open hole section from 7,290 ft.

Another drill stem test is planned in the lower section of the open hole. Workers will then drill and core to the targeted heavier condensate and potential oil zone where the company expects to perform additional tests and formation evaluation. Following testing and logging of the lower vertical section of the wellbore, InterOil plans to drill a horizontal lateral to explore a potential oil zone.

Phil Mulacek, InterOil chief executive officer, said, "We anticipate that the higher condensate ratio [in the second test] of the Antelope structure will improve the previously estimated economics of the stripping plant proposed to be constructed in the Gulf Province."

Algeria's Ain Tsila gas-condensate size grows

Well tests established a reservoir more than 22 km long at the Ain Tsila gas-condensate discovery on the Isarene permit in eastern Algeria's Illizi basin, said Petroceltic International PLC.

Tests at the AT-3 delineation well indicated that the gas column more than 80 m thick is in the same pressure regime as wells AT-1 and AT-2, "demonstrating that this gas-condensate discovery extends for a distance of over 22 km, from AT-1 to AT-3," Petroceltic said.

Petroceltic and Algeria's state owned Sonatrach could not frac the Ordovician reservoir at AT-3 because the pressures required exceeded the pressure rating of the wellhead equipment.

Local high in-situ stress caused by localized tectonic history is a known issue in other Illizi basin fields in Algeria. Petroceltic considers the pressure regime likely to be of limited extent rather than regionally extensive. The company filed a discovery declaration for Ain Tsila field.

Petroceltic suspended the well with a view to completing the fracture stimulation and testing as part of a future Ain Tsila appraisal campaign when wellhead equipment with a higher pressure rating can be deployed, possibly later in 2010, subject to government and partner approval.

Petroceltic said, "Data from the three wells drilled in the Ain Tsila discovery have demonstrated the presence of an extensive and probably continuous gas accumulation capable of flowing at rates exceeding 30 MMscfd following fracture stimulation."

The company is drilling the INW-2 well on the Issaouane Northwest prospect in the northwest part of the block. The rig has logged two gas-bearing intervals in the primary Devonian F2 objective and is drilling in the secondary Ordovician reservoir ob-

jective. The Devonian F2 gas intervals will be tested after drilling is finished.

Petroceltic said it is "working to interpret and integrate the large volume of data from these discoveries, with a view to making an application to the Algerian authorities for an appraisal period extension to the production-sharing contract in the near future.". ✦

Drilling & Production — *Quick Takes*

ExxonMobil plans injection for Hawkins field

ExxonMobil Production Co. plans to reinject nitrogen and other gases to produce an additional 40 million boe from mature Hawkins field in northeastern Texas.

Company officials plan to install equipment to recover the gases from the field's natural gas production and reinject them into the reservoir to increase production. They claim the project will reduce the plant's air emissions by almost one-third and extend the life of the field, discovered by the forerunner of ExxonMobil in 1940, for an additional 25 years.

Construction is expected to begin in the first quarter, employing a workforce of 300 at its peak. Start-up is anticipated in late 2011.

Hawkins field lies in Wood County about 100 miles east of Dallas and is one of the largest fields discovered in the state. Over the past 70 years, it has produced more than 800 million bbl of oil.

Exco ordered to stop Marcellus drilling

Exco Resources Inc., Dallas—the first company permitted in an eastern Pennsylvania county to drill for natural gas on the Marcellus shale formation—has been ordered to cease operations.

According to Greenfield Township in Lackawanna County, Exco violated a local zoning ordinance. State regulators last summer gave the company a permit to drill near the Skyline Public Golf Course, which is zoned for commercial recreation.

But Township supervisor Joseph Slebodnik has since said drilling for gas is not allowed in that area. Exco has 30 days to appeal the violation notice to the township's zoning hearing board.

Exco Chief Operating Officer Hal Hickey said the company will continue working with the township and will ensure the firm is in full compliance with "all governing jurisdictions."

Last July, Exco said it received the permit from state regulators to drill two sites near the Skyline Public Golf Course in Greenfield Township.

According to reports, the golf course was part of a collectively negotiated gas lease of 25,000 acres that Exco bought for $2,100/acre and an 18% production royalty.

The award came after Pennsylvania's Department of Environmental Protection issued a statement in April in support of drilling for gas in the Marcellus shale, noting that "the Commonwealth fully supports these activities and the development of the Marcellus play."

Since then, however, environmental activists have been stepping up pressure on Pennsylvania officials to discontinue drilling for gas in the state's Marcellus shale areas.

In December, the activist PennEnvironment organization pressured public officials with a report outlining what it called "the most urgent and widespread" environmental and public health concerns associated with Marcellus Shale gas drilling in the state.

"Our elected officials are going to have to make a decision: are they going to protect the public's health, or are they going to put polluter profits ahead of the health of the Commonwealth's citizens and environment?" said said Erika Staaf, Clean Water Advocate with PennEnvironment. ✦

Processing — *Quick Takes*

Partnership acquires Gulf brand from Chevron

Gulf Oil LP, Framingham, Mass., acquired all rights, title, and interest to the Gulf brand in the US from Chevron USA Inc. and plans to expand its use of the brand throughout the US.

Although the brand has been in existence nearly 110 years, for the last 20 years Gulf-branded gasoline in the Lower 48 has been available only in an 11-state region in the Northeast through a licensing agreement between Chevron and Gulf Oil's parent Cumberland Farms Inc. The limited partnership is one of the Northeast's largest wholesalers of petroleum products.

In 2005, Gulf Oil initiated an extensive overhaul of its marketing and business strategy to enhance the brand value of Gulf and to restore the image and perception of Gulf as a premium gasoline retailer.

The forerunner Gulf Oil Corp., formed in 1907, was a major international oil company that once ranked among the top "Seven Sisters." In the first decade of the 20th century, the company promoted the concept of branded products by selling gasoline in containers and from pumps marked with a distinctive orange disc logo. It is credited with establishing the first drive-in service station in 1911. Gulf Oil was merged into Chevron in 1984. To comply with federal antitrust provisions, Chevron sold some Gulf stations to Cumberland Farms in 1985.

Petrochemical complex advances in Qatar

Qatar Petroleum and ExxonMobil Chemical Qatar Ltd. have agreed to advance development of a petrochemical complex that would include the world's largest steam cracker at Ras Laffan, Qatar.

The complex, which the companies still label "proposed," would include a 1.6 million-tonne/year (tpy) steam cracker, two 650,000-tpy gas-phase polyethylene plants, and a 700,000-tpy ethylene glycol plant.

Feed will be natural gas from supergiant North field. The complex will use ExxonMobil steam cracking and polyethylene processes and product technologies.

The plant would start up in late 2015.

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Contract let in Spanish refinery expansion

Repsol YPF SA has let contract to Foster Wheeler AG to design, supply, and erect a heat recovery steam generator to be integrated in a cogeneration plant under construction in the expansion of its Cartagena refinery in Murcia, Spain (OGJ, Apr. 7, 2008, p. 24).

The 40-Mw cogeneration plant is part of a project that will double distillation capacity to 220,000 b/d.

Other capacity additions include 50,000 b/d of hydrocracking, 60,000 b/d of coking, and 60,000 b/d of desulfurization.

More than 50% of the expanded complex's output will be middle distillates, mainly diesels. ✦

Transportation — *Quick Takes*

Uzbekistan cuts gas by 50% to Tajikistan

Uzbekistan's state-owned Uzbektransgaz has reduced its supplies of natural gas to neighboring Tajikistan by 50% due to a dispute over payment.

Shavkat Shoimov, deputy head of Tajikstan's state-owned Tajiktransgaz said Uzbektransgaz demanded prepayment for gas, but his country does not "have such means and there are no free resources."

Shoimov said, "We do not have funds to make prepayments now. Funds we have are enough for only 2 or 3-day gas shipments," he said.

"This is the reason for gas supply cuts from 480,000 cu m to 240,000 cu m/day," said Shoiumov, who added that his firm in turn has had to impose cuts on to Tajik factories.

According to analyst IHS Global Insight, Uzbekistan regularly halts or sharply reduces gas exports to Tajikistan, usually to enforce payment of debts accumulated for supplies already received.

"In an effort to end this cycle of debt and supply cut-offs, Uzbekistan last year began requiring its main gas debtor countries—Kyrgyzstan and Tajikistan—to make prepayments for gas supplies," the analyst said.

Last month, Tajiktransgaz and Uzbektransgaz signed an agreement on Uzbek gas shipments to Tajikistan in 2010. Under the agreement, Tajikistan is due to import 250 million cu m of gas from Uzbekistan next year.

At the time, Tjiktransgaz head Saidmamat Sharofiddinov said the gas price would vary quarterly depending on the on world market trends and that "The gas price for the first quarter of 2010 will become known only in early January."

Sharofiddinov also said that Tajikistan would buy Uzbek gas on a take-or-pay agreement and that under the contract "The conditions remain the same—we will make prepayments every 10 days."

PetroChina assumes Aramco lease at Statia terminal

PetroChina, eyeing shifts in world trading patterns, has taken over Saudi Aramco's lease on 5 million bbl of oil storage capacity at the NuStar Energy LP Statia terminal on the Dutch Caribbean island of St. Eustatius.

The facility, which was released after Aramco obtained free oil storage facilities in Okinawa, is a strategically located hub for oil tankers plying the waters between North, Central, and South America and the Caribbean.

It can handle the largest oil tankers, is close to major US refining and transport hubs on the Gulf Coast, and can eventually be used by China as part of a broader oil trading network within the region and beyond.

Analysts said PetroChina's lease of the facility anticipates the expansion of the Panama Canal now under way, which will allow passage of larger ships carrying greater amounts of oil, LNG, and other commodities.

Overall, Panama is spending $5.25 billion in the first major expansion of the canal since it was opened in 1914. Enlargement of the canal, which currently handles 5% of global trade, is to be completed in 2014.

The enlarged canal will allow passage of tankers capable of carrying 1 million bbl of oil, LNG carriers, and Capesize bulk cargo vessels that transport coal, metals, and other raw materials, taking weeks off transit times and shifting global trade patterns. Asian countries may find it cheaper to buy oil from traditional US suppliers such as Venezuela as shipping costs come down, and analysts say the amount of crude stored in the Caribbean will likely increase as improved logistics allow traders to take advantage of more arbitrage opportunities.

FERC issues final EIS for proposed Ruby gas line

Construction of a proposed natural gas pipeline from southwestern Wyoming to southern Oregon could create some adverse environmental impacts that could be mitigated, the US Federal Energy Regulatory Commission said on Jan. 8.

The $3 billion Ruby Pipeline Project would extend 675 miles from an interconnect with existing pipelines near Opal, Wyo., across northern Utah and Nevada to interconnects east of Malin, Ore., according to its sponsor, Ruby Pipeline LLC. It would include four compressor stations with 160,500 hp of total capacity in addition to the 42-in. line with an initial capacity of 1.5 bcfd of gas, the El Paso Corp. subsidiary said at its web site.

The project's adverse environmental impacts could be reduced to less than significant levels with implementation of the sponsor's proposed mitigation measures, additional mitigation measures which Ruby is discussing with other agencies, and additional FERC recommendations, the final EIS indicated.

FERC said its final EIS decision was based on factors including more than 44% of the project using existing right-of-way or land nearby, Ruby's commitment to design and operate the pipeline in accordance with US Department of Transportation regulations, and Ruby's plans to implement site-specific or activity-specific plans, procedures, and agreements to protect natural resources, avoid or limit environmental impacts, and promote restoration of disturbed areas.

The project's sponsor said that construction could begin later this year after all permits are obtained, with an estimated March 2011 in-service date. ✦

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

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Refinery	E1340	E1340C
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Petrochemical	E1341	E1341C
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U.S. Pipeline Study — There are 14 categories of operating and financial data on the liquids pipeline worksheet and 13 on the natural gas pipeline worksheet.
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Worldwide Survey of Line Pipe Mills — Detailed data on line pipe mills throughout the world, process, capacity, dimensions, etc.
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Letters

Climate and plague

St. Augustine said it best: "Faith is to believe what we cannot see; and the reward of this faith is to see what we believe," in this particular case, the deleterious effects of man-made carbon dioxide emissions. On the other hand, if one prefers to trust evidence, the answers are perfectly clear.

Carbon dioxide is a transparent, odorless, and tasteless gas and not a pollutant. Its concentration is increasing slowly in the atmosphere but has not yet reached 400 ppm, while it will take 20,000 ppm to make you feel short of breath and 50,000 ppm to kill you. No reason to panic.

Some 18,000 years ago the Arctic Ice Cap covered much of the north part of this continent, Europe, and Asia; there was 1 km of ice over the place where I am writing these lines. Most of it has now melted, and it is likely that all of it will soon. This is corroborated by a concomitant rise of sea level. No sane person denies global warming or its fluctuations.

The ice cores have sampled a 620,000-years-long record. There is no substantial controversy about their analysis or interpretation. They show seven distinct glaciations separated by interglacial periods. We had nothing to do with bringing about these climate changes since we appeared only some 180,000 years ago and started substantive emissions of carbon dioxide only 150 years ago.

The ice cores show that every interglacial period started with a sharp increase of temperature, followed, some 600-800 years later, by a sharp rise in atmospheric carbon dioxide. Therefore, clearly, rising temperatures caused the rising levels of carbon dioxide and not the other way around. Since carbon dioxide is about two times more soluble at 0° C. than at 20° C., it is obvious that rising temperatures caused it to outgas from the enormous reservoir of seawater; later, decreasing temperatures returned it to solution.

Therefore, carbon dioxide has a very subordinate effect on global temperatures. What drives them has not yet

been conclusively nailed down, but having noticed that everywhere on earth days are warmer than nights, my money is on the sun and the effects of its vagaries. The predictions of people who cannot tell the weather 1 week in advance but emit discordant claims to know it 100 years ahead shows arrogance.

The remedy proposed by many governments reminds one of Clement VI's AD 1338 prescription to end an epidemic of plague: Let all Christians travel to Rome (the center of the epidemic) and join their prayers to that of its victims. One and one-quarter million did. Ninety percent of them caught the disease and died. Not good governance, I suggest, but innocuous when compared to compelling 7 billion, soon 9 billion people to cut their carbon emissions by up to 85%.

Jamil Azad
Geoscientist
Calgary

Calendar

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

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IPAA OGIS Florida, Hollywood, Fla., (202) 857-4722, (202) 857-4799 (fax), website: www.ipaa.org. 19-20.

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Global Floating LNG Summit, London, +44 0 207 368 9300, e-mail: enquire@iqpc.co.uk, website: www.global-flngsummit.com. 20-21.

SPE Oil and Gas India Conference and Exhibition, Mumbai, (972) 952-9393, (972) 952-9435 (fax), e-mail: spedal@spe.org, website: www.spe.org. 20-22.

SPE Deep Gas Conference, Manama, (972) 952-9393, (972) 952-9435 (fax), e-mail: spedal@spe.org, website: www.spe.org. 24-27.

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

Health, Safety, Environment & Training Conference & Exhibition, Houston, (713) 292 1945, (713) 292 1946 (fax), e-mail: info@iadc.org, website: www.iadc.org. 26-27.

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

API/AGA Joint Committee on Oil and Gas Pipeline Welding Practices Conference, New Orleans, (202) 682-8000, (202) 682-8222 (fax), website: www.api.org. 27-29.

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

Journally Speaking

Writing significantly

Bob Tippee
Editor

As writers, journalists become products of accumulated correction.

To write well, after all, is partly to avoid mistakes of grammar, punctuation, usage, and other essentials. To avoid mistakes, writers must know one when they see one. Most writers outsource development of this skill.

Here's how it works: A writer submits his or her lovingly crafted copy to the tender mercies of an editor, who makes changes. (This process sometimes is known as disimprovement.) Then, especially with young writers, editors generously give voice to grand rulings that fix themselves in habit.

As a result, to take just one example, experienced journalists never write the word "approximately." "About" is shorter and therefore preferable. Journalists who don't adopt this prohibition on their own eventually encounter an editor eager to make the needed adjustment.

The word "around" won't do in this context, either, by the way. Editors will quickly tell you it means something different.

Even writers who wonder about the reasons for doing so find themselves writing "about" when they wish to express approximation. The alternative is automatic redaction, which feeds on itself. All writers know that once an editor makes a change, other alterations follow. So they write "about" every time.

Amplifying this effect is a natural migration from trade to academia, as journalists earn graduate degrees and become professors of news writing and editing. From such noble perches they can transfer their correction-shaped skills to whole classes at a time.

Subtle machinery

This machinery is subtle but comprehensive. Inevitably, however, incorrect corrections propagate through it.

Scores of journalists, for example, still believe the word "none" requires a singular verb, as in "None of the writers writes well."

Somewhere, sometime in the past, some editor—probably one who went to night school and became a journalism instructor—divined that "none" is a contraction of the singular phrase "not one."

Yet the word's prime definition is "not any," which can require a plural verb, depending on what follows the phrase. So it's okay to write, "None (not any) of the writers write well."

This revelation has caused some writers to wonder why they invested all that tuition money in journalism school. The unenlightened, thanks to some assuredly administered correction of the past, would rather swallow a wasp than follow "none" with a plural verb.

At Oil & Gas Journal, this editor is pressing a campaign against the venomous word "significant."

The adjective means important in the sense of full of meaning. Confined to that definition, it offers no offense. How else would you discuss significant digits?

But lazy writers don't stop there. They modify all manner of nouns with the word—and verbs with its adverb form.

You don't need to look hard to find sentences such as these: "Economists expect a significant increase in oil demand." "Oil demand will increase significantly."

Growl.

If the expected increase in oil demand were not significant, the writer wouldn't be writing about it. The reader needs to know what makes the increase significant. Is it historically large or small? A reversal of decline? What? It's on that point that the writer should focus.

The adverb form, "significantly," is just as vacuous. The verb phrase "increase significantly" deploys two words and seven syllables to express nothing more than a direction of change.

It's better to use short, stout verbs like "jump," "leap," or "soar," or, for a tamer tone, "rise," or "increase" with a percentage. The English language offers many options.

The problem, of course, is that choosing the best verb requires work. The writer must make a precise decision about the intended message then find the word that states it best. This task is not easy. It requires thinking and writing at the same time. Not everyone can do it.

But anyone can type lame monstrosities such as "increase significantly" onto a computer screen and plod blissfully on to the next heap of hollow syllables.

You're infected

If you have read this far you are infected. You will begin to notice how often "significant" and "significantly" appear in text, how much space they occupy, and how little they contribute to meaning.

And when you write, as you begin to type one of those abominations, a message will flash in your subconscious: There's a better way to say this.

You have been corrected. ✦

Editorial

Another leasing setback

The second-worst part of land management under US Interior Sec. Ken Salazar is duplicity. The worst part is a systematic slowdown in development of oil and gas resources.

Salazar's pattern has been described here before: He claims to be addressing reckless leasing of the Bush administration. He says he's injecting caution into a nevertheless brisk leasing program in service to national energy interests. Then he slows leasing and discourages related work. Since taking office early last year, Salazar has withdrawn leases, rescinded an oil shale leasing program, supported legislation that will prevent or impede leasing of 28 million acres, and shortened terms of offshore leases on which drilling doesn't proceed according to his schedule (OGJ, Nov. 23, 2009, p. 18).

This is no way to develop energy supply. This is no way to create jobs.

Creating delay

Salazar now has announced onshore leasing reforms certain to create delay and thwart activity (see story, p. 33). Among other things, the reforms will limit use of categorical exclusions, which the Energy Policy Act of 2005 created to streamline environmental reviews. True to form, the interior secretary claimed to be correcting the Bush administration's "anywhere, anyhow" policy while pressing forward with a healthy leasing schedule. Neither claim is valid.

Salazar selectively offers leasing figures to imply his department harbors no reluctance to make federal land available for oil and gas leasing. In a press conference on the new onshore rules, he averred that the Bureau of Land Management in 2009 held 35 offering of onshore leases involving 2,542 parcels covering 2.9 million acres.

To Americans unfamiliar with the issue, those numbers might seem to describe a robust effort. To them, Interior thus might appear to be meeting its statutory obligations to offer public land for oil and gas development. To those Americans, therefore, industry protestations can seem unfounded. Salazar played to these impressions when he said, "I think those in the industry who are crying out are crying out because we're being careful and supporting development in the right way in the right places."

In fact, onshore leasing has slowed remarkably. Environmentalists opposed to oil and gas work know this and know enough about leasing numbers to be pleased. An offering of 2,542 parcels in 12 months represents a shrunken program. In late November, Salazar said BLM in 2009 had sold 1,212 of 2,346 parcels offered. At that rate, it will have issued 1,313 leases in calendar 2009.

Indeed, that's much less leasing than occurred during the Bush administration. According to calculations from BLM data, the federal government issued an average of 2,976 leases/year during 2001-08. Through that period, Salazar said in the press conference, BLM worked as a "candy store" for the petroleum industry, representatives of which were "kings of the world." The implication is that—with BLM acting as "essentially the handmaiden of the industry"—onshore oil and gas leasing surged ahead under Bush and that the interior secretary now is bringing it back under control.

If Salazar's premise is true, leasing during the Bush term should have exceeded activity of prior years. By the best measure of the propensity to lease—leases issued—it did not. The average number of leases issued per year during the Clinton administration was 3,796—28% above the Bush rate.

So Salazar is wrong when he claims to be sustaining leasing at healthy levels; in fact, he's discouraging an activity that's good for employment and essential to energy supply. And he's wrong in his portrayals of the Bush tenure as a period of unbridled leasing; in fact, average annual onshore leases per year in that period declined.

Troubling prejudice

Salazar's rhetorical slaps at the oil and gas industry should trouble anyone concerned about energy supply. They reveal prejudice substantiated by the interior secretary's record of leasing resistance. It's a record that contradicts US energy and employment imperatives. And it's a record spun out of a pattern of misrepresentation.

The US needs better stewardship of federal oil and gas resources than Salazar so far has provided. ✦

US energy demand set for slim expansion in 2010

Marilyn Radler
Senior Editor-Economics

Laura Bell
Statistics Editor

Moderate economic growth will spur a small recovery in US energy demand this year.

Total US energy demand will grow less than 1% in 2010 on the heels of last year's 4% decline. Demand for oil, natural gas, and renewable energy sources will increase, while a slide in coal demand will add to last year's drop.

OGJ looks for oil prices to move more in line with market fundamentals this year. The 2009 rise in oil prices was tied to the prospect of an economic recovery and weakness in the US dollar more than to supply and demand levels.

While the amount of US commercial crude oil in storage was robust during 2009, finishing the year above the year-end 2008 level, so were crude prices. The spot price of West Texas Intermediate averaged $77.99/bbl in November 2009, having climbed from an average of $39.09/bbl in February of that year.

Global oil demand

Oil demand in 2010 in Organization for Economic Cooperation and Development (OECD) countries will be unchanged from a year ago, averaging 45.5 million b/d, according to estimates from the International Energy Agency. But a 1.5 million b/d boost in demand from countries outside the OECD will cause total demand to climb.

Worldwide demand for oil this year will average 86.3 million b/d, rebounding from last year's average of 84.9 million b/d and nearly reaching the 2007 average of 86.5 million b/d.

IEA estimates that demand in OECD Pacific countries will slump a bit in 2010, but that demand in OECD North America will take up this slack. Outside the OECD, IEA expects a climb in demand in all areas except Europe, which will hold demand at an average of 700,000 b/d this year. The largest non-OECD increase in demand will be in the Middle East, where demand will average 7.6 million b/d, up from 7.2 million b/d last year.

In 2009, oil demand sank in North America to average 23.3 million b/d vs. 24.2 million b/d a year earlier. Demand averaged 14.6 million b/d in OECD Europe, down from the 2008 average of 15.3 million b/d.

Outside the OECD last year, collective demand grew. Chinese demand managed to climb to average 8.4 million b/d in 2009, up from 7.9 million b/d a year earlier. The only non-OECD region to post a contraction was the former Soviet Union, where demand averaged 3.9 million b/d vs. a year-earlier average of 4.2 million b/d.

Worldwide oil supply

Worldwide output of oil will increase this year to average 86 million b/d, compared with 84.9 million b/d last year and 86.4 million b/d two years ago.

All of the supply growth will come from non-OECD countries, as OECD output will shrink this year, according to IEA estimates. Crude and natural gas liquids production will decline in Mexico, Norway, and the UK.

Outside the OECD, IEA calls for oil output to increase in Brazil, Colombia, Oman, Russia, Azerbaijan, and China. Total non-OPEC, non-OECD supply will average 30.3 million b/d this year, up 1

million b/d from last year.

Including processing gains and other biofuels, IEA forecasts that 2010 non-OPEC supply will average 51.6 million b/d, up from last year's 51.3 million b/d.

IEA figures also show that NGL production within OPEC, which is not subject to the group's output ceilings, will continue to climb, averaging 5.7 million b/d this year. Last year the organization's NGL supply averaged 4.9 million b/d.

OGJ estimates that OPEC crude output will average 28.68 million b/d this year, nearly unchanged from 2009. Considering the current demand estimates, this would end in a stockdraw of 300,000 b/d for the year.

With oil prices near $80/bbl at the start of 2010 and economic recovery still weak in many industrialized countries, OPEC should be reluctant to cut its output ceilings any time soon. Despite full OECD oil inventories, an oil-price spike now could strike a blow to economic recovery in the US and elsewhere.

In 2009, OPEC crude supply averaged an estimated 28.73 million b/d, resulting in an average worldwide oil supply of 84.9 million b/d and no change in inventories.

WORLDWIDE SUPPLY AND DEMAND

	2009 1st Qtr.	2nd Qtr.	3rd Qtr.	4th Qtr.	Year	2010 1st Qtr.	2nd Qtr.	3rd Qtr.	4th Qtr.	Year
	Million b/d									
DEMAND										
OECD										
North America	23.5	22.9	23.3	23.4	23.3	23.4	23.1	23.6	23.6	23.4
Europe	14.9	14.2	14.5	14.7	14.6	14.8	14.3	14.6	14.8	14.6
Pacific	8.1	7.3	7.3	7.9	7.7	8.0	7.1	7.1	7.6	7.5
Total OECD	**46.6**	**44.4**	**45.1**	**46.0**	**45.5**	**46.2**	**44.5**	**45.3**	**46.1**	**45.5**
Non-OECD										
FSU	3.9	3.8	4.0	4.0	3.9	4.1	4.0	4.2	4.2	4.1
Europe	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7
China	7.7	8.6	8.8	8.6	8.4	8.4	8.9	8.8	8.7	8.7
Other Asia	9.9	10.1	9.7	9.8	9.9	10.3	10.3	10.0	10.1	10.2
Latin America	5.8	6.0	6.1	6.0	6.0	6.0	6.2	6.3	6.2	6.2
Middle East	6.7	7.3	7.8	7.1	7.2	7.1	7.6	8.0	7.5	7.6
Africa	3.2	3.2	3.2	3.2	3.2	3.3	3.3	3.3	3.3	3.3
Total Non-OECD	**37.9**	**39.7**	**40.3**	**39.5**	**39.3**	**39.9**	**41.1**	**41.4**	**40.8**	**40.8**
Total Demand	**84.5**	**84.1**	**85.3**	**85.5**	**84.9**	**86.1**	**85.6**	**86.7**	**86.8**	**86.3**
Supply										
OECD										
North America	14.2	13.9	14.2	14.3	14.1	14.2	13.9	13.5	13.9	13.9
Europe	4.9	4.5	4.2	4.3	4.5	4.3	3.9	3.8	4.0	4.0
Pacific	0.7	0.6	0.7	0.7	0.7	0.7	0.8	0.8	0.8	0.8
Total OECD	19.7	19.0	19.0	19.2	19.2	19.2	18.6	18.1	18.7	18.6
Non-OECD										
FSU	13.0	13.2	13.3	13.6	13.3	13.7	13.9	13.7	13.9	13.8
Europe	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
China	3.7	3.8	3.8	3.9	3.8	4.0	4.0	4.0	4.1	4.0
Other Asia	3.6	3.6	3.6	3.6	3.6	3.7	3.7	3.8	3.8	3.7
Latin America	4.3	4.3	4.3	4.4	4.3	4.5	4.5	4.6	4.7	4.6
Middle East	1.7	1.7	1.7	1.6	1.6	1.6	1.6	1.6	1.6	1.6
Africa	2.5	2.5	2.5	2.5	2.5	2.5	2.4	2.4	2.4	2.4
Total Non-OECD	29.0	29.2	29.4	29.7	29.3	30.1	30.3	30.2	30.6	30.3
Processing gains	2.3	2.3	2.3	2.3	2.3	2.2	2.2	2.2	2.2	2.2
Other biofuels	0.4	0.4	0.5	0.4	0.4	0.5	0.5	0.5	0.5	0.5
Total Non-OPEC	**51.3**	**50.9**	**51.2**	**51.7**	**51.3**	**52.0**	**51.6**	**51.1**	**52.0**	**51.6**
OPEC										
Crude	28.5	28.5	28.8	29.1	28.7	28.9	28.5	28.5	28.8	28.7
NGL	4.6	4.7	5.0	5.2	4.9	5.4	5.6	5.9	6.0	5.7
Total OPEC	**33.1**	**33.2**	**33.9**	**34.3**	**33.6**	**34.3**	**34.1**	**34.4**	**34.8**	**34.4**
Total supply	**84.4**	**84.0**	**85.0**	**86.0**	**84.9**	**86.3**	**85.7**	**85.5**	**86.8**	**86.0**
Stock change	--	(0.1)	(0.3)	0.5	--	0.2	0.1	(1.2)	--	(0.3)

Totals may not add due to rounding.
Source: International Energy Agency , OGJ estimates for OPEC crude 4th quarter and year 2009, and all of 2010 OPEC crude.

US economy, energy

The economy's recovery will be tempered by a lack of jobs growth, as companies remain reluctant to hire in 2010 due to uncertainties about taxes and the availability of credit.

OGJ forecasts that the US economy will grow 3% this year, but jobs growth will be slow. The Bureau of Labor Statistics reported that for December 2009, the unemployment rate was unchanged from the previous month at 10%. However, the civilian labor force that month lost 661,000 persons. Had they been counted among the unemployed, the rate would have jumped above the October 2009 rate of 10.2%.

Some large retailers recently have reported better-than-expected results

US ENERGY DEMAND

	2008	2009	Change, %	2010	Change, %	% share of total energy 2008	2009	2010
Oil	37,285	35,600	–4.5	35,960	1.0	37.5	37.3	37.5
Gas	23,788	23,360	–1.8	23,710	1.5	23.9	24.5	24.7
Coal	22,421	20,180	–10.0	19,780	–2.0	22.6	21.2	20.6
Nuclear	8,455	8,460	0.1	8,460	0.0	8.5	8.9	8.8
Hydro, other	7,476	7,775	4.0	8,000	2.9	7.5	8.2	8.3
Total	**99,425**	**95,375**	**–4.1**	**95,910**	**0.6**	**100.0**	**100.0**	**100.0**

Source: 2008 US Energy Information Administration; 2009 and 2010 OGJ estimate and forecast.

OGJ FORECAST OF US SUPPLY AND DEMAND

	Year 2010 Volume 1,000 b/d	Year 2010 % change from 2009	Year [1]2009 Volume 1,000 b/d	Year [1]2009 % change from 2008
DOMESTIC DEMAND				
Motor gasoline	9,045	0.5	9,000	0.1
Dist. 1–4	7,460	0.5	7,423	0.1
Dist. 5	1,585	0.5	1,577	0.1
Jet fuel	1,425	1.1	1,410	–8.4
Dist. 1–4	989	1.1	978	–8.4
Dist. 5	436	1.1	432	–8.4
Distillate	3,650	1.5	3,595	–8.9
Dist. 1–4	3,165	1.5	3,117	–8.9
Dist. 5	485	1.5	478	–8.9
Residual	525	–0.4	527	–15.3
Dist. 1–4	393	–0.4	395	–15.3
Dist. 5	132	–0.4	132	–15.3
LPG and ethane	1,950	1.8	1,915	–2.0
Dist. 1–4	1,894	1.8	1,860	–2.0
Dist. 5	56	1.8	55	–2.0
Other products	2,220	1.7	2,182	–10.9
Dist. 1–4	1,971	1.7	1,937	–10.9
Dist. 5	249	1.7	245	–10.9
TOTAL DOMESTIC DEMAND	**18,815**	**1.0**	**18,629**	**–4.5**
Dist. 1–4	15,872	1.0	15,711	–4.4
Dist. 5	2,943	0.8	2,918	–4.5
EXPORTS	**2,000**	**–2.9**	**2,060**	**14.3**
Dist. 1–4	1,671	–2.9	1,722	14.3
Dist. 5	329	–2.9	338	14.3
TOTAL DEMAND	**20,815**	**0.6**	**20,689**	**–2.9**
Dist. 1–4	17,544	0.6	17,433	–2.9
Dist. 5	3,271	0.5	3,256	–2.9
SUPPLY				
DOMESTIC PRODUCTION				
Crude & condensate	5,450	2.6	5,310	7.3
Dist. 1–4	3,979	2.6	3,877	7.3
Dist. 5	1,471	2.6	1,433	7.3
NGL	1,950	2.6	1,900	6.5
Dist. 1–4	1,878	2.6	1,830	6.5
Dist. 5	72	2.6	70	6.5
Total domestic production	**7,400**	**2.6**	**7,210**	**7.1**
Dist. 1–4	5,857	2.6	5,707	7.0
Dist. 5	1,543	2.6	1,503	7.2
IMPORTS				
Crude oil	8,900	–1.5	9,040	–7.6
Dist. 1–4	7,803	–1.5	7,926	–7.6
Dist. 5	1,097	–1.5	1,114	–7.6
Products & unfinished oils	2,620	–1.5	2,660	–15.1
Dist. 1–4	2,467	–1.5	2,505	–15.1
Dist. 5	153	–1.5	155	–15.1
TOTAL IMPORTS	**11,520**	**–1.5**	**11,700**	**–9.4**
Dist. 1–4	10,270	–1.5	10,430	–9.5
Dist. 5	1,250	–1.5	1,270	–8.6
Processing gain, loss, etc.	1,805	–0.7	1,817	–1.6
Dist. 1–4	1,623	–0.7	1,634	–1.6
Dist. 5	182	–0.7	183	–1.6
TOTAL NEW SUPPLY	**20,725**	**0.0**	**20,727**	**–3.6**
Dist. 1–4	17,750	–0.1	17,771	–4.0
Dist. 5	2,975	0.6	2,956	–0.7
STOCK CHANGE	**(90)**	**—**	**38**	**—**
Dist. 1–4	206	—	338	—
Dist. 5	(296)	—	(300)	—
CRUDE RUNS TO STILLS	**14,600**	**2.1**	**14,306**	**–2.3**
TOTAL INPUT TO STILLS	**14,900**	**1.8**	**14,635**	**–2.6**
TOTAL REFINING CAPACITY	**17,700**	**0.2**	**17,673**	**0.4**
REFINING UTILIZATION (%)	**84.2**	**1.7**	**82.8**	**–2.9**
TOTAL INDUSTRY STOCKS[2]	**1,016**	**–3.1**	**1,049**	**1.4**
Refined products	700	–3.0	722	1.8
Crude oil	316	–3.4	327	0.3
SPR crude oil stocks	727	—	727	3.6
IMPORT DEPENDENCY				
Total Imports % Domestic Demand	61.2		62.8	
Net Imports % Domestic Demand	50.6		51.7	

[1]Preliminary estimate. [2]Million bbl at end of period

for late-2009, and General Motors announced earlier this month that it projects it will turn a profit this year, having exited bankruptcy just last summer with government assistance.

The National Association of Credit Management (NACM) reported this month that the economy remains weak, but headed in the right direction. The group's December Credit Managers' Index (CMI) matched the mood of the economy as a whole—essentially flat, but showing some mild progress.

NACM said the performance of the CMI looks solid compared with the doldrums experienced a year ago, but in a couple of months there will be an opportunity to compare recovery periods. There has been a consistent performance since April 2009, the report said, and by April 2010, there should be a more solid level of expansion. If this doesn't start to manifest itself there will be renewed fears of a double-dip recession, NACM said.

The US GDP last year declined 1%, falling 6.4% in the first quarter and 0.7% in the second quarter. The economy fell into recession during 2008, when GDP sank by 2.7% in the third quarter and then by 5.4% in the fourth quarter.

Meanwhile, the employment situation soured. In June 2007, the US unemployment rate was 4.6%. A year later it rose to 5.6%, then unemployment rose to 7.2% in December 2008. By June 2009, the US unemployment rate was 9.4%. These figures hid the fact that many in the US were underemployed, working part time or at jobs below their skill levels.

BLS reported that the number of people working part time for economic reasons was about unchanged at 9.2 million last month and has been relatively flat since March 2009. These individuals were working part time because their hours had been cut back or because they were unable to find a full-time job.

US energy demand will grow only 0.6% this year, OGJ forecasts, following last year's contraction to 95.4 quadril-

lion btu (quads) from a 2008 total of 99.4 quads. High energy prices, the weak economy, and high unemployment will keep a limit on this year's total energy demand.

Energy by source

Some sources of energy will incur modest demand increases this year, but others will be unchanged or lower from 2009 demand levels.

The biggest gainer this year will be the category of hydroelectric power and all other renewable energy sources. Demand for this group of energy sources will grow to 8 quads, up just 2.9% from last year, and meet 8.3% of US energy needs.

Increased use of wind, hydroelectric power generation, and biofuels is driving demand for renewables, such that last year the group of energy sources posted 4% demand growth.

Natural gas demand in 2010 will climb 1.5% to 23.71 quads, based on increased use in power generation and some strengthening in industrial demand. Gas will account for 24.7% of the energy market this year.

Last year, gas demand shrank 1.8% on a decline in demand by industrial users as well as by residential and commercial customers. Electric power generators consumed slightly more gas during 2009 than during 2008.

Coal demand will fall another 2% this year after last year's 10% contraction in light of low gas prices. The use of coal moved lower across all types of its consumers but was down most sharply among industrial users and electric power generators.

Dominating the energy market with a 37.5% share, oil demand will climb 1% this year following last year's 4.5% decline. Most oil products will be in greater demand compared with last year's weak levels. Motor gasoline demand registered a small uptick, but all other products saw a decline in demand in 2009.

OGJ expects that nuclear energy demand will be unchanged in 2010 at 8.46 quads, as the number of operable units in the US holds at 104—the same number since 1998. Demand for nuclear energy barely increased last year from a total of 8.455 quads in 2008.

US NATURAL GAS SUPPLY AND DEMAND

	2007	2008	2009	Change, % 09/08	2010	Change, % 10/09
		bcf			bcf	
Marketed production						
Texas	6,092	6,810	7,015	3.0	6,900	–1.6
Louisiana	1,364	1,369	1,520	11.0	1,500	–1.3
Federal Gulf of Mexico	2,799	2,331	2,440	4.7	2,400	–1.6
Other states	9,764	10,748	10,920	1.6	11,020	0.9
Total production	**20,019**	**21,258**	**21,895**	**3.0**	**21,820**	**–0.3**
Imports						
Canada	3,783	3,589	3,300	–8.1	3,250	–1.5
Mexico	54	43	25	–41.9	20	–20.0
LNG	771	352	410	16.5	430	4.9
Total imports	**4,608**	**3,984**	**3,735**	**–6.3**	**3,700**	**–0.9**
Supplemental gas	63	55	55	—	55	—
Losses, etc.*	(1,014)	(1,128)	(1,450)	28.5	(1,300)	–10.3
Total new supply	**23,676**	**24,169**	**24,235**	**0.3**	**24,275**	**0.2**
Supply from storage	193	32	(300)	—	—	—
Total supply	**23,869**	**24,201**	**23,935**	**–1.1**	**24,275**	**1.4**
Exports	822	1,006	1,150	14.3	1,140	–0.9
Total consumption	**23,047**	**23,195**	**22,785**	**–1.8**	**23,135**	**1.5**

*Extraction losses and unaccounted for gas
Source: 2007 and 2008 Energy Information Administration; 2009 and 2010 OGJ estimates and forecast.

OIL, GAS, PRODUCTS PRICES

	Crude oil		Products		Natural gas	
Year	Average US wellhead price	Average landed cost of imports	Unleaded gasoline pump price	No. 2 fuel oil wholesale price	Average US wellhead price	Average delivered commercial price
	$/bbl		¢/gal		$/Mcf	
1976	8.19	13.32	61.4	NA	0.58	1.64
1977	8.57	14.36	65.6	NA	0.79	2.04
1978	9.00	14.35	67.0	36.9	0.91	2.23
1979	12.64	21.45	90.3	56.9	1.18	2.73
1980	21.59	33.67	124.5	80.3	1.59	3.39
1981	31.77	36.47	137.8	97.6	1.98	4.00
1982	28.52	33.18	129.6	91.4	2.46	4.82
1983	26.19	28.93	124.1	81.5	2.59	5.59
1984	25.88	28.54	121.2	82.1	2.66	5.55
1985	24.09	26.67	120.2	77.6	2.51	5.50
1986	12.51	13.49	92.7	48.6	1.94	5.08
1987	15.40	17.65	94.8	52.7	1.67	4.77
1988	12.58	14.08	94.6	47.3	1.69	4.63
1989	15.86	17.68	102.1	56.5	1.69	4.74
1990	20.03	21.13	116.4	69.7	1.71	4.83
1991	16.54	18.02	114.0	62.2	1.64	4.81
1992	15.99	17.75	112.7	57.9	1.74	4.88
1993	14.25	15.72	110.8	54.4	2.04	5.22
1994	13.19	15.18	111.2	50.6	1.85	5.44
1995	14.62	16.78	114.7	51.1	1.55	5.05
1996	18.46	20.31	123.1	63.9	2.17	5.40
1997	17.23	18.11	123.4	59.0	2.32	5.80
1998	10.88	11.84	105.9	42.2	1.96	5.48
1999	15.56	17.23	116.5	49.3	2.19	5.33
2000	26.72	27.53	151.0	88.6	3.68	6.59
2001	21.84	21.82	146.1	75.6	4.00	8.43
2002	22.51	23.91	135.8	69.4	2.95	6.63
2003	27.56	27.69	159.1	88.1	4.88	8.40
2004	36.77	36.07	188.0	112.5	5.46	9.43
2005	50.28	49.29	229.5	162.3	7.33	11.34
2006	59.69	59.11	258.9	183.4	6.39	12.00
2007	66.52	67.97	280.1	207.2	6.37	11.32
2008	94.04	93.33	326.6	274.5	8.07	11.99
2009*	56.30	58.15	235.0	167.0	3.70	9.45

*Estimated.
Source: 1976-2008 US Energy Information Administration; 2009 OGJ estimates.

US PRODUCTION OF CRUDE OIL AND LEASE CONDENSATE

	[1]2009	2008	2007	2006	2005	2004	2003	2002	2001	2000	Cumulative 1859–2009 1,000 bbl
	1,000 b/d										
District 1:											
Fla., NY, Pa., W.Va.	17	21	21	22	23	19	20	20	20	21	2,807,770
Total Dist. 1	**17**	**21**	**21**	**22**	**23**	**19**	**20**	**20**	**20**	**21**	**2,807,770**
District 2:											
Illinois	25	26	26	28	28	30	32	34	28	33	3,641,286
Indiana	5	5	5	5	5	5	5	5	6	6	558,981
Kansas	109	108	100	98	93	93	93	86	93	94	6,411,517
Kentucky	8	7	7	6	7	7	7	8	8	9	784,847
Michigan	17	17	16	14	15	18	18	24	20	22	1,275,644
Nebraska	6	7	6	6	7	7	8	8	8	8	508,029
North Dakota	210	172	124	109	98	85	81	85	87	89	1,700,238
Ohio	16	16	15	15	15	16	15	20	17	18	1,125,624
Oklahoma	182	175	172	172	170	171	179	183	188	192	14,722,715
Others[2]	7	6	5	5	5	4	4	3	4	4	72,370
Total Dist. 2	**585**	**539**	**476**	**458**	**443**	**436**	**442**	**456**	**459**	**475**	**30,801,251**
District 3:											
Alabama	20	21	20	21	22	20	22	24	26	29	659,931
Arkansas	16	17	17	17	17	18	20	21	21	20	1,794,210
Louisiana	1,410	1,153	1,266	1,272	1,061	1,470	1,562	1,538	1,620	1,534	30,335,771
Mississippi	64	60	57	48	48	47	45	51	54	54	2,377,760
New Mexico	164	162	162	164	166	176	181	183	186	184	5,455,872
Texas	1,395	1,285	1,306	1,317	1,489	1,285	1,356	1,418	1,364	1,394	63,348,751
Total Dist. 3	**3,069**	**2,698**	**2,828**	**2,839**	**2,803**	**3,016**	**3,186**	**3,235**	**3,271**	**3,215**	**103,972,295**
District 4:											
Colorado	66	66	66	64	63	60	58	40	45	50	2,018,883
Montana	77	86	96	99	90	68	53	43	44	42	1,688,601
Utah	64	60	54	49	46	40	36	41	42	43	1,364,898
Wyoming	142	145	148	145	141	141	144	153	157	166	7,066,365
Total Dist. 4	**349**	**357**	**364**	**357**	**340**	**309**	**291**	**277**	**288**	**301**	**12,138,747**
District 5:											
Alaska	648	683	722	741	864	908	974	988	963	971	16,598,029
California	641	652	667	684	704	730	767	797	799	837	28,158,579
Nevada	1	1	1	1	1	1	1	2	2	2	52,551
Total Dist. 5	**1,290**	**1,336**	**1,390**	**1,426**	**1,569**	**1,639**	**1,742**	**1,787**	**1,764**	**1,810**	**44,809,159**
US total	**5,310**	**4,951**	**5,079**	**5,102**	**5,178**	**5,419**	**5,681**	**5,775**	**5,802**	**5,822**	**194,529,111**

[1]Preliminary. [2]Includes Missouri, South Dakota, and Tennessee.

US oil supply

US oil production will continue to rebound from its recent low in 2008, when crude and condensate output averaged 4.95 million b/d. OGJ forecasts that oil production in 2010 will average 5.45 million b/d, up from 5.31 million b/d last year.

During 2009, there were no major disruptions to production, such as hurricanes in the Gulf of Mexico. This is in sharp contrast to 2008, when two major storms caused average US oil production to sink below 4 million b/d in the month of September of that year.

Alaskan oil production slid last year to average an estimated 648,000 b/d, down from the 2008 average of 683,000 b/d. In its December 2009 Short-Term Energy Outlook, EIA forecasts that Alaskan oil production this year will fall to average 590,000 b/d.

In 2009, average oil production increased in a few states, including Louisiana, North Dakota, Texas, and Oklahoma. Average production in Louisiana jumped to an estimated 1.41 million b/d last year from a 2008 average of 1.153 million b/d. In North Dakota, oil production climbed to an estimated 210,000 b/d last year from 172,000 b/d a year earlier.

NGL production will climb to average 1.95 million b/d, up from 1.9 million b/d in 2009 and 1.784 million b/d in 2008.

Imports, exports

In 2010, US imports will slide, although not as sharply as they did last year. OGJ forecasts that the US will import 8.9 million b/d of crude in 2010, excluding any for the Strategic Petroleum Reserve. This will be a 1.5% decrease, following a 7.6% decline in crude imports last year.

US imports of petroleum products also will fall by 1.5% this year to average 2.62 million b/d, following last year's 15.1% decline on extremely weak demand for products and plentiful volumes in storage.

Last year, the source of the most US crude and products imports was Canada, with average volume of 2.228 million

Supply and demand for crude in the US

	[1]2009	2008	2007	2006	2005	2004	2003	2002	2001	2000
					1,000 b/d					
SUPPLY										
Crude imports[2]	9,040	9,783	10,031	10,118	10,126	10,088	9,665	9,140	9,328	9,071
Crude production	5,310	4,950	5,079	5,102	5,178	5,419	5,681	5,746	5,801	5,822
Unaccounted for crude	64	65	39	25	76	143	54	110	117	155
Total supply	**14,414**	**14,798**	**15,149**	**15,245**	**15,380**	**15,650**	**15,400**	**14,996**	**15,246**	**15,048**
DEMAND										
Crude refinery runs	14,306	14,648	15,156	15,242	15,220	15,475	15,304	14,947	15,128	15,067
Crude exports	37	29	27	25	32	27	12	9	20	50
Crude into SPR	68	13	23	11	25	102	108	134	26	–73
Total demand	**14,411**	**14,690**	**15,206**	**15,278**	**15,277**	**15,604**	**15,424**	**15,090**	**15,174**	**15,044**
Crude stock change (industry)	3	108	–57	–33	103	46	–24	–94	72	4
Primary (industry)[3]	327	326	286	312	324	286	269	278	312	286
SPR	727	702	697	689	685	676	638	599	550	541
Total crude stocks (million bbl)	**1,054**	**1,028**	**983**	**1,001**	**1,009**	**962**	**907**	**877**	**862**	**827**

[1]Preliminary. [2]Includes imports for the Strategic Petroleum Reserve. [3]Includes Alaskan crude in transit.
Source: US Energy Information Administration.

US energy consumption and efficiency

Year	GDP, billion 2005 $	Energy consumption, trillion btu	Energy consumption per GDP, 2005 $ (Mbtu)	Oil energy consumption, trillion btu	Oil energy consumption per GDP, 2005 $ (Mbtu)	Natural gas energy consumption, trillion btu	Natural gas energy consumption per GDP, 2005 $ (Mbtu)	Total oil and natural gas energy consumption, trillion btu	Total oil and gas energy consumption per GDP, 2005 $ (Mbtu)	Oil and natural gas energy % of total energy
1973	4,917.0	75,708	15.4	34,840	7.1	22,512	4.6	57,352	11.7	75.8
1974	4,889.9	73,991	15.1	33,455	6.8	21,732	4.4	55,187	11.3	74.6
1975	4,879.5	71,999	14.8	32,731	6.7	19,948	4.1	52,679	10.8	73.2
1976	5,141.3	76,012	14.8	35,175	6.8	20,345	4.0	55,520	10.8	73.0
1977	5,377.7	78,000	14.5	37,122	6.9	19,931	3.7	57,053	10.6	73.1
1978	5,677.6	79,986	14.1	37,965	6.7	20,000	3.5	57,965	10.2	72.5
1979	5,855.0	80,903	13.8	37,123	6.3	20,666	3.5	57,789	9.9	71.4
1980	5,839.0	78,122	13.4	34,202	5.9	20,394	3.5	54,596	9.4	69.9
1981	5,987.2	76,335	12.7	31,931	5.3	19,928	3.3	51,859	8.7	67.9
1982	5,870.9	73,234	12.5	30,231	5.1	18,505	3.2	48,736	8.3	66.5
1983	6,136.2	73,066	11.9	30,054	4.9	17,357	2.8	47,411	7.7	64.9
1984	6,577.1	76,693	11.7	31,051	4.7	18,507	2.8	49,558	7.5	64.6
1985	6,849.3	76,491	11.2	30,922	4.5	17,834	2.6	48,756	7.1	63.7
1986	7,086.5	76,722	10.8	32,196	4.5	16,708	2.4	48,904	6.9	63.7
1987	7,313.3	79,156	10.8	32,865	4.5	17,744	2.4	50,609	6.9	63.9
1988	7,613.9	82,774	10.9	34,222	4.5	18,552	2.4	52,774	6.9	63.8
1989	7,885.9	84,886	10.8	34,211	4.3	19,712	2.5	53,923	6.8	63.5
1990	8,033.9	84,652	10.5	33,553	4.2	19,603	2.4	53,156	6.6	62.8
1991	8,015.1	84,522	10.5	32,845	4.1	20,149	2.5	52,994	6.6	62.7
1992	8,287.1	85,866	10.4	33,527	4.0	20,835	2.5	54,362	6.6	63.3
1993	8,523.4	87,579	10.3	33,841	4.0	21,351	2.5	55,192	6.5	63.0
1994	8,870.7	89,248	10.1	34,670	3.9	21,842	2.5	56,512	6.4	63.3
1995	9,093.7	91,173	10.0	34,437	3.8	22,671	2.5	57,108	6.3	62.6
1996	9,433.9	94,175	10.0	35,673	3.8	23,085	2.4	58,758	6.2	62.4
1997	9,854.3	94,765	9.6	36,160	3.7	23,223	2.4	59,383	6.0	62.7
1998	10,283.5	95,183	9.3	36,817	3.6	22,830	2.2	59,647	5.8	62.7
1999	10,779.8	96,817	9.0	37,838	3.5	22,909	2.1	60,747	5.6	62.7
2000	11,226.0	98,975	8.8	38,264	3.4	23,824	2.1	62,088	5.5	62.7
2001	11,347.2	96,326	8.5	38,186	3.4	22,773	2.0	60,959	5.4	63.3
2002	11,553.0	97,858	8.5	38,227	3.3	23,558	2.0	61,785	5.3	63.1
2003	11,840.7	98,209	8.3	38,809	3.3	22,897	1.9	61,706	5.2	62.8
2004	12,263.8	100,351	8.2	40,294	3.3	22,931	1.9	63,225	5.2	63.0
2005	12,638.4	100,485	8.0	40,393	3.2	22,583	1.8	62,976	5.0	62.7
2006	12,976.2	99,875	7.7	39,958	3.1	22,224	1.7	62,182	4.8	62.3
2007	13,254.1	101,554	7.7	39,773	3.0	23,628	1.8	63,401	4.8	62.4
2008	13,312.2	99,425	7.5	37,285	2.8	23,788	1.8	61,073	4.6	61.4
[1]2009	13,177.4	95,375	7.2	35,600	2.7	23,360	1.8	58,960	4.5	61.8
[2]2010	13,572.8	95,910	7.1	35,960	2.6	23,710	1.7	59,670	4.4	62.2

[1]Estimated. [2]Forecast.
Source: US Energy Information Administration.

b/d. Mexico, which exported 1.266 million b/d of crude and products to the US last year, was followed by Venezuela, Saudi Arabia, Nigeria, and Russia.

Of all products, residual fuel oil was imported the most last year with an average of 350,000 b/d. Distillate and motor gasoline imports trailed imports of resid, followed by propane and jet fuel imports.

The US will export 2 million b/d of oil this year, mostly as products. In 2009, US oil exports averaged 2.06 million b/d, up from 1.8 million b/d a year earlier.

CRUDE IMPORTS BY COUNTRY OF ORIGIN[1]

	[2]2009	2008	2007	2006	2005	2004	2003	2002	2001	2000
	1,000 b/d									
Algeria[3]	303	312	443	362	228	215	112	30	11	1
Angola	449	504	498	513	456	306	363	321	321	295
Australia	18	33	2	5	10	21	27	51	34	49
Canada	1,898	1,956	1,888	1,802	1,633	1,616	1,549	1,445	1,356	1,348
China	6	11	6	19	24	14	13	20	13	33
Colombia	264	178	137	141	156	142	166	235	260	318
Congo, Republic of	0	0	0	0	0	14	2	23	1	8
Congo	69	67	63	27	25	8	27	3	40	42
Ecuador	174	214	198	272	276	232	139	100	113	125
Gabon	60	58	63	60	127	142	131	143	140	143
Indonesia[3]	30	16	15	16	19	34	26	50	40	36
Iran[3]	0	0	0	0	0	0	0	0	0	0
Iraq[3]	441	627	484	553	527	655	481	459	795	620
Kuwait[3]	197	206	175	179	227	241	208	216	237	263
Malaysia	8	2	1	7	10	18	21	9	15	29
Mexico	1,105	1,187	1,409	1,577	1,556	1,598	1,569	1,500	1,394	1,313
Nigeria[3]	739	922	1,084	1,037	1,077	1,078	832	589	842	875
Norway	59	30	56	98	119	143	181	348	281	302
Oman	37	17	32	35	22	10	35	17	20	2
Qatar[3]	8	0	0	1	0	4	0	9	0	0
Saudi Arabia[3]	1,007	1,503	1,447	1,423	1,445	1,495	1,726	1,519	1,611	1,523
Trinidad & Tobago	31	23	48	67	64	49	67	68	51	56
United Arab Emirates[3]	38	4	9	5	9	5	10	10	21	3
United Kingdom	112	78	101	130	224	238	359	405	244	291
Venezuela[3]	997	1,039	1,148	1,142	1,241	1,297	1,183	1,201	1,291	1,223
Others	989	796	724	647	651	513	438	369	197	173
Total imports	**9,040**	**9,783**	**10,031**	**10,118**	**10,126**	**10,088**	**9,665**	**9,140**	**9,328**	**9,071**
Total from OPEC	**3,761**	**5,415**	**5,388**	**4,783**	**4,757**	**5,042**	**4,578**	**4,083**	**4,848**	**4,544**

[1]Includes imports for the Strategic Petroleum Reserve. [2]Preliminary. [3]OPEC member.
Source: US Energy Information Administration.

EXPORTS OF REFINED PRODUCTS AND CRUDE

	*2009	2008	2007	2006	2005	2004	2003	2002	2001	2000
	1,000 b/d									
Gasoline	185	172	127	142	136	124	125	124	133	144
Distillate	620	528	268	215	138	110	107	112	119	173
Residual	448	355	330	283	251	205	197	177	191	139
Lubricants	56	60	59	55	40	41	37	33	26	26
Coke	381	377	366	366	347	350	361	337	336	319
Asphalt and road oil	28	23	19	15	11	6	10	6	5	6
LPG	90	67	57	56	53	43	56	67	44	74
Other refined products	216	191	179	160	158	142	122	119	97	109
Total refined products	2,023	1,773	1,405	1,292	1,134	1021	1,015	975	951	990
Crude	37	29	27	25	32	27	12	9	20	50
Total exports	**2,060**	**1,802**	**1,433**	**1,317**	**1,165**	**1,048**	**1,027**	**984**	**971**	**1,040**

* Preliminary.
Source: US Energy Information Administration.

Inventories

With product demand gaining steam and refinery utilization still suppressed, stocks of crude and oil products will diminish during 2010.

Crude oil in storage, excluding that in the SPR, will fall to 316 million bbl at the close of 2010. This is down from a yearend 2009 total of 327 million bbl, which was 1 million bbl higher than a year earlier.

The total volume of oil products in storage also will move lower from the end of 2009. OGJ forecasts that product stocks will total 700 million bbl at the end of this year, down from the year-earlier total of 722 million bbl.

Volumes of motor gasoline, jet fuel, and distillate in storage were plentiful during 2009, even as imports and refinery utilization rates were weak, due to feeble demand.

The amount of crude in the SPR will remain at its physical capacity of 727 million bbl at the end of 2010. Last year, the reserve grew to this level from 702 million bbl. The Department of Energy took advantage of lower oil prices in the first half of the year.

Also last year, repayments to the SPR were made for supply released to refiners in the wake of hurricanes in 2008, and the SPR took delivery of royalty-in-kind oil during 2009.

Refining

Recovering product demand will cause average US refinery utilization in 2010 to pick up a bit from 2009, climbing to 84.2%.

Operable capacity will increase only slightly this year to 17.7 million b/d

IMPORTS OF REFINED PRODUCTS

	[1]2009	2008	2007	2006	2005	2004	2003	2002	2001	2000
	1,000 b/d									
Gasoline	207	302	413	475	603	496	518	498	454	427
Kerosene	2	2	3	5	7	2	6	5	5	2
Jet fuel-kerosene	86	103	217	186	190	127	109	107	148	162
Distillate	225	213	304	365	329	325	333	267	344	295
Residual	443	349	372	350	530	426	327	249	295	352
Unfinished oils	689	763	717	689	582	490	335	410	378	274
Other[2]	1,008	1,400	1,410	1,520	1,346	1,191	971	854	920	877
Total US	**2,660**	**3,132**	**3,436**	**3,590**	**3,587**	**3,057**	**2,599**	**2,390**	**2,543**	**2,389**

[1]Preliminary. [2]Includes plant condensate.
Source: US Energy Information Administration.

ROTARY RIG ACTIVITY BY STATES

	2009	2008	2007	2006	2005	2004	2003	2002	2001	2000
Alabama	3.7	4.5	4.6	4.6	3.6	2.5	2.4	3.0	5.3	4.1
Alaska	7.7	8.3	8.4	8.0	9.3	9.9	9.7	11.2	13.4	8.2
Arizona	0	0.0	0.0	0.0	0.0	0.0	0.0	0.3	0.0	0.0
Arkansas	44.1	50.4	45.4	24.0	9.3	6.4	2.1	0.8	1.5	3.9
California	22.8	41.2	35.4	33.3	27.2	23.9	21.1	22.3	36.4	24.1
Land	22	40.4	33.8	29.3	23.0	20.4	17.9	19.7	32.5	20.7
Offshore	0.8	0.8	1.6	4.0	4.2	3.5	3.2	2.6	3.9	3.4
Colorado	50.4	114.0	106.7	88.5	73.9	54.2	38.8	27.8	32.3	18.4
Florida	0.6	1.0	0.4	0.3	1.6	1.1	0.7	0.2	0.4	0.2
Idaho	0	0.0	0.3	0.3	0.0	0.0	0.0	0.0	0.0	0.0
Illinois	0.8	0.5	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Indiana	2.1	1.7	2.0	0.0	0.0	0.0	0.0	0.5	0.0	0.0
Kansas	19.6	11.3	13.8	9.6	6.7	6.7	8.7	7.5	22.4	22.0
Kentucky	9.7	10.2	9.0	7.2	4.7	4.4	4.3	4.8	6.4	4.9
Louisiana	150	167.3	177.0	188.4	182.1	166.8	157.2	162.8	213.8	194.4
North	89.2	67.9	57.9	57.5	48.4	39.3	28.5	23.2	30.3	24.1
Inland waters	8.1	20.4	24.6	19.2	22.8	18.2	14.3	16.3	20.4	15.8
South	14.8	25.6	33.8	38.5	32.5	30.3	29.6	31.6	44.1	36.7
Offshore	37.9	53.3	60.7	73.2	78.4	79.1	84.8	91.7	119.0	117.9
Michigan	0	1.1	1.5	2.2	2.6	3.0	3.1	1.3	1.2	2.4
Mississippi	10.1	13.1	14.0	10.3	10.3	9.8	8.0	7.6	14.2	11.2
Montana	2.7	10.7	16.9	21.3	24.0	19.9	14.0	7.9	10.0	6.5
Nebraska	0.3	0.1	0.1	0.0	0.0	0.8	0.0	0.1	0.2	0.6
Nevada	3.4	3.3	2.2	1.3	1.9	1.5	1.2	0.0	0.0	0.0
New Mexico	43.7	78.6	78.1	93.8	82.8	67.2	64.4	41.5	68.2	67.9
New York	2.2	6.0	6.4	6.4	4.3	4.9	2.8	4.3	5.4	3.3
North Dakota	49.4	68.1	38.9	31.5	20.4	15.0	13.7	10.1	14.3	13.4
Ohio	7.9	11.6	13.2	7.5	9.2	6.7	7.4	8.7	9.6	8.5
Oklahoma	94.4	200.0	188.2	178.7	152.1	158.8	128.2	90.8	130.2	99.4
Pennsylvania	41.7	23.0	15.6	15.7	13.2	8.9	10.1	10.3	10.6	8.7
South Dakota	0.3	1.6	1.5	1.1	2.0	0.5	0.2	0.2	0.6	0.2
Texas	432.2	898.4	834.3	746.4	614.7	505.9	448.5	337.5	462.5	343.4
Gulf Coast	88.2	187.1	180.3	170.3	184.6	156.1	153.0	134.3	168.1	127.1
Offshore & inland waters	3.4	10.1	10.5	14.8	10.5	14.1	20.2	16.2	26.4	16.6
North	24.8	41.7	36.7	33.5	31.8	37.4	39.4	30.1	27.4	14.5
Panhandle	34.8	81.9	60.5	68.2	62.5	47.5	26.0	14.6	21.0	16.7
East	150.7	305.8	294.8	243.3	172.5	131.2	107.2	68.1	106.1	78.0
West Central	38.5	93.9	94.6	79.0	53.0	45.3	28.4	21.9	31.7	17.4
West	91.7	178.0	156.9	137.5	100.0	74.2	74.2	52.5	81.6	73.1
Utah	18.3	41.6	41.1	40.2	27.7	21.5	13.4	13.1	20.8	15.5
West Virginia	22.2	26.9	31.6	26.5	17.4	15.1	15.5	13.2	18.1	14.1
Wyoming	40.0	73.9	73.6	99.0	78.5	73.6	53.6	40.2	55.0	41.0
Others	7.1	10.6	7.6	2.6	3.6	1.5	1.2	2.2	3.6	2.0
Total US	**1,087.4**	**1,879.0**	**1,767.8**	**1,648.7**	**1,383.1**	**1,190.5**	**1,030.3**	**830.2**	**1,156.4**	**918.3**
Land	1,035.3	1,791.8	1,669.8	1,536.6	1,265.9	1,074.0	905.6	699.9	981.4	761.2
Inland Waters	8.2	22.0	25.7	22.2	23.7	19.4	16.8	17.7	21.9	17.3
Offshore	43.9	65.3	72.6	89.9	93.4	97.0	107.9	112.6	153.1	139.8
Canada-land	221.5	380.4	340.0	466.5	454.3	361.1	369.8	259.5	336.3	339.7
Canada-offshore	1.2	1.2	2.5	3.6	3.8	3.9	3.8	6.1	5.2	4.7
Grand total	**1,310.1**	**2,260.6**	**2,110.3**	**2,118.8**	**1,841.2**	**1,555.5**	**1,403.9**	**1,095.8**	**1,497.9**	**1,262.7**

Source: Baker Hughes Inc. Note: May not add due to independent rounding.

from 17.673 million b/d, slowing the trend of incremental annual capacity growth. Meanwhile, total inputs to refineries will rebound from the 2009 average of 14.6 million b/d to average 14.9 million b/d.

Gross inputs to US refineries plunged in the fourth quarter of 2009 on weak demand. Total inputs for the 4 weeks ending Nov. 27, 2009, averaged 14.1 million b/d, which was down about 1 million b/d from a year earlier.

MARKETED NATURAL GAS PRODUCTION[1]

	[2]2009	2008	2007	2006	2005	2004	2003	2002	2001	2000
	MMcfd									
Alaska	1,065	1,099	1,217	1,218	1,335	1,289	1,305	1,269	1,292	1,254
Louisiana	4,232	3,740	3,637	3,729	3,551	3,697	3,760	3,731	4,115	3,975
New Mexico	3,854	3,962	4,131	4,409	4,507	4,460	4,234	4,471	4,628	4,645
Oklahoma	5,116	5,138	4,945	4,627	4,491	4,524	4,572	4,250	4,426	4,419
Texas	18,974	18,607	16,694	15,106	14,456	13,845	14,460	14,085	14,473	14,432
Wyoming	6,364	6,179	5,557	4,976	4,491	4,350	4,125	3,983	3,737	2,974
Federal offshore	6,805	6,368	7,592	7,951	8,581	10,845	12,263	12,804	13,774	13,482
Others	13,575	9,486	11,435	11,085	10,442	10,314	10,159	9,984	9,912	10,004
Total	**59,986**	**54,579**	**55,209**	**53,101**	**51,855**	**53,326**	**54,877**	**54,578**	**56,357**	**55,184**
Volume change	5,407	-630	2,108	1,246	-1,471	-1,550	299	-1,779	1,173	925
Percent change	9.9	-1.1	4.0	2.4	-2.8	-2.8	0.5	-3.2	2.1	1.7
Imports	10,233	10,886	12,624	11,469	11,893	11,635	10,164	10,979	10,896	10,332
Exports	3,151	2,748	2,253	1,983	1,996	2,334	1,644	1,414	1,023	666

[1]Includes nonhydrocarbon gases. [2]Preliminary.
Source: US Energy Information Administration

REFINERY RUNS BY DISTRICTS

	2009 Crude runs[1]	2009 Input to crude stills[1]	2009 % of operable capacity	Crude runs 2008	2007	2006	2005	2004	2003	2002	2001	2000
	1,000 b/d			1,000 b/d								
East Coast	1,180	1,163	71.6	1,332	1,426	1,418	1,534	1,508	1,516	1,455	1,413	1,485
Appalachian Dist.[1]	89	89	94.1	90	87	94	93	89	88	85	86	86
Total Dist. 1	**1,269**	**1,253**	**72.8**	**1,421**	**1,513**	**1,512**	**1,627**	**1,597**	**1,605**	**1,541**	**1,499**	**1,571**
Ill., Ind., Ky.[2]	1,995	2,011	84.9	2,079	2,131	2,161	2,143	2,157	2,107	2,108	2,165	2,239
Minn., Wisc., Daks.	407	409	91.4	412	401	413	420	403	395	701	414	422
Okla., Kan., Mo.	737	744	87.0	730	694	723	735	729	710	701	724	712
Total Dist. 2	**3,139**	**3,164**	**86.2**	**3,221**	**3,226**	**3,297**	**3,298**	**3,288**	**3,212**	**3,511**	**3,303**	**3,373**
Texas:												
Inland	555	573	85.3	584	570	610	579	604	572	554	574	573
Gulf Coast	3,373	3,405	83.5	3,276	3,417	3,445	3,489	3,682	3,652	3,475	3,549	3,455
Louisiana Gulf	2,780	2,855	85.7	2,749	3,035	2,913	2,751	2,906	2,872	2,848	2,922	2,843
N. La., Ark.	168	160	69.1	182	187	197	186	151	156	148	154	178
New Mexico	101	101	76.1	107	106	95	95	94	81	84	79	90
Total Dist. 3	**6,977**	**7,093**	**84.0**	**6,899**	**7,315**	**7,260**	**7,098**	**7,438**	**7,332**	**7,109**	**7,278**	**7,139**
Total Dist. 4	**542**	**549**	**88.2**	**536**	**542**	**553**	**558**	**556**	**528**	**520**	**500**	**505**
Total Dist. 5	**2,379**	**2,577**	**80.1**	**2,571**	**2,560**	**2,621**	**2,638**	**2,596**	**2,627**	**2,567**	**2,547**	**2,479**
Total US	**14,306**	**14,635**	**82.8**	**14,648**	**15,156**	**15,242**	**15,220**	**15,475**	**15,304**	**15,247**	**15,128**	**15,067**

[1]Preliminary. [2]Includes Appalachian Dist. 2
Source: US Energy Information Administration

Refinery utilization averaged an estimated 82.8% last year. Early maintenance pushed down utilization to average 81.5% in February 2009 vs. 85% in February 2008. The utilization rate peaked last year for the month of June, averaging 86.1%. During the final month of 2009, refinery utilization averaged just above 80%, according to EIA figures.

Amid the weakness in product demand, prices remained low even as crude prices on the world market regained strength late last year. With the economy in recession, refiners were unable to pass on their high crude prices to their customers.

The refiners' acquisition cost of domestic and imported crude in November 2009 averaged $76.85/bbl, according to EIA. That month, the Gulf Coast cash operating refining margin sank to average just 6¢/bbl, according to Muse, Stancil & Co. (MSC). The highest monthly average last year was for January, when this margin averaged $6.67/bbl.

US East Coast cash margins fared worse than the Gulf Coast margin, averaging a negative $1.10/bbl in March 2009 and only about $1.50/bbl for the year, according to MSC.

Oil products

Demand for all major oil products except resid will increase this year. Total domestic demand for products will average 18.815 million b/d, rebounding from 2009, but still down from the 2008 average of 19.5 million b/d.

Product demand growth in 2010 will be sluggish along with growth

US REFINED PRODUCTS, NATURAL GAS LIQUIDS, AND CRUDE STOCKS

	[1]2009	2008	2007	2006	2005	2004	2003	2002	2001	2000
	1,000 bbl									
Gasoline[2]	204,575	214,738	219,369	213,226	209,735	219,081	208,167	210,609	211,465	197,429
Motor[3]	203,507	213,550	218,107	211,806	208,328	217,601	206,827	209,096	209,851	195,852
Aviation[3]	1,068	1,188	1,262	1,420	1,407	1,480	1,340	1,513	1,614	1,577
Special naphthas	1,337	1,438	1,571	1,609	1,524	1,800	2,006	2,038	2,006	2,112
Kerosene	2,360	2,248	2,804	3,373	5,092	4,885	5,584	5,463	5,388	4,107
Distillate	152,519	146,013	133,944	143,651	136,022	126,272	136,542	134,085	144,513	118,027
Residual	34,738	36,057	39,338	42,397	37,387	42,363	37,800	31,333	41,047	36,200
Kerosine jet fuel	42,105	37,969	39,458	39,129	41,741	40,086	38,767	39,123	41,871	44,409
Naphtha jet fuel	—	—	—	—	—	—	17	56	82	109
Natural gas liquids & LRG	137,734	126,909	105,870	125,109	118,206	111,085	100,889	113,285	128,272	87,722
Unfinished oils	85,419	83,463	81,209	83,782	85,723	81,380	75,904	75,766	87,700	84,217
Other refined products	61,213	60,241	58,736	66,349	53,926	56,512	55,364	59,447	61,784	67,030
Total products stocks	722,000	709,076	682,299	718,625	689,356	683,464	661,040	671,205	724,128	641,362
Crude stocks (ex. SPR)	327,000	325,840	286,105	312,276	323,704	285,741	268,875	277,614	311,980	285,507
Total stocks (ex. SPR)	**1,049,000**	**1,034,916**	**968,404**	**1,030,901**	**1,013,060**	**969,205**	**929,915**	**948,819**	**1,036,108**	**926,869**
SPR stocks	**727,000**	**701,823**	**696,941**	**688,605**	**684,544**	**675,600**	**638,388**	**599,091**	**550,241**	**540,678**
Total stocks (incl. SPR)	**1,776,000**	**1,736,739**	**1,665,345**	**1,719,506**	**1,697,604**	**1,644,805**	**1,568,303**	**1,547,910**	**1,586,349**	**1,467,547**

[1]Preliminary. [2]Includes reformulated, oxygenated, and other finished gasoline. [3]Includes blending components.
Source: US Energy Information Administration

of the US economy. As long as unemployment remains high, demand for transportation fuels will have limited upside potential. Transportation fuel demand last year sagged on declines in commercial trucking, business travel, and leisure travel.

Motor gasoline demand will average 9.045 million b/d this year, up just 0.5%. Last year demand for gasoline was little changed from a year earlier at 9 million b/d.

Gasoline prices last year dipped to average $2.35/gal after peaking in 2008 with an annual average pump price for unleaded gasoline of $3.26/gal.

OGJ forecasts that a small increase in business travel this year will boost average jet fuel demand to 1.425 million b/d. Down 8% from a year earlier to 1.41 million b/d, jet fuel demand in 2009 hit its lowest annual average since 1993.

Demand for distillate fuel oil will move up 1.5% this year to average 3.65 million b/d, not as high as its 2008 average of 3.945 million b/d. Distillate demand fell 9% last year is spite of much lower prices.

Demand for distillate by industrial users declined the sharpest last year, while use among residential, commercial, and electric power customers was little changed from a year earlier. Most distillate demand is for ultralow-sulfur diesel and used for transportation, while the remaining demand is for heating oil.

Residual fuel oil demand will dip to average 525,000 b/d from last year's 527,000 b/d. Resid, which is mostly used in electric power generation, has experienced declining demand in favor of gas since the early 1980s. Demand for resid declined 15% last year.

Demand for liquefied petroleum gases will rebound nearly to their 2008 level, averaging 1.95 million b/d this year. In 2009, demand for LPG fell 2% as a result of dismal construction activity and petrochemical demand.

Natural gas

US gas demand will climb 1.5% this year as a result of colder winter weather and an increase in gas use for power generation. Gas consumption by industrial users sank last year and will see limited growth in 2010.

OGJ forecasts that gas production will sink marginally this year to 21.82 tcf. Marketed production of gas in the US last year jumped 3% from a year earlier to 21.895 tcf. This 2009 increase was due to a recovery in output following 2008 hurricane activity and to a boost in production from shale-gas plays.

Louisiana's gas output surged 11% last year, but will sink by 1.3% this year. Gas production in Texas and in the federal Gulf of Mexico will decline 1.6% in 2010, following last year's increased production.

US imports of gas will move lower again this year, but by a much smaller margin than the 2009 drop. A hike in imports of LNG was unable to overcome a loss of imports from Canada and Mexico last year, such that total imports fell to 3.735 tcf from a total of 3.984 tcf a year earlier.

OGJ forecasts that LNG imports will climb again this year by almost 5% to total 430 bcf, but that gas imports from Canada and Mexico will decline again, for a total decline in imports of almost 1%.

Because of the uptick in domestic demand, the US will export 1.14 tcf of gas in 2010, slightly less than a year ago. During 2009, gas exports surged 14% due to plentiful supplies in storage and slumping demand.

The amount of gas in storage will be unchanged from the end of 2009. Last year, the amount of working gas in storage grew 300 bcf on weakened demand and increased production. Storage levels throughout 2009 stayed above their 2008 totals, and after the first quarter of 2009, the amount of gas in storage stayed at the top of the recent 5-year range.

The wellhead price of gas last year sank to average an estimated $3.70/Mcf, compared with $8.07/Mcf a year earlier. And the average delivered commercial price of gas last year declined 21% from 2008 to average $9.45/Mcf. ✦

Marginally higher drilling in view in US, Canada

Alan Petzet
Chief Editor-Exploration

The roller coaster drilling year of 2009 gives way to somewhat brighter prospects in the US and Canada in 2010.

US and Canada average rig counts were each down 42% in 2009 compared with 2008 by Baker Hughes figures, and in many parts of the US operators ran fewer than half the rigs on average than they did in 2008.

Still, the US count rebounded from fewer than 900 rigs in early June 2009 to 1,189 as the year ended.

The bright spots in the US in 2009 were in Kansas, dominated by relatively shallow drilling; North Louisiana, center of the Haynesville shale gas play, and Pennsylvania, where the Devonian Marcellus shale gas play added to drilling for even shallower Appalachian formations.

Vast shale gas and oil plays emerging over millions of acres in several states probably kept the rig count from slumping worse than it did in response to the sharply lower oil and gas prices than those that prevailed in the first half of 2008.

Here are highlights of OGJ's early year drilling forecast for 2010:

- Operators will drill 38,238 wells in the US, up from an estimated 37,062 wells in 2009.
- All operators will drill 1,651 exploratory wells of all types, up from an estimated 1,544 last year.
- The Baker Hughes Inc. count of active US rotary rigs will average 1,130 rigs/week this year, up from 1,087 in 2009 and down from 1,867 in 2008, and 1,767 in 2007.
- Operators will drill 8,585 wells in western Canada, up from an estimated 7,974 wells in 2009.

US drilling

The 2009 US rig count averaged 42% below the 2008 level and was the lowest since 2003, when operators averaged 1,030 rigs/week.

First quarter US drilling fell to a level not seen since 2004, marking the end of 6 years of first quarter growth, the American Petroleum Institute estimated.

Chesapeake Energy Corp., Oklahoma City, said it operated 103 rigs drilling for gas in the US in early December 2009. The next busiest US gas drillers, according to the Smith International survey, were ExxonMobil Corp. at 41 rigs, EnCana Corp. at 36 rigs, EOG Resources Inc. at 31 rigs, and Anadarko Petroleum Corp. at 24 rigs.

ExxonMobil buttressed its position in North American unconventional gas with purchase of XTO Energy Inc., and assumption by Newfield Exploration Co. and Anadarko Petroleum of most assets of bankrupt TXCO Resources Inc. could add impetus to the Eagle Ford and Pearsall shales and other South Texas Maverick basin plays in 2010 and beyond.

New York had an average of 2.2 rigs/week in 2009 compared with 6 rigs/week in 2008, and the future is uncertain until the state resolves issues surrounding drilling and hydraulic fracturing in the Marcellus shale (OGJ Online, Dec. 29, 2009).

Appalachian shale gas drilling could spread into Maryland in 2010. Samson Resources Co., private Tulsa operator, sought permits in November 2009 to drill four Marcellus wells in Garrett County in far western Maryland. Garrett County formerly produced gas

A LOOK AT 30 YEARS OF US WELL COMPLETIONS

Year	Total wells[1]	Total footage	Total explor–atory wells	Year	Total wells[1]	Total footage	Total explor–atory wells
[2]2010	38,238	225,352,000	1,651	1995	23,061	124,426,000	3,406
[2]2009	37,062	315,518,000	1,554	1994	23,324	130,654,000	3,788
[2]2008	52,097	325,566,000	5,474	1993	26,032	138,509,000	3,604
2007	47,057	279,001,000	3,833	1992	23,921	123,456,000	3,494
2006	49,375	289,959,000	3,696	1991	28,417	141,391,000	4,399
2005	44,679	254,844,000	3,727	1990	30,615	149,518,000	5,074
2004	39,051	213,908,000	3,192	1989	28,363	134,901,000	5,251
2003	30,487	158,221,000	2,593	1988	32,238	155,164,000	6,350
2002	27,794	145,055,000	2,271	1987	36,253	163,848,000	6,903
2001	36,061	184,462,000	3,181	1986	39,015	177,641,000	7,156
2000	31,261	149,848,000	2,517	1985	70,806	316,778,000	12,208
1999	22,107	109,854,000	2,141	1984	84,983	368,796,000	15,138
1998	25,822	143,625,000	2,723	1983	75,738	316,617,464	13,845
1997	30,208	165,480,000	3,353	1982	83,889	375,382,919	15,882
1996	25,724	138,588,000	3,364	1981	89,234	406,520,453	17,430

[1]Well counts in most recent years subject to reporting lag. [2]Estimated.
Source: 1981-2006 American Petroleum Institute.

from Devonian Oriskany sand at three fields discovered before 1970.

Canada

December 2009 was the year's best month for drilling permit filings in Canada with more than 2,100 permits issued, possibly indicating a turnaround.

Canadian gas drilling levels will depend on how north-of-the-border gas competes with gas developed in shale formations closer to markets in the US.

Longer laterals are swelling footage figures from the Horn River basin shale plays in Northeast BC to the Montney combination play in British Columbia and Alberta to the Bakken oil play in the Williston basin southern Saskatchewan and Manitoba.

Eastern Canada offshore and land drilling were at low levels in 2009, but success in emerging shale gas plays in Quebec and New Brunswick hint that at least a few more wells might be drilled in those areas in 2010.

Several wells in Quebec have tested gas at respectable rates from Ordovician Utica shale, but there is no sustained production from the Utica or the Ordovician Lorraine shale. A few large surface mining projects exist, but almost Canada's entire oil sands resource is expected to be produced ultimately by drilling wells, the Canadian Association of Petroleum Producers noted.

World rigs

The world rig count including North America fell 34% year to year to 2,408 units in November 2009, Baker Hughes reported.

Almost 80% of the world's active rigs were working in the Western Hemisphere in that month.

November drilling year to year was up slightly to 257 rigs in Asia-Pacific and 68 rigs in Africa and declined to 252 rigs in the Middle East and 86 rigs in Europe (OGJ, Dec. 21, 2009, p. 64).

India showed a good gain to 98 rigs from 82 in November 2008, and Venezuela fell to 55 rigs from 80. India's count included 65 land rigs and 33 offshore units. ✦

Oil & Gas Journal well forecast for 2010

	2009 estimate				2010 forecast		
State	Total comp.	Exploratory wells	Field wells	Total ft (1,000)	Total comp.	Exploratory wells	Field wells
Alabama	372	15	357	1,621	360	14	346
Alaska	165	17	148	1,107	155	7	148
Arizona	1	–	1	2	2	2	0
Arkansas	922	55	867	6,158	960	67	893
California land	1,966	65	1,901	4,585	2,030	67	1,963
California offshore	4	–	4	25	6	–	6
Colorado	1,871	56	1,815	11,776	1,935	74	1,861
Illinois	299	9	290	708	323	10	313
Indiana	137	8	129	235	145	8	137
Kansas	3,939	154	3,785	12,294	4,060	171	3,889
Kentucky	888	26	862	2,359	905	24	881
Louisiana	3,125	129	2,996	29,290	3,170	128	3,042
North	2,465	113	2,352	22,537	2,545	115	2,430
South	240	5	235	2,373	220	4	216
Offshore	420	11	409	4,379	405	9	396
Maryland	–	–	–	–	2	2	–
Michigan	387	12	375	659	395	11	384
Mississippi	214	11	203	1,929	185	9	176
Montana	159	3	156	937	190	3	187
Nebraska	68	3	65	341	75	3	72
Nevada	4	1	3	28	5	1	4
New Mexico - East	589	29	560	4,750	610	33	577
New Mexico - West	465	20	445	2,776	480	21	459
New York	43	3	40	164	36	3	33
North Dakota	797	106	691	9,531	835	119	716
Ohio	796	30	766	2,859	822	35	787
Oklahoma	2,241	78	2,163	16,751	2,315	88	2,227
Pennsylvania	3,676	143	3,533	11,579	3,800	175	3,625
South Dakota	12	2	10	49	17	3	14
Tennessee	104	3	101	236	110	3	107
Texas	8,848	401	8,447	75,740	9,219	399	8,820
Dist. 1	299	13	286	1,921	320	13	307
Dist. 2	535	31	504	5,046	560	34	526
Dist. 3	642	31	611	5,588	680	30	650
Dist. 4	663	25	638	6,720	690	23	667
Dist. 5	994	40	954	11,137	1,030	37	993
Dist. 6	1,177	77	1,100	12,730	1,225	69	1,156
Dist. 7-B	573	17	556	3,570	605	19	586
Dist. 7-C	699	25	674	5,109	725	28	697
Dist. 8	955	32	923	6,513	990	32	958
Dist. 8-A	710	21	689	3,844	735	21	714
Dist. 9	847	50	797	5,324	875	55	820
Dist. 10	714	35	679	7,818	740	33	707
Offshore	40	4	36	420	44	5	39
Utah	610	35	575	4,335	630	33	597
Virginia	511	5	–	1,177	525	4	521
Washington	1	1	–	13	–	–	–
West Virginia	1,823	71	1,752	7,035	1,855	82	1,773
Wyoming	2,025	53	1,972	6,371	2,081	52	2,029
US total	**37,062**	**1,544**	**35,518**	**217,419**	**38,238**	**1,651**	**36,587**
Western Canada	7,974	1,599	6,375	36,219	8,585	1,712	6,873
Alberta	5,505	1,051	4,454	22,708	5,875	1,105	4,770
Saskatchewan	1,684	317	1,367	7,428	1,805	343	1,462
Brit. Columbia	560	203	357	4,694	630	232	398
Manitoba	225	28	197	1,388	275	32	243
NWT-Yukon	4	3	1	25	6	5	1
Eastern offshore	3	1	2	35	5	2	3
Eastern land	15	3	12	104	22	6	16

EIA: World economic recovery to restore oil demand growth

Nick Snow
Washington Editor

Global oil demand declined a second consecutive year in 2009 for the first time since 1983, the US Energy Information Administration said. But the decline hit bottom in mid-2009 and the worldwide economy began to recover during the second half, it observed on Jan. 12 in its latest short-term energy outlook.

It expects the recovery to continue, contributing to global oil demand growth of 1.1 million b/d in 2010 and 1.5 million b/d in 2011. Countries outside the Organization for Economic Cooperation and Development are likely to account for most of 2010's growth, although US demand is projected to increase slightly by 200,000 b/d after a very weak 2009, EIA said.

"The world oil market should gradually tighten in 2010 and 2011, provided the global economic recovery continues as projected," it said. While it anticipates that non-OECD countries will lead this year's oil demand recovery, "OECD countries should begin to show significant oil demand growth in 2011 in response to improving economic conditions," EIA continued. It said it expects OECD countries' overall economic growth to more than double from 1.2% in 2010 to 2.7% in 2011.

EIA said while compliance with production cuts announced by the Organization of Petroleum Exporting Countries has weakened and global inventories and spare production capacity remain very high by historical standards, expectations of a continued global economic turnaround have buttressed oil markets. It forecast that prices for West Texas Intermediate, the US benchmark crude, which have been trending upward since February 2009, will continue to climb during 2010-11.

"Non-OPEC oil supply increased by more than 600,000 b/d in 2009, the largest annual increase since 2004," EIA said, adding that higher production in the US, Brazil, and the former Soviet Union (FSU) were the largest contributors.

Very little increase

It nevertheless expects very little increase in non-OPEC supply during 2010-11, with a 400,000 b/d rise this year followed by a 100,000 b/d decline next year. Brazil, where EIA expects production to increase by 400,000 b/d by the end of 2011 from rising offshore and biofuels activity, is the largest contributor, with an additional 200,000 b/d each from the US and the FSU. "However, large declines in production from the North Sea [700,000 b/d] and Mexico [400,000 b/d] are responsible for offsetting these sources of growth," it said.

EIA said while world oil markets have firmed in partial response to OPEC's production cuts since a year ago, the global economic recovery's strength and durability is still uncertain. It forecast that annual average OPEC crude production, which fell by almost 2.2 million b/d on average during 2009, will increase by an average 500,000 b/d through 2011 as global oil demand recovers. EIA also expects OPEC production of non-crude petroleum liquids, which production targets do not cover, to grow by 600,000 b/d in 2010 and 700,000 b/d in 2011.

It suggested that OPEC's surplus production capacity, which averaged 2.8 million b/d during 1998-2008, will continue to be high, reaching almost 6 million b/d by yearend 2011. It also said that OPEC's world market share could rise from 40% in 2009 to 42% in 2011 because of low supply growth outside the cartel. "The combination of higher market share and the relatively high level of surplus production capacity would give the group greater influence over the world oil market in coming years," EIA said.

US crude oil production, meanwhile, grew 360,000 b/d year-to-year to an average 5.31 million b/d in 2009, it continued. It forecast slower growth in 2010 (130,000 b/d) followed by a slight 20,000 b/d decline in 2011. EIA also expects domestic ethanol production to keep rising to meet the federal renewable fuel standard's requirements, climbing from an average 690,000 b/d in 2009 to 790,000 b/d in 2010 and 840,000 b/d in 2011.

US demand falls

"Liquid fuels consumption declined by 810,000 b/d, or 42%, in 2009—the second consecutive annual decline," EIA reported. "Motor gasoline was the only major petroleum production whose consumption did not decline, having increased by a scant 0.1%. Despite the cold weather that gripped much of the nation in late December, average annual distillate fuel consumption declined by 330,000 b/d, or 8.3%, in 2009, led by a precipitate decline in transportation usage."

Noting that regular gasoline prices increased from a nationwide monthly average of $1.79/gal in January 2009 to $2.61/gal in December, the federal energy forecasting and analysis service said that it expects those prices to average $2.84/gal in 2010 and $2.96/gal in 2011.

"Pump prices are likely to pass $3/gal at some point during the upcoming spring and summer," it added. "Because of growth in motor gasoline consumption, the difference between the average gasoline retail price and the average cost of crude oil widens in 2010 before starting to level out in 2011."

It forecast that on-highway diesel fuel prices, which averaged $2.46/gal in 2009, will average $2.98/gal in 2010 and $3.14 in 2011. "As with motor gasoline, the expected recovery in the consumption of diesel fuel in the US, as

well as growth in distillate fuel usage outside the US, strengthens refining margins for distillate throughout the forecast period," EIA said.

It also expects the average price for WTI to grow from $62/bbl in 2009 to $80/bbl in 2010 and $84/bbl in 2011, assuming that US real gross domestic product grows by 2% in 2010 and 2.7% in 2011 while world oil-consumption-weighted real GDP grows by 2.5% in 2010 and 3.7% in 2011. ✦

Salazar draws industry heat with oil, gas leasing reform

Nick Snow
Washington Editor

US Interior Secretary Ken Salazar announced onshore federal oil and gas leasing reform which he said would provide producers greater certainty but which oil and gas groups argued would create delays.

"The previous administration's 'anywhere, anyhow' policy on oil and gas development ran afoul of communities, carved up the landscape, and fueled costly conflicts that created uncertainty for investors and industry," Salazar said during a Jan. 6 teleconference. "We need a fresh look—from inside the federal government and from outside—at how we can better manage Americans' energy resources."

The reforms aim to have the US Bureau of Land Management, the Department of the Interior agency responsible for onshore federal land outside national parks and national forests, consider site-specific conditions for individual lease sales during comprehensive interdisciplinary reviews.

BLM also will be required to play a more active role in selecting proposed leases beyond accepting or rejecting industry nominations. The agency also will develop master leasing and development plans for areas where intensive oil and gas production is expected so other important resource value can be considered before development commitments are made.

"Almost nobody is happy with the status quo," said Salazar. "Court battles over oil and gas leases are costing millions of dollars. The public often feels shut out of the process. BLM professionals were told in the past to sit at their desks and approve applications instead of getting out in the field and examining situations first-hand. These reforms are overdue."

Categorical exclusions

He also said BLM would issue guidance regarding the use of categorical exclusions (CXs), which were established under Section 390 of the 2005 Energy Policy Act as a time and money-saving alternative to a full review under the National Environmental Policy Act (EPACT).

CXs let BLM approve some oil and gas activities based on existing environmental or planning analysis. Under the new policy, Salazar said, BLM will not use them in cases involving "extraordinary circumstances" such as impacts to protected species, historic or cultural resources, or human health and safety in accordance with House Council on Environmental Quality guidelines.

"We recognize that there are a number of safeguards in place already to protect public lands as we develop energy resources," said BLM Director Robert V. Abbey, who also joined the teleconference. "But we also realize we can do better. This includes managing resources at the leasing phase prior to making irreversible commitments."

He said BLM would review the leasing and CX guidance after 1 year. "We anticipate that there may be a slowdown in reviewing the number of parcels which have been nominated to allow us to conduct the reviews we're announcing today," he conceded.

He cited an interagency team led by Mark Stiles of the US Forest Service that reviewed Utah leases awarded in a December 2008 sale but rejected by BLM last February at Salazar's direction. He said the team identified several tracts that should not have been offered. "In spot checks of other offices, we believe we've found other instances where leases may have been offered without considering significant cultural resources and wildlife habitat," Abbey said.

Salazar also issued a secretarial order establishing an energy reform team within the office of Wilma A. Lewis, assistant interior secretary for land and minerals management, to identify and oversee implementation of energy reforms. "We will promote efficiency and effectiveness in development of the nation's renewable and traditional energy resources," she said during the teleconference.

Restore certainty

Salazar and Abbey both said the new leasing guidelines would restore certainty to a federal onshore oil and gas leasing program where protests have mushroomed. Salazar said protests of BLM oil and gas leases grew from 1% of the total issued in 1998 to 40% in 2008.

Abbey added, "Oil and gas is not produced from leases which are successfully protested. We believe that by going through a more diligent review, more oil and gas will actually be produced."

Asked how the new guidelines could change BLM's leasing approach from the past, which began with producers' expressions of interest in possible tracts, Salazar replied, "I think the change is that in the past, the public lands were the central candy store where the oil industry walked in and took what it wanted. That's not how it should be done. We have to make sure that development is taking place in the right way at the right time in the

right places. Our people will be doing a higher level of review than in the past."

Abbey said BLM will continue to accept nominations from producers, adding, "BLM will make the final decision now on where leases will be offered.

The CX guidance which BLM plans to issue will be consistent with EPACT's intent and not require additional congressional action, he said.

Salazar said his department offer for lease more than 50 million acres offshore and 2 million acres onshore. "That shows we are moving forward to develop this country's oil and gas resources beneath the public lands," he said. "We have no intention of changing that. We are moving forward with a balanced approach. We don't believe we should be drilling everywhere and anywhere."

'Double-talk'

Officials from three oil and gas associations immediately protested.

"In what has become increasingly familiar double-talk from this administration, Interior Secretary Salazar today again spoke of the importance of domestic oil and natural gas while making it more difficult to produce," American Petroleum Institute Pres. Jack N. Gerard said. "Under the guise of offering certainty for investors, [he] has taken steps to further delay and limit American energy resources for all Americans."

He noted that since Salazar became interior secretary, revenues from onshore federal oil and gas leasing in Colorado, Montana, New Mexico, Utah, and Wyoming have plunged more than 80%, and the total acreage leased has shrunk to its lowest level ever.

"In Wyoming alone, nearly 70% fewer lease acres were issued by the federal government in 2009 than in 2008," Gerard said.

Independent Petroleum Association of America Pres. Barry Russell said, "We do not see the need to further expand the consultation process that is already in place as it will only lead to more delay and confusion for small producers."

Russell said IPAA also strongly supports using CXs as outlined in EPACT and believes that efforts to revise or only allow their use under "extraordinary circumstances" will limit independent producers' ability to use "these important and common-sense tools." IPAA believes oil and gas development decisions are best made in BLM field offices instead of taking what the group considers a top-down approach advocated in the new guidelines, he added.

"This initiative will add great bureaucracy, delay and confusion to the oil and gas leasing process on federal lands. The current leasing process on federal lands works, and if small changes need to be made to the system, BLM has the ability to make those corrections. The concept of developing a master leasing plan will only create the potential for litigation and protest on every oil and gas lease issued by the agency," Russell warned.

Current system works

Kathleen Sgamma, government affairs director at the Independent Petroleum Association of Mountain States in Denver, said Interior is "moving to a bureaucratic command-and-control system in which government bureaucrats, rather than scientists with expertise in oil and gas development, dictate where energy development should occur."

"The market-based system has worked well for decades, allowing government land managers to specify what lands are appropriate for leasing and leaving it to the geologists and engineers to do the exploration and nominate projects based on geologic and market conditions," she maintained.

Sgamma said IPAMS hopes BLM career employees with oil and gas experience will be prominent on the team charged with reviewing permitting and other aspects of federal onshore oil and gas leasing.

"We also hope that IPAMS will have a seat at the table," she said. "Our members have a longer history of developing natural gas and oil on federal lands in an environmentally responsible manner."

Salazar rejected industry protests. Citing numbers of lease sales held last year, he said, "I think those in the industry who are crying out are crying out because we're being careful and supporting development in the right way in the right places."

Congressional response

Congressional energy leaders' responses generally followed party lines.

"Through greater coordination between agencies, and by providing the oil and gas industry needed certainty and clarity up front, we will ensure that America's domestic energy resources are developed in a fiscally sound and environmentally sensitive manner," said US House Natural Resources Committee Chairman Nick J. Rahall (D-W.Va.).

Senate Energy and Natural Resources Committee Chairman Jeff Bingaman (D-NM) said Salazar's announcement "sets out useful and important steps to ensure appropriate management of publicly owned energy resources." He said he was particularly pleased that the secretary was addressing CXs, which were intended under EPACT to streamline environmental reviews for certain kinds of energy projects on public lands but which a Government Accountability Office review this past September found DOI frequently violating under a confusing and inconsistent policy.

Congressional Republicans from the Rocky Mountains were critical.

"This announcement is yet another indication that the administration has no intention to honor its promise to produce a balanced energy plan that includes domestic energy production," said Sen. Robert B. Bennett (Utah). "[DOI] continues to look for ways to make domestic energy more expensive to producing by stalling the process for several years."

Sen. John Barrasso (Wyo.) called the announcement "a step in the wrong direction" and said, "Increasing the bureaucratic hurdles for energy development will only hinder our economic recovery and discourage job creation."

Rep. Rob Bishop (Utah), ranking member of the Natural Resources Committee's National Parks, Forests, and Public Lands Subcommittee and chairman of the Congressional Western Caucus, said he was particularly frustrated with new restrictions on CXs, which he considers one of EPACT's biggest successes. Salazar should understand that CXs under Section 390 are statutory, not administrative, he said.

"There is nothing in the statutory language that even mentions extraordinary circumstances; rather, the language is straightforward in mandating the use of categorical exclusions when the conditions in the statute are met," he said. ✦

Interior Sec. Salazar blasted for 'kings of the world' statement

Nick Snow
Washington Editor

An oil state US House Democrat strongly criticized Interior Secretary Ken Salazar for his characterizations of the oil and gas industry during a teleconference last week with reporters.

Asked about possible criticism of changes in new onshore leasing policies he was announcing, Salazar replied: "I think the difference was that [oil and gas producers] were essentially kings of the world in the prior administration. Whatever they wanted to happen, happened. We brought that to an end because we wanted to protect the public's resources. I expect the shrill responses from the oil and gas industry will come anyway."

Rep. Dan Boren (D-Okla.), as he released a letter to Salazar protesting the changes, said on Jan. 7: "This kind of comment is beyond the pale when thousands of Oklahomans and people from other energy-producing states are losing their jobs due to the recession. It's the type of rhetoric that only serves

Fuel ethanol limits

At first glance, the Jan. 6 letter to three key federal energy and environment policymakers from 14 trade associations about possible early approval of a higher ethanol content in motor fuels might have seemed routine. But the communication included a summary of required midlevel ethanol tests that clearly showed how much work still needs to be done.

The group, which included the American Petroleum Institute, National Petrochemical & Refiners Association, petroleum product retailing and marketing associations, and manufacturers of automobiles, boats, and outdoor recreation equipment, expressed concern that the US Environmental Protection Agency might decide to prematurely raise the fuel ethanol limit to 15% from 10%.

"We urge EPA to base its decision on a complete and sound scientific record, and we urge [the US Department of Energy] to help provide this science by spending all the $15 million targeted for expanding and accelerating midlevel ethanol blends research in the 2010 appropriations bill," the 14 associations said.

Extend comments

"Moreover, EPA should reopen the E15 waiver comment period to allow public review of new test data prior to making a final decision on the waiver request," they told EPA Administrator Lisa P. Jackson, US Secretary of Energy Steven Chu, and Carol Browner, White House coordinator of energy, environmental, and global climate change policy.

The group's recommended tests are extensive. For light-duty vehicles alone, they include vehicle fuel storage and handling, onboard diagnostics, base engine durability, catalyst durability and deterioration, evaporative emissions' useful life, tailpipe and exhaust emissions, emission inventory and air quality modeling, and vehicle drivability and fuel volatility.

Some tests are already under way. The Coordinating Research Council is conducting a broad range of studies, the "Auto/Oil E10+ Test Program for Highway 'Non-FFV' Vehicles," funded by the oil and auto industries with DOE.

Just under way

"This test program was initiated in 2008 and, with a concerted effort and adequate funding, could be complete in 2011," Greco said in a Dec. 16, 2009, letter to Gina McCarthy, EPA's assistant administrator for air and radiation. Work is just getting started in studies of base engine durability and onboard diagnostic systems' false illuminations, he noted.

Recommended infrastructure tests in the Jan. 6 letter included underground storage tanks (USTs), dispensers, enhanced vapor recovery equipment, adhesives and seals, and sensors. For USTs alone, it indicated that fiberglass reinforced storage tanks manufactured before 1981 were not intended to store any ethanol, and those made in the 1980s and early '90s were built to store up to E10 only.

In his letter, Greco also cited the need for a comprehensive vehicle testing program including models from before 2004. He said, "It is important to protect consumers by evaluating the full range of short and long-term impacts of increasing the amount of ethanol blended into motor fuels." ✦

to add insult to injury, like he's just trying to pile on their misery."

Boren noted that independent producers drill 90% of the nation's oil and gas wells. He said, "They are the mom-and-pop outfits that run a handful of wells, the young entrepreneur seeking to expand his operation, or the regional company that employs hundreds or even thousands of people in communities across the nation. And quite frankly, they consider this brand of rancor a slap in the face and a direct attack on their pride in having helped build this country's economy."

During the teleconference, Salazar and US Bureau of Land Management Director Robert V. Abbey said the changes would provide producers more certainty because they would help reduce lease protests and lawsuits. Industry groups responded that the new policies would simply create more delays.

'Central candy store'

Salazar said, "I think the change is that in the past, the public lands were the central candy store where the oil industry walked in and took what it wanted. That's not how it should be done. We have to make sure that development is taking place in the right way at the right time in the right places. Our people will be doing a higher level of review than in the past."

In his letter, Boren told Salazar that the new policies not only violate the 2005 Energy Policy Act, for which the secretary and US President Barack Obama voted as members of the US Senate, but also were not consistent with the administration's goal of a US energy policy that provides more jobs and strengthens energy security.

"Within the House Natural Resources Committee, I am constantly reminded why decisions relating to the development of natural resources are always best made at the local level," the federal lawmaker wrote. "Developing a master leasing plan under the stewardship of yet another disassociated, Washington-based regulatory team will only create potential for litigation and protest on every oil and gas lease issued by the agency. This top-down approach will add greater bureaucracy and costly delays to an industry so critical to our nation and our future."

Boren said millions of Americans are employed by the US oil and gas industry, earning an average $45/hr, or more than $93,000/year, which he said is more than double the average estimate of jobs created by so-called "green investment."

Boren told Salazar: "Why do policymakers within the administration deny the connection between your so-called 'kings of the world' and the millions of American jobs they provide? To these companies and the people behind them, statements such as your 'kings of the world' comment are a profound affront." ✦

EPA proposes strictest federal smog standards yet

Nick Snow
Washington Editor

The US Environmental Protection Agency proposed the strictest federal standards yet for ground-level ozone, commonly known as smog. The primary standard, which aims to protect human health, would be 0.06-0.07 ppm over 8 hr. EPA also proposed a secondary seasonal standard to protect plants and trees.

The agency said it is proposing replacing standards set by the administration of former President George W. Bush that many believed were not adequate. "Using the best science to strengthen these standards is a long overdue action that will help millions of Americans breath easier and live healthier," EPA Administrator Lisa P. Jackson said on Jan. 7.

Jackson announced in September 2009 that EPA would reconsider the existing 0.075 ppm standards that were set in March 2008. As part of its reconsideration, EPA said it reviewed the science that guided the earlier decision, including more than 1,700 public studies and comments during its rulemaking process. It also reviewed the findings of the independent Clean Air Scientific Advisory Committee, which recommended standards in the proposed ranges.

Depending on their final level, the new standards would yield $13-100 billion in health benefits, according to EPA. Implementing the proposal would cost $19-90 billion, it estimated.

Congressional Democrats applauded the agency's action. "I am pleased that EPA is once again basing its clean air decision on the advice of independent scientists. I applaud this reversal of a Bush administration decision to ignore science," said House Energy and Commerce Committee Chairman Henry A. Waxman (Calif.)

So did environmental organizations. "This rule will help ensure that all major sources of pollution get cleaned up," said Carl Pope, the Sierra Club's executive director. "It will drive the need for cities and states to reduce the smog pollution spewing from vehicle tailpipes."

The American Petroleum Institute was more critical. "The action lacks scientific justification," API said in a statement. "EPA acknowledges the newer studies on ozone 'do not materially change any of the broad scientific conclusions regarding the health effects of exposure.' Given that conclusion, there is absolutely no basis for EPA to propose changing the ozone standards promulgated by the EPA administrator in 2008," API said.

API warned, "To do so is an obvious

politicization of the air quality standard setting process that could mean unnecessary energy cost increases, job losses, and less domestic oil and natural gas development and energy security."

EPA will take public comments for 60 days following the proposal's publication in the Federal Register. It also has scheduled public hearings on the proposed standards in Arlington, Va., and Houston on Feb. 2, and in Sacramento on Feb. 4. ✦

Indonesia unveils long-term oil, gas plan

Eric Watkins
Oil Diplomacy Editor

Indonesia unveiled a long-term oil and gas management plan to attract $32 billion in investments for oil and gas facilities in 2010-14.

About 70% of the spending budget is targeted for investment in gas facilities, including LNG and LPG refineries, receiving terminals, and residential pipeline networks. The remaining 30% is for oil facilities, including refineries and rigs.

In 2010, Indonesia is aiming at $2.94 billion in oil and gas investment, while it expects to increase that total in 2011 to $3.18 billion.

The government sees 2013 as the peak year for investment in oil and gas, with a target of $10.57 billion—more than twice the level of investment in 2012 at $4.32 billion.

Kardaya Warnika, former chairman of regulator BPMigas, said the government would focus on expanding gas in order to reduce the nation's dependency on oil.

Indonesia's oil production lags behind domestic demand growth. Imports are costly as the Indonesian government subsidizes sales on the domestic market—a strategy that has stretched its finances to unacceptable levels.

Last month, in an effort to boost

WATCHING THE WORLD

Eric Watkins, Oil Diplomacy Editor

Blog at www.ogjonline.com

Reprise in Madagascar

A year ago, we were watching Madagascar's oil and gas industry, and the signs were not promising as demonstrators rampaged in the streets and set fire to an oil depot (OGJ, Feb. 2, 2009, p. 34).

The trouble erupted when the government closed a radio station belonging to the opposition party whose leader, Andry Rajoelina, said two protesters were killed in the affray.

President Marc Ravalomanana had earlier accused Rajoelina of promoting the government's overthrow and declared that the government would act decisively to "restore order" on the island nation.

Well, that hasn't happened, and the oil and gas industry has suffered. Oh, to be sure, China's Shaanxi Yanchang Petroleum Group Co. Ltd. (SYPG) last week did buy 15% of Hong Kong's Sino Union, a firm that operates oil blocks in Madagascar.

Yanchang buys in

SYPG, together with Sino Union and Hong Kong and China Gas Co., plans to set up a joint venture to develop and operate two oil fields—on Blocks 3113 and 2104—which have combined reserves of 5.6 billion bbl of oil.

But the Chinese firms may have to wait a while before getting on with their work, as the political crisis that erupted a year ago continues to disrupt the country's oil and gas industry.

Indeed, just last month, a top official of the country confirmed that Madagascar had delayed the auction of 50 offshore Indian Ocean oil blocks until this year's second half after months of political turmoil worried foreign investors.

Joeli Lalaharisaina, acting director general of the Office of National Mines and Strategic Industries (Omnis), told Reuters in an interview he expected exploration activity to pick up after a marked slowdown in 2009.

"The auction was supposed to take place in November but given the political crisis…we have been forced to push it back until next year. That's if everything goes well," he said.

'Just temporary'

According to Lalaharisaina, the sale of exploration rights, which will see the number of 2,000 sq km offshore blocks available increase from 6 to more than 50, was now scheduled for August or September.

The delay followed a military-backed coup in March 2009, and it was followed by threats to revise existing contracts with international oil companies. In fact, according to Lalaharisaina, ExxonMobil Corp. was still waiting to return its staff to Madagascar.

"It's a major worry right now that investors might pull out. Right now we are trying to reason with them, to make them understand the crisis is temporary," he said.

Yes, of course, the crisis is "just temporary" as are all things in life. But investors want something more definite than that.

"Madagascar will encourage any company which wants to build a refinery here, but for the moment there are no plans and it is too expensive for the state to consider," Lalaharisaina said.

Could it be too dangerous, as well? ✦

oil production by 11%, state-owned PT Pertamina reported that it expected to increase capital spending to $4.15 billion in 2010—a 77% increase from 2009 (OGJ Online, Nov. 13, 2009).

Meanwhile, Kardaya said gas development by 16 new rigs will continue until 2014 with an average investment target of $3.22 billion/year.

"Next year, we will kick off the development of two new gas rigs, namely in Lapangan Rambutan in South Sumatra and Pondok Tengah in West Java, with a total investment of $2.42 billion," said Kardaya, who added wells drilled by the two new gas rigs are expected to produce up to 1.02 bscfd of gas.

Gas plants planned

In 2011, Indonesia plans to construct five natural gas plants: Blok A in Nanggroe Aceh Darussalam, Jambi Merang in Jambi, Randublatung in Central Java, Gajah Baru in Natuna, and Kepodang in East Java.

To process the gas from the rigs, Indonesia plans to construct LNG and LPG refineries, with a total investment of $3.65 billion during the 2010-14.

Oil rigs and refineries will also be constructed in 2010-14 at a total investment of $3 billion and $6.52 billion, respectively.

Abdul Qoyum Tjandranegara, former president director of state-owned gas producer PT PGN, criticized the government management plan, saying, "Boosting gas production is good, but it would be a waste if the government exports gas.

"If we maximize the gas for domestic use, particularly for transportation and domestic use, we will not need to subsidize fuel as much as we do now," said Qoyum, whose remarks underscored concerns of many Indonesians.

In January, Indonesia urged gas producers in the country to maintain production or produce more gas to meet rising demand from domestic and overseas markets.

Previously, Indonesia's acting coordinating minister for the economy Sri Mulyani Indrawati said the government had put higher priority on gas for the domestic market than on gas for export (OGJ Online, Jan. 25, 2009). ✦

US biofuels policies flawed, Baker Institute study finds

Paula Dittrick
Senior Staff Writer

US policymakers need to consider the unintended consequences of federal subsidies and tariffs that go to domestic ethanol producers, concluded a study from Rice University's Baker Institute for Public Policy.

A paper on the study results, "Fundamentals of a Sustainable US Biofuels Policy," questions the economic, environmental, and logistical basis for corn-based ethanol. The paper's authors question whether mandated volumes for biofuels can be met.

"We need to set realistic targets for ethanol in the United States instead of just throwing taxpayer money out the window," said Amy Myers Jaffe, one of the paper's several authors. Jaffe is a fellow in energy studies at the Baker Institute and associate director of the Rice Energy Program.

The US government spent $4 billion in biofuel subsidies during 2008 to replace roughly 2% of the US gasoline supply. The average cost to the taxpayer of those "substituted" barrels of gasoline was roughly $82/bbl, or $1.95/gal, on top of the retail gasoline price.

A research grant in environmental engineering from Chevron Technology Ventures supported the study.

The paper suggests that Congress should reconsider biofuels mandates as outlined in the Energy Independence and Security Act, which outlines production targets for renewable fuels, mainly biodiesel and ethanol. EISA calls for production targets of 9 billion gal/year of biofuels in 2008 rising to 36 billion gal/year by 2022.

"Corn ethanol is capped at 15 billion gal/year in the law, but even that level will be difficult to reach given logistical and commercial barriers," the study said, adding that the use of flex-fuel vehicles is unlikely to be extensive enough to achieve the EISA mandates.

EISA also called for 21 billion gal of advanced biofuels, produced from sources like switch grass, corn stover, and algae, to be used in the US fuel supply by 2022. But the Baker Institute study said existing US mandated volumes for cellulosic ethanol and other nonfood biofuels currently are not achievable commercially.

The study's authors also question the tariff imposed on ethanol imported from Latin America and the Caribbean.

Because sustainable production of US corn-based ethanol faces limitations, the study found "tariff policies that block cheaper imports are probably misguided…. We believe on balance that the economic and geopolitical benefits to this trade with select regional suppliers would outweigh any 'energy security' costs to having some larger percentage of US ethanol supplies arriving from foreign sources."

Increased corn-based ethanol production from the Midwestern Corn Belt could exacerbate damage to ecosystems and fisheries along the Mississippi River and in the Gulf of Mexico, the study said.

Runoff from nitrogen fertilizers contributed to the gulf's "dead zone," a large area of poorly oxygenated water near the mouth of the Mississippi River in which some organisms cannot live. Runoff includes fertilizers and chemicals such as herbicides, fungicides, and pesticides.

Increased corn production to meet growing ethanol mandates also means farmers will use more water for irrigation. This could create water shortages in some areas experiencing significant increases in fuel crop irrigation.

Moreover, the study challenges claims that ethanol use lowers greenhouse gas GHG emissions.

"There is no scientific consensus on the climate-friendly nature of US-produced corn-based ethanol, and it should not be credited with reducing GHGs when compared to the burning of traditional gasoline," the study said. ✦

Total inaugurates CCS pilot in southwest France

Paula Dittrick
Senior Staff Writer

Total Exploration & Production France on Jan. 11 inaugurated a carbon capture, transportation, and storage pilot project at the Lacq natural gas processing plant and industrial complex in southwestern France.

Carbon dioxide will be injected for storage in the depleted Rousse gas field, which was selected for the pilot project because it's isolated from other reservoirs and is not directly connected with any aquifer.

An estimated 120,000 tonnes of CO_2 will be injected into Rousse field during 2 years. Sensors placed within 7 observation wells will monitor closely the stored CO_2 for 3 years after the injection is completed, Total said. Some monitoring will continue beyond the 3 years, Total added.

The pilot project involves changes at both Rousse field and at Lacq.

At Lacq, Air Liquide is supplying oxycombustion carbon capture technology in a steam boiler. Oxycombustion replaces the air in a boiler with pure oxygen, creating flue gas that is 90-95% CO_2. Lacq currently has five steam boilers of which one was converted for the oxycombustion process.

Until now, CO_2 emissions from the boiler were released into the atmosphere. Air Liquide developed burners used in the oxycombustion process and also is providing oxygen.

Once purified, the CO_2 will be compressed and transported via an existing 27-km pipeline to Rousse field where the CO_2 will be injected 4,500 m deep. This pipeline formerly transported gas from Rousse field to the Lacq plant. Also at Rousse, the injection well needed a work over and a compression unit was installed.

The Intergovernmental Panel on Climate Change estimated that CCS has the potential to mitigate one third of carbon emissions and could be used at 7,000 industrial plants worldwide by 2050. Total believes oxycombustion could reduce by 50% the capture costs, which typically account for two thirds of the expense in a CCS project.

Total said it will pay most costs for the pilot project. Cost is estimated at €60 million project. The French Petroleum Institute, the French Bureau of Geological and Mining Research, and others are participating in the pilot. ✦

COMPANY NEWS

Total, Chesapeake announce Barnett shale joint venture

Chesapeake Energy Corp. announced a $2.25 billion joint venture agreement with Total E&P USA Inc. in which Total will acquire a 25% interest in Chesapeake's upstream Barnett shale assets.

In other recent company news:

• Ultra Petroleum Corp., Houston, plans to buy 80,000 net acres prospective for Devonian Marcellus shale gas in central and northern Pennsylvania from an undisclosed private company.

• Berry Petroleum Co., Denver, entered into an agreement with an unidentified private seller to acquire interests in producing properties principally in the Wolfberry trend in West Texas for $126 million cash.

• Newfield Exploration Co., Houston, and Anadarko Petroleum Corp. plan to jointly acquire TXCO Resources Inc.'s assets in the Maverick basin for as much as $310 million. The final amount will be determined at closing, which is expected in February. The closing is subject to bankruptcy court approval. TXCO, San Antonio, filed for Chapter 11 bankruptcy protection in May 2009.

• Noble Energy Inc. agreed to pay $494 million to Suncor Energy Inc. for oil and gas properties in Colorado.

• Sun River Energy Inc., Wheat Ridge, Colo., will acquire private Raven Wing Resources Inc., which participates in four pending projects in the Sweetgrass arch of Montana, Powder River basin in Wyoming, and Utah Wasatch Plateau. Consideration is $3.5 million cash and assumption of $360,000 in liabilities. Sun River plans to arrange financing through its established lender.

• Talisman Energy Inc., Calgary, outlined a $5.2 billion (Can.) budget for 2010—an increase of more than 10%

from its 2009 budget.

• St. Mary Land & Exploration Co., Denver, announced a 2010 total budget of $725 million, of which exploration and drilling is slated to receive $561 million.

Total, Chesapeake JV

The transaction between Total and Chesapeake covers 270,000 net acres of Chesapeake's Barnett shale leasehold that accounts for 700 MMcfd of gas equivalent of current net production and proved reserves of 3 tcf of gas equivalent.

Total will pay $800 million upon the transaction's closing, expected by Jan. 31 and subject to regulatory approvals. In addition, Total will pay $1.45 billion by financing 60% of Chesapeake's drilling and completion costs in the JV area. The $1.45 billion obligation is expected to be fulfilled by yearend 2012.

Chesapeake believes its JV leasehold position will support drilling 3,100 additional net locations with 6.3 tcf of gas equivalent of unproved reserves. About 60% of Chesapeake's core and Tier 1 leasehold is developed.

Total has the right to acquire a 25% share in any new acreage that Chesapeake acquires in the Barnett shale until Dec. 31, 2015. Total and Chesapeake also agreed to jointly study other Barnett shale opportunities as well as shale plays in Canada.

Currently, Chesapeake has 20 rigs working in the Barnett shale, and it expects to ramp up to about 30 rigs working there throughout much of 2010.

Christophe de Margerie, Total chief executive officer, said the agreement marks Total's entry into the US shale plays. Total currently holds assets in the Gulf of Mexico.

Aubrey K. McClendon, Chesapeake's chief executive officer, said Chesapeake is maintaining its previously announced 2010 production target of 2.6 tcf of gas equivalent.

"We plan to continue to take advantage of our large asset base by pursuing other joint ventures, including potentially our large acreage positions in the Eagle Ford shale and in several Midcontinent unconventional plays," McClendon said.

Separately, Chesapeake already has JVs with Plains Exploration & Production Co., BP America, and Statoil.

Chesapeake is drilling a well in the Eagle Ford shale play. McClendon said he expects production there in about 45 days.

Ultra's Marcellus stake

Ultra's $400 million Marcellus deal, expected to close in late February and retroactive to Oct. 1, 2009, will boost the company's holding in the play to 250,000 net acres with the potential for 1,800 net drilling locations, said Michael D. Watford, chairman.

"With this acquisition, we believe that our net recovered resource in the Marcellus alone will exceed 8.5 tcfe, an increase of 3.5 tcfe from current estimates," Watford said.

Ultra Petroleum drilled 30 Marcellus horizontal wells in 2009, 13 of which were producing in late December. Initial production rates for the producing wells average 7.5 MMcfd, and preliminary estimated ultimate recoveries range from 3.5 to 4 bcf.

The company started 2009 with 288,000 gross (152,000 net) acres in the Marcellus. Through a combination of land acquisitions and swaps, including the acquisition to close in February, it has added more than 192,000 gross acres, nearly doubling its position to 480,000 gross (250,000 net) acres.

The company's expanding core position is concentrated around Tioga, Bradford, Lycoming, Potter, Clinton, and Centre counties.

Berry in West Texas

Berry's proved reserve estimates associated with the properties are 11.2 million boe, 92% of which are in the Wolfberry, 85% are oil reserves, and 23% are proved developed reserves. In 2010, the acquisition is expected to add 1,300 boe/d to Berry's production on a 12-month annual average. Berry has identified over 130 drilling locations in the Wolfberry trend targeting the Spraberry, Dean, Wolfcamp, and Strawn formations.

Robert Heinemann, president and chief executive officer, said, "This acquisition provides Berry with the opportunity to diversify its oil resources and add a high margin, scalable oil resource to our portfolio. We believe the Wolfberry is an excellent fit with Berry's engineering and execution competencies and complements our existing stable base of low geologic risk oil assets. We will be the operator of 70% of the acquired properties and plan to transition a new West Texas focused asset team over the coming months."

Berry is increasing its 2010 capital budget by an additional $30 million to range $250-290 million. The company plans to drill 27 wells on the Permian property, funded from internally generated cash flow. One rig is currently drilling and Berry expects the acquired properties to provide self-funded production growth over the coming years.

Berry expects its 2010 production to be 32,250-33,000 boe/d, an increase of 8-10% over 2009. In addition, Berry's production from oil assets is expected to grow 20% by yearend driven by Diatomite and Wolfberry development.

The effective date of the transaction was Jan. 1. Closing is expected in March, subject to customary conditions.

Newfield, Anadarko in Maverick

Newfield and Anadarko's transaction with TXCO involves acreage in the Eagle Ford and Pearsall shale plays in southwest Texas.

Newfield will acquire more than 350,000 gross acres in Maverick basin (300,000 net acres) for $217 million.

Current net production of the assets being acquired by Newfield is 1,500 boe/d—two thirds of which is oil.

An Anadarko subsidiary plans to acquire more than 80,000 net acres from TXCO for $93 million. Anadarko

already had 180,000 net acres in this area.

Lee Boothby, Newfield president and chief executive officer, said this transaction marks Newfield's entry into Maverick basin, where he expects an active drilling program this year.

US Bankruptcy Judge Ronald B. King is handling the TXCO case at the Western District's office in San Antonio.

TXCO executives said the bankruptcy filing stemmed from extreme volatility in energy prices and the economic downturn.

According to the bankruptcy filing, TXCO had assets of $431.9 million and total debts of $322.8 million.

Noble's Colorado deal

Noble's acquisition will add 10,000 boe/d, or 46 MMcfd of natural gas and 2,500 b/d of liquids to the Houston independent's production.

The transaction involves 340,000 total net acres of which nearly 200,000 acres are in the Denver-Julesburg, or DJ, basin.

The DJ basin contains Wattenberg field, which is Noble Energy's largest onshore US asset. The transaction includes 53 million bbl of proved reserves, of which 80% are in Wattenberg field.

Noble Energy has identified several thousand projects associated with the acquisition, including more than 2,000 drilling sites in Wattenberg.

The acquisition, subject to regulatory approvals, is expected to close late in the first quarter.

Noble Energy plans to add two rigs to its Wattenberg program this year as a result of the transaction, increasing its operated drilling activity in the field to eight rigs.

Suncor of Calgary is selling the properties, some of which it acquired through its acquisition of Petro-Canada. Suncor is divesting certain assets so it can focus on oil sands development in Western Canada.

Sun River-Raven Wing deal

Several of the drillable opportunities in the Raven Wing portfolio are stepouts and infill locations near existing production. Sun River said it should be able to begin drilling several locations within 6 months of closing.

First to be developed is oil at 2,500 ft on 4,200 net acres on the Sweetgrass arch. The property could accommodate as many as 210 wells if fully developed on 20-acre spacing at a cost of $300,000/completed well.

The Powder River basin project involves $1 million wells at 8,500 ft on 1,900 net acres, with as many as 24 wells possible if fully developed on 80-acre spacing.

The Wasatch Plateau project targets several potential gas reservoirs as deep as 6,000 ft on 36,000 net acres. Cost is $500,000-$1.5 million/well depending on depth and completion process, and as many as 300 wells could be drilled.

Raven Wing doesn't own land on the fourth opportunity, a field infill and extension concept in the Powder River basin.

Talisman budget

Talisman says it plans to spend $1.6 billion on North American shale plays. Within the Pennsylvania Marcellus play in the US and the Montney play in British Columbia, Talisman expects to double its development drilling as compared with 2009.

Talisman plans development spending of $780 million in Southeast Asia, primarily on oil developments in Vietnam and Australia. The company also plans to spend $800 million on UK development projects.

About $270 million was allotted for 2010 spending on conventional properties.

Talisman said it is examining "the sale of a significant amount of noncore conventional assets in North America, depending on market conditions." These assets, which were not identified, currently produce 40,000 boe/d.

John A. Manzoni, Talisman president and chief executive officer, said the company remans "vigilant" in looking for acquisitions.

"We expect returns to increase," Manzoni said, adding he expects the company will reduce its finding and development costs.

Talisman said its activity levels will be "robust" given $60/bbl oil and $3.50/MMbtu gas prices on the New York Mercantile Exchange. The company plans to issue yearend 2009 results on Feb. 10.

St. Mary's 2010 budget

The independent announced a $350 million budget for 2009 early last year, down more than 50% from the $758 million budget St. Mary initially forecast for 2008.

Tony Best, St. Mary chief executive officer and president, said the company will deploy "a meaningful amount of investment in our emerging resource plays, particularly in the Eagle Ford and Haynesville shales."

The 2010 exploration and drilling budget allocates $216 million for Eagle Ford play, $89 million for the Haynesville play, and $89 million for the Permian basin.

St. Mary will operate 75% of the exploration and development capital it deploys during the year. The company plans to operate two drilling rigs continuously on its Eagle Ford interests in the South Texas counties of Webb, Dimmitt, and La Salle.

Best said St. Mary has increased efficiencies in the Eagle Ford drilling program, allowing it to increase activity without increasing rig count. St. Mary's first operated well in Eagle Ford was drilled in 45 days while a recent well was drilled in fewer than 14 days.

The Eagle Ford play will account for 34 gross operated wells during 2010, and St. Mary plans to have 100% working interest on most of those wells.

About $24 million of the facilities budget will be deployed in the Eagle Ford play to expand infrastructure there. The facilities budget is separate from the exploration and drilling budget. ✦

PDVSA, Eni to form JVs to develop, refine Orinoco oil

Venezuela's Petroleos de Venezuela SA (PDVSA) and Italy's Eni SPA agreed to establish two joint ventures to produce and refine oil from the Junin 5 block in the Orinoco belt.

"This agreement is the result of 2 years of continuous work between PDVSA and Eni," said the Italian firm's Chief Executive Paolo Scaroni. "Junin is among the blocks with greatest expectations within the very attractive Orinoco belt," he said, adding that the refinery will give the project "greater robustness."

The Junin sector of the Orinoco belt was known as Zuata until PDVSA changed the names of the belt's four main segments in 2005.

Joint ventures

Scaroni and PDVSA Pres. Rafael Ramirez agreed to form separate JVs to extract and refine the heavy crude found in the 424-sq km Junin 5 block, with PDVSA taking 60% and Eni 40% of each venture.

One JV is to produce 75,000 b/d of oil in 2014. When production eventually reaches 240,000 b/d, the second JV will build a refinery at the Jose Industrial Complex.

PDVSA said the arrangements, which must be approved by Venezuela's National Assembly as well as the two companies' boards, will be signed in Caracas on Jan. 26.

Last December, China and Venezuela signed five similar agreements, one concerning refining and two touching on exploration and development of oil fields in the Orinoco belt (OGJ Online, Dec. 30, 2009).

Last November, Ramirez—who also serves as Venezuela's minister of oil—told the third World Congress on Heavy Oil that certified crude reserves in the Orinoco belt are expected to reach 235.6 billion bbl by the third quarter of 2010 and its total reserves 316 billion bbl.

Ramirez said the Orinoco belt is producing more than 532,000 b/d of 16-32° gravity oil, and he highlighted several projects aimed at increasing production.

In particular, the minister mentioned a consortium of Russian companies and PDVSA that aims to produce 450,000 b/d from Junin 6; a JV with CNPC that will produce 400,000 b/d from Junin 4; and a project with Petrovietnam at Junin 2 expected to produce 200,000 b/d.

Vast potential

According to analyst IHS Global Insight, few would argue with the huge production potential offered by Venezuela' heavy oil reserves and the promise of new investment from foreign companies should result in higher production volumes in the coming years.

"However, the Venezuelan government' production forecasts have been overoptimistic in the past, and it remains to be seen whether its choice of business model and partners is best suited to meet its ambitious goal of 6.862 million b/d production capacity by 2021," the analyst said.

Baker Hughes indicates that overall drilling in Venezuela has declined as it has in many areas of the world the past 18 months. After averaging 80 rigs/month in January-November 2008, the country averaged 61 rigs/month in January-November 2009. Baker Hughes drilling figures include rigs working in the Orinoco belt.

Venezuelan President Hugo Chavez's administration nationalized four Orinoco heavy oil projects in 2007. PDVSA was in arrears on payments to various drilling contractors in 2009, and the administration seized the assets of some foreign and domestic drilling contractors in mid-2009.

The 12,000-sq km Orinoco belt is comprised of four main areas: from west to east, they are Boyaca, Junin, Ayacucho, and Carabobo, with each main area subdivided into 27 blocks (see map, OGJ, Nov. 21, 2005, p. 54). ✦

Lodgepole Scallion zone yields oil in North Dakota

Alan Petzet
OGJ Chief Editor-Exploration

Continental Resources Inc., Enid, Okla., said an initial test of a horizontally drilled section of Scallion limestone in west-central North Dakota produced at an uneconomic 7-day rate of 65 b/d of oil and 37 Mcfd of associated gas and plans no further drilling at present.

Scallion, a lower member of the Lodgepole formation of Mississippian age, lies at 9,500 ft just above the Upper Bakken shale. Continental Resources also tested the Middle Bakken shale in the Traxel 1-31H well in Mercer County, ND, but didn't encounter meaningful oil shows.

The company drilled one lateral in each of the two formations and completed the Scallion leg with a multistage plug-perf style frac.

The Traxel exploratory well on the little-drilled southeastern perimeter of the Bakken play "establishes the potential for another producing reservoir in the Bakken petroleum system of the Williston basin. Productivity would have to increase for it to be economic," Continental Resources said.

Continental Resources plans to monitor activity by other operators in this part of the play before drilling more test wells. Scallion has produced oil since the 1960s from about 2,000 ft in the North Virden pool in Manitoba about 100 miles north of the Traxel well.

The company, which holds 483,000 net acres in the North Dakota Bakken play, in the past 6 months has added 70,000 net acres of leases strategically located on the western and eastern edges of the Nesson anticline as well as expanding westward into Williams County, where it is drilling its first well.

It plans to operate 15 North Dakota Bakken rigs by mid-2010 compared with seven at the end of 2009.

Six rigs will be on ECO-Pads, a patented concept of a single drill pad located on the shared boundary of abutting north-south, 1,280-acre spacing units. Four wells will be drilled from each ECO-Pad, with one Middle Bakken and one Three Forks-Sanish well each into the north unit and a similar pair of wells into the south unit.

The concept is expected to reduce well cost and allow for a longer horizontal bore in each well, generating higher initial productivity and reserves, Continental Resources said. ✦

Colombia

Pacific Rubiales Energy Corp., Toronto, said two of three appraisal wells in Colombia's Rubiales field extended known production into new areas while two exploratory wells on the adjacent Quifa block found no hydrocarbons. Both are in the Llanos basin.

The Rub-251 and Rub-366 appraisal wells on prospect D in northern Rubiales field each cut 31 ft of net pay in Carbonera with porosities above 30%, extending the late 2008 D block discovery to the southeast and its continuation onto the Quifa block. They are to be completed as vertical producers.

Rub-310 is to be converted to an injection well as its Carbonera section was water saturated.

Exploratory wells Quifa-15 and 16 on the B and C prospects 15-18 km northeast of Rubiales production found good reservoir characteristics in Carbonera but no hydrocarbons. Both are on the highest part of the structure of the Rubiales-Quifa area. The company will conduct seismic inversion to identify the stratigraphic anomaly that did not permit migrating oil to reach the area targeted by the two wells.

Iraq

ShaMaran Petroleum Corp., formerly Bayou Bend Petroleum Ltd., let a contract to Gulf Geophysics FZCO, a subsidiary of Bureau of Geophysical Prospecting, Beijing, to shoot 800 line-km of 2D seismic on ShaMaran's Pulkhana, Arbat, and K-42 blocks in Iraqi Kurdistan.

Acquisition is to start by Jan. 15, 2010. The program is designed to provide seismic data coverage of the Pulkhana development block as part of a planned appraisal program. Shooting on the other two blocks is designed to confirm known leads and identify new targets.

New Zealand

An internal assessment indicates a best-estimate resource of 19.1 million stb of original oil in place on the Winchester exploration permit PEP 38748 in New Zealand's onshore Taranaki basin.

TAG Oil Ltd., Vancouver, BC, which controls 100% of the permit, said the resource is assigned to the six drill-ready prospects. The resources were determined from 3D seismic data, well log data, core pyrolysis, and analog field data.

The oil is believed to be in the Miocene Mount Messenger formation on the permit, between TAG Oil's Cheal oil and gas discovery under appraisal and large Ngatoro oil and gas field.

UK

Premier Oil PLC took a farmout from Serica Energy PLC to earn a 50% interest in UK Central North Sea Block 22/19c.

Premier Oil will drill an exploratory well to 10,000 ft on the Oates prospect in mid-2010 and will become block operator. The block also has the Bowers Paleocene prospect.

Oates is a large Paleocene Forties sand stratigraphic trap identified on 3D seismic data similar to nearby Forties sand fields such as Huntington, Montrose, and Columbus. Serica discovered Columbus in 2006 and is in final development planning.

Serica is in final negotiations to farm out its Conan prospect in East Irish Sea blocks 113/26b and 113/27c, in which it holds 100% interest. Serica will farm out a 35% interest in the license for which the farmee will contribute 70% of well costs. Serica will remain as operator with 65% interest.

Alberta

Yoho Resources Inc., Calgary, secured 5,120 acres at 100% working interest strategically located on a new resource play focused on the Devonian Duvernay formation in the Kaybob area 150 miles northwest of Edmonton, Alta.

The company assembled the lands in the last 6 months at attractive prices relative to the recent highly competitive land sale of Dec. 16, 2009. Ongoing geological and geophysical work will dictate the timing of any field work in this area, the company said.

Canadian Imperial Venture Corp., St. John's, Newf., chose a contractor to shoot a 72-sq-mile geophysical survey on lands where CIVC and Batavia Energy Inc., Toronto, plan to conduct an unconventional shallow gas play in an undisclosed area of southern Alberta.

The program includes geological and geophysical mapping, drilling, and land acquisition. Spending is projected at $5 million in 24 months.

British Columbia

A 640-m horizontal leg drilled underbalanced in the underpressured Cretaceous Dunlevy formation at Buick Creek, BC, north of Dawson Creek, has flowed at a stable 2.9 MMcfd of gas at 5.6% drawdown, said Yoho Resources Inc., Calgary.

Sample analysis indicated high quality sandstone reservoir for the entire horizontal section. The company estimated sandface absolute open flow potential to be 12.7 MMcfd.

Yoho Resources has a 97.5% capital expenditure interest in the well and a 78.5% revenue interest. The well is to be connected and flowing in early February 2010, and several follow-up locations are to be drilled this year.

Yoho Resources Inc., Calgary, negotiated a pooling of interests with a large producing company to expand Yoho Resources' land holdings to 22 sq miles from 10 sq miles at Two Rivers, BC, where the target is a Devonian Montney gas resource play.

Yoho Resources' working interest after the pooling will average 47%. The company also negotiated a farmout to earn an increased interest in certain of the pooled lands by completing an existing well bore in the Montney formation. Completion is expected to proceed in January 2010.

Arizona

The Manuel Seep prospect in the Holbrook basin in Apache County, Ariz., will be tested for oil, gas, and helium in the Permian Supai, Pennsylvanian Naco, and Devonian Martin formations, said PetroSun Inc., Scottsdale, Ariz.

PetroSun said that Energy Southwest LLC notified PetroSun that it has received a firm funding commitment of $12.5 million for Manuel Seep Phase 1. The agreement between PetroSun and Energy Southwest covers 838,870 acres of oil and gas rights in Arizona and New Mexico (OGJ, Sept. 21, 2009, p. 51).

Mississippi

KFG Petroleum Corp., Natchez, Miss., plans to drill three exploratory wells in Fayette field, Jefferson County, Miss., in the first quarter of 2010, including a 10,000-ft test to Cretaceous Lower Tuscaloosa.

The other two wells will be a south offset to the Spring Hill-1 to confirm that shallow oil pool at 4,100 ft and another Wilcox wildcat to test a prominent 3D seismic high in the Artman sand of Wilcox at 5,200 ft.

The field has stabilized at 70 b/d of oil from Wilcox at the Spring Hill-1 and 2 wells. Two zones are behind pipe in Spring Hill-1. The company holds 4,100 acres in the area.

North Dakota

FieldPoint Petroleum Corp., Austin, acquired a lease of 440-800 gross acres at $155/acre with 16-20% royalty in Renville County, ND., on the north side of the North Dakota Bakken unconventional oil play.

Most of the play is to the south in Mountrail, Burke, Divide, and Dunn counties. The company didn't give a date for drilling and said it might have to acquire more leasehold if available.

Texas

West

CrownQuest Operating LLC, private Midland operator, and Lynden Energy Corp., Vancouver, BC, tied in the first Wolfberry well, spud a second, and expects to spud a third within a week in a five-county program in West Texas.

Production capability isn't known yet for the Harrell-34-1, which went to TD 10,906 ft and had nine frac stages. Miller Trust-101 and Mallard 23-2 are projected to 10,000-11,000 ft targeting oil and gas in Permian Spraberry and Wolfcamp.

The overall project covers five prospects on 12,063 net acres in Glasscock, Howard, Martin, Midland, and Sterling counties. A typical completion covers a 2,500-3,000-ft gross interval at 7,000-10,500 ft. Lynden Energy is earning a 43.75% working interest in the three wells by funding 50% of costs.

Refrigeration provides economic process for recovering NGL from CO_2-EOR recycle gas

Kenneth. J. Vargas
Falcon EDF Ltd.
Calgary

Removing and selling NGL from the produced gas stream is one on the ways CO_2 enhanced oil recovery projects can improve their economics.

These projects involve gas recycling into the reservoir for maintaining pressure and improving oil mobility. The recycled gas absorbs NGL in the reservoir that can be recovered with a refrigeration process.

The process involves refrigerating the gas and then separating, stabilizing, and recovering the NGL. A company then can market the recovered NGL as C_3, C_{3+}, C_4, and C_{5+} or use it to spike the crude.

This article describes the following aspects of NGL recovery:

- Process plant required for each alternative (C_{3+}, fractionated liquids, or crude spiking).
- Liquid recoveries for varying process conditions such as chiller final temperature.
- Process property method selection.
- Process flow diagram with material balance.
- Approximate costs for different process alternatives.
- Economics of the alternatives.

It is best to install this NGL recovery and refrigeration facility early in the CO_2 injection project's life.

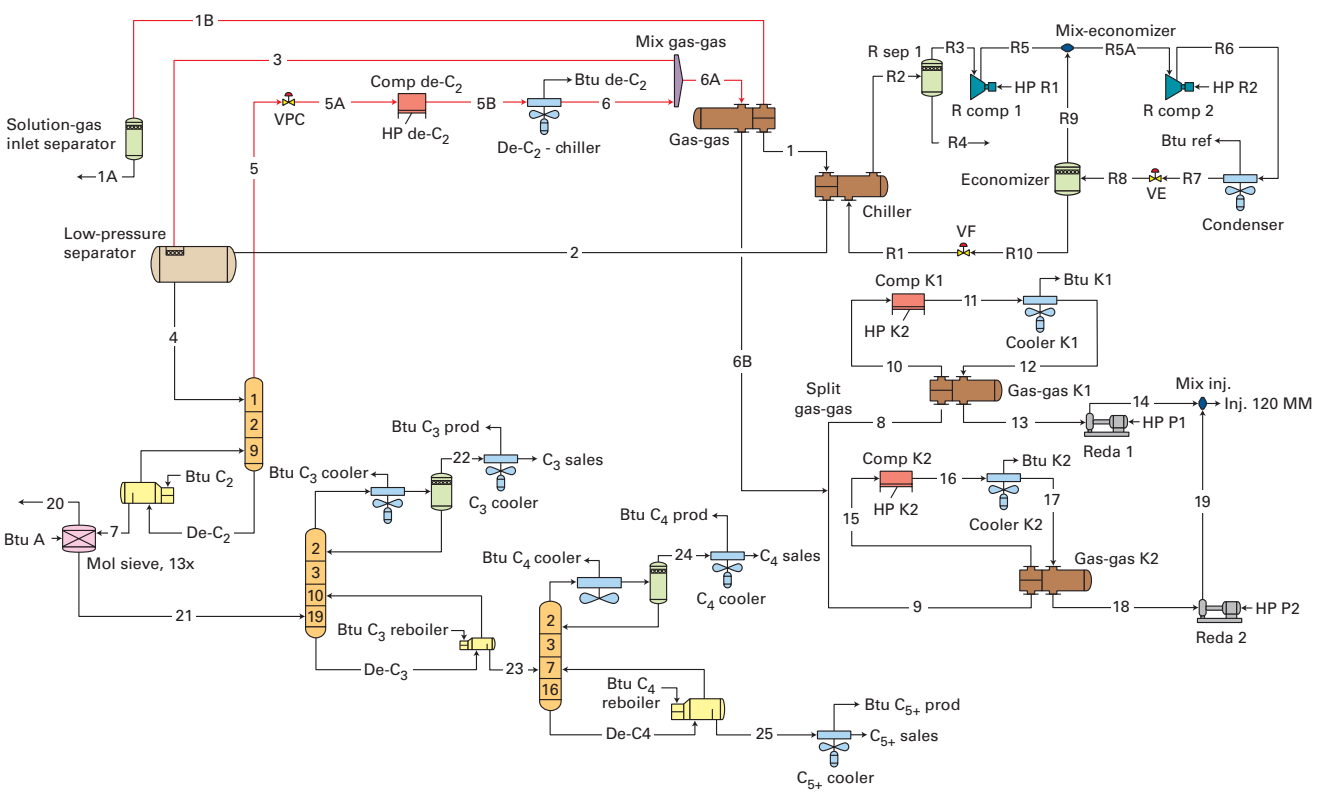
Process facility

A typical CO_2-EOR NGL recovery plant consists of the basic battery with additional equipment to handle increased produced gas and water, as follows:

- Inlet separation.

Process flow

Fig. 1



MATERIAL BALANCE

Stream	2	13	18	Btu-Ref	C_3-sales	C_4-sales	C_{5+}-sales
Vapor fraction	0.7994	1.0000	0.0000	2.0000	1.0000	0.0000	0.0000
Temperature, °C.	–29.0000	38.0000	32.0000	0.0000	43.0000	43.0000	43.0000
Pressure, kPa-g	1,324.8419	8,792.9143	8,792.9143	0.0000	1,194.8897	574.3614	608.8352
Flow, MMscfd	120.0000	59.0204	58.9976	0.0000	0.3459	0.7178	0.9172
Liquid flow, cu m/day	7,904.8550	3,824.8715	3,823.3949	0.0000	36.0220	86.1025	134.4131
Liquid flow, b/d	49,719.9569	24,057.6765	24,048.3892	0.0000	226.5710	541.5676	845.4313
Mole weight	43.6115	43.2465	43.2465		44.1822	57.8919	79.1946
Energy, btu/hr	2.50311E+07	1.01560E+07	4.49534E+06	3.38568E+07	249,477.1803	15,050.2347	–4,466.9296
Energy, hp	9,837.6048	3991.4675	1,766.7385	13,306.2406	98.0482	5.9150	–1.7556
H_2 mole fraction	0.000000	0.000000	0.000000		0.000000	0.000000	0.000000
N_2 mole fraction	0.008801	0.008949	0.008949		0.000000	0.000000	0.000000
CO_2 mole fraction	0.918692	0.934119	0.934119		0.000286	0.000000	0.000000
H_2S mole fraction	0.009101	0.009245	0.009245		0.000000	0.000000	0.000000
C_1 mole fraction	0.015102	0.015355	0.015355		0.000000	0.000000	0.000000
C_2 mole fraction	0.013501	0.013728	0.013728		0.000043	0.000000	0.000000
C_3 mole fraction	0.016002	0.013220	0.013220		0.993553	0.022790	0.000000
iC_4 mole fraction	0.002900	0.001526	0.001526		0.005000	0.231329	0.000198
nC_4 mole fraction	0.007401	0.002945	0.002945		0.001118	0.739641	0.009998
C_{5+} mole fraction	0.008500	0.000912	0.000912		0.000000	0.006240	0.989804

- Treating or emulsion breaking for further phase separation.
- Liquid products storage (oil and water).
- Produced gas compression for all oil and water separation pressures.
- Water injection.

Fig. 1 shows the process flow diagram and Table 1 the material balance for 14 of the most relevant streams. The additional units for CO_2-EOR include:

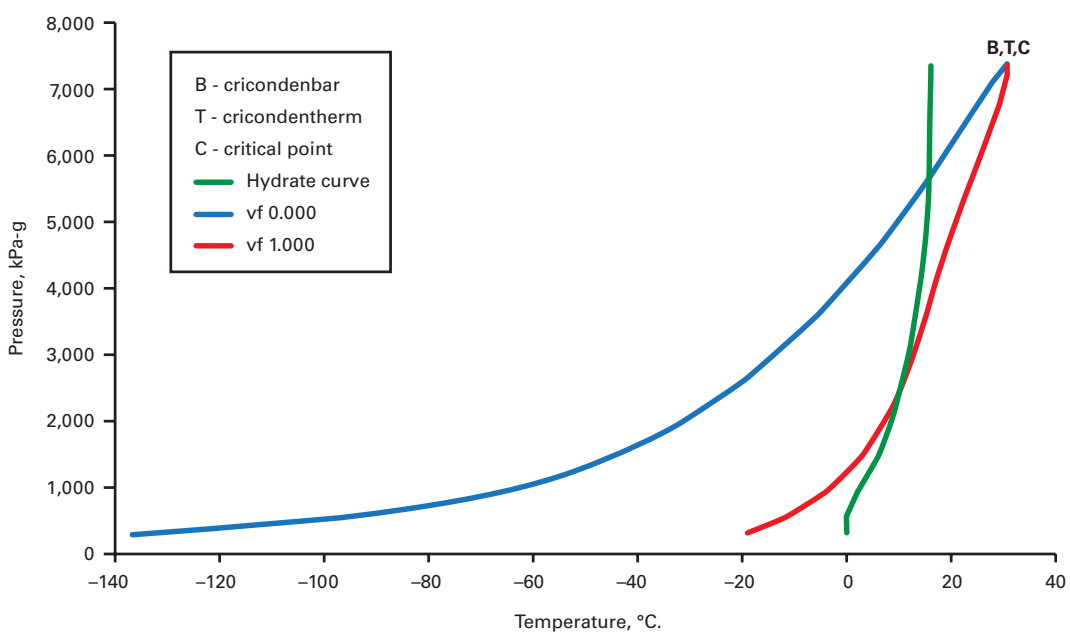
- Solution gas, gas-gas precooling exchanger.
- Solution gas chiller with propane refrigeration plant.
- Low-temperature separator to feed refrigerated liquids to the fractionation plant.
- Amine or mol-sieve liquid NGL sweetening unit.
- Lean-gas, pump-suction exchangers. The case shown in Fig. 1 has two 1.70 million cu m/day (60 MMscfd) trains.
- Two compressor trains of 1.70 million cu m/day each to boost the pressure from 1,256 kPa-g (182 psig) to obtain a dense phase for 92% CO_2 gas. The critical point is 7,500 kPa-g (1,090 psig), and the pressure selected was 8,860 kPa-g (1,285 psig), which is in the dense-phase region. Fig. 2 shows the phase envelope for the solution gas.
- Two centrifugal multiphase pumps, one per train to boost the pressure to the injection pressure of 15,400 kPa-g, or 2,230 psig.

The analysis looked at the following three alternatives for liquids recovery:

1. Fractionation plant with de-ethanizer, depropanizer (sell C_3 product), debutanizer (sell C_4 and C_{5+} product), and distillation towers with ancillaries (aerial condensers, reflux drums reboilers, and product coolers).
2. De-ethanizer to produce C_{3+} product and sell.
3. De-ethanizer to produce C_{3+} and spike the crude.

PHASE ENVELOPE

Fig. 2



Process design

The design assumed a gas with a 1.5 sp gr (43.6 molecular weight).

Table 1

HP-P1	HP-P2	HP-R1	HP-R2	Inj -120 MM	R3	Solution gas
2.0000	2.0000	2.0000	2.0000	1.0000	1.0000	1.0000
0.0000	0.0000	0.0000	0.0000	62.3072	–32.9945	27.0000
0.0000	0.0000	0.0000	0.0000	15,411.8830	50.3597	1,380.0000
0.0000	0.0000	0.0000	0.0000	118.0180	40.2712	120.0000
0.0000	0.0000	0.0000	0.0000	7,648.2664	4187.2170	7,904.8550
0.0000	0.0000	0.0000	0.0000	48,106.0657	26,336.7577	49,719.9569
				43.2465	43.8165	43.6115
3.70150E+06	2.70696E+06	1.00267E+07	1.69455E+06	2.10598E+07	2.12384E+07	5.43272E+07
14,54.7471	1,063.8752	3,940.6609	665.9849	8,276.8284	8,347.0270	21,351.3939
				0.000000	0.000000	0.000000
				0.008949	0.000000	0.008801
				0.934119	0.000000	0.918692
				0.009245	0.000000	0.009101
				0.015355	0.000000	0.015102
				0.013728	0.020000	0.013501
				0.013220	0.980000	0.016002
				0.001526	0.000000	0.002900
				0.002945	0.000000	0.007401
				0.000912	0.000000	0.008500

Gas composition

Table 2

Component	Mole fraction
H_2	0.0000
He	0.0000
N_2	0.0088
CO_2	0.9187
H_2S	0.0091
C_1	0.0151
C_2	0.0135
C_3	0.0160
iC_4	0.0029
C_4	0.0074
iC_{5+}	0.0085

Table 2 shows the gas composition.

This article presents the design for only the 92% CO_2 gas content with a full fractionation case because the recoveries for this case are more conservative due to the high CO_2 concentration. The base case includes a fractionation train because all other alternatives are subsets of it. The other two alternatives either sell or spike the crude with the C_{3+}.

The analysis used the Peng-Robinson property method for all the simulations.

Table 3 summarizes the key stream simulations of the process shown in Fig. 1.

Propane refrigeration

The refrigeration loop is in the upper right-hand corner of Fig. 1. A gas-gas exchanger precools the plant inlet solution gas. It uses cold gas off of the low-temperature separator.

After the gas-gas exchanger, a chiller refrigerates the gas to –29° C. The refrigeration feeding the chiller on the shell side is a propane loop with an economizer on the interstage of the propane screw compressor.

The schematic simplified the propane loop as a two-stage refrigeration without a second chiller on the last stage. It shows only one chiller for simplicity.

A two-stage refrigeration loop would reduce the compression by 19% and the condenser duty by 8%. The material balance (Table 1) reflects this. It shows the process requires 3,940 hp for the first stage (HP R1) and 670 hp for the second stage (HP R2). The design corrects the total 4,610 hp by –19% for two-stage efficiency. Thus refrigeration compression would total about 3,750 hp.

The propane refrigeration condenser would provide 33.9 MMbtu/hr × 0.91 or 31 MMbtu/hr.

Note the process requires an ethylene-glycol injection loop for dehydrating the gas to avoid gas hydrates after cooling.

For simplicity, Fig. 1 does not show EG injection.

NGL stabilization

The lower left-hand portion of Fig. 1 shows the fractionation plant. The refrigerated gas goes to a low-temperature separator, which separates the liq-

Process conditions

Table 3

Inlet parameters	
Level of CO_2, %	92
Inlet separator pressure, kPa-g	1,380
Inlet separator temperature, °C.	27
Inlet gas-gas exchanger	
Tubeside in-out temperature, °C.	27/–1
Shellside in-out temperautre, °C.	–28, 3
Duty, MJ/hr, MMbtu/hr	8.4, 8.0
Propane refrigeration	
Chiller in-out temperature, °C.	–1/–29
Chiller duty, MJ/hr, MMbtu/hr	7.8/7.4
Propane compressor, hp	4,610
Propane condenser duty, MJ/hr, MMbtu/hr	35.8/31
De-ethanizer	
Flow in, cu m/day	1,689
Tower diameter, mm	1,100
Reboiler duty, MJ/hr, MMbtu/hr	15.8/15
Liquid produced, cu m/day	257
Overhead gas, 1,000 cu m/day	625
Recompressor, hp	100
Inlet gas-gas K1-K2 exchangers	
Duty, MJ/hr, MMbtu/hr	4.0-3.8/3.8-3.5
Minimum tempererature out, °C.	38 (gas), 32 (liquid)
Pump maximum flow, cu m /day, MMscfd	3,824/59
Pump flow specific gravity	0.4-0.55
Pump, hp	1,454-1,064
Depropanizer	
Flow in, cu m/day	256
Tower diamater, approximate mm	610
Reboiler duty, MJ/hr, MMbtu/hr	1.9/1.8
Liquid produced, cu m/day	220
Overhead gas, 1,000 cu m/day	9.8
Debutanizer	
Flow in, cu m/day	86
Tower diamater, approximate mm	310
Reboiler duty, MJ/hr, MMbtu/hr	3.1/2.9
Liquid produced, cu m/day	134
Overhead gas, 1,000 cu m/day	20.3

NGL RECOVERIES

Table 4

Case	Type	Refrigeration, hp	Refrigeration temp., °C.	Liquid production increase, cu m/day
1	Spike oil	1,630	–23	167
2	Spike oil	2,200	–27	167 (no change)
3	NGL C_{3+}	1,600	–23	176
4	NGL C_{3+}	2,200	–27	215
5	Fractionate	4,610	–29	C_3 = 36, C_4 = 86, C_{5+} = 134
	Case 5, sum of C_3, C_4, and C_{5+}			256

FRACTIONATION PLANT COST*

Table 6

Capital costs for 3.912 million cu m/day (120 MMscfd) plant	Million $
300 cu m/day de-ethanizer complete (includes recompression, reboiler)	2.2
5,000 hp propane refrigeration, complete unit	9.0
Two 9 GJ/hr heat exchangers (chiller and gas-gas)	1.3
Two 2.7-4.0 GJ/hr heat exchangers (gas-gas K1 and gas-gas K2)	0.7
NGL recovery depropanizer-butanizer complete	3.0
Refrigeration major electrical and mechanical equipment	3.0
NGL mol sieve sweetening	1.0
Low-termperature separator	0.8
Piping racks, cable trays, insulation buildings, and other consumables	3.5
Total all equipment and materials	**24.5**
Installed costs (1.5 × equipment and materials)	**36.8**
Contingency (20%)	**12.3**
Total	**73.6**

*Costs from skid vendors.

THEORETICAL MAXIMUM NGL RECOVERY*

Table 5

Component	Mole fraction	Volume, Mscfd	Ideal gas conversion, cu ft/gal	Maximum liquid NGL liquid yield, cu m/day (b/d)
N_2	0.0088	1,056		
CO_2	0.9186	110,232		
H_2S	0.0091	1,092		
C_1	0.0151	1,812		
C_2	0.0135	1,620		
C_3	0.016	1,920	36.37	200 (1,256.92)
iC_4	0.0029	348	30.64	43 (270.42)
nC_4	0.0074	888	31.79	106 (665.08)
iC_5	0.002	240	27.38	33.2 (208.70)
nC_5	0.0024	288	27.67	39.4 (247.82)
C_{6+}	0.0042	504	26.16	73 (458.72)
Total		**120,000**		**494 (3,107.66)**

*From Table 4 the total theoretical NGL recovery from the recycle gas stream is 494 cu m /day. Our fractionation is recovering 256 cu m/day or 52%.

NGL COSTS RECOVERED*

Table 7

Hydrocarbon cut	Rate $/cu m × cu m/day	Rate $/day	$ million/year
C_3's	295 × 36	11,000	
C_4's	400 × 86	34,000	
C_{5+}	345 × 134	46,000	
Total		**91,000**	**31.85**

*The crude spiking alternative gives lower yields because much of the NGL flash after mixing. The costs recovered are $345/cu m × 167 = $58,000/day or $20.165 million/year.

uids that enter the fractionation plant.

The fractionation plant has three distillation towers. The first is a de-ethanizer (de-C_2 in Fig. 1) with a reboiler as the bottom stage. The deethanized liquids go to the depropanizer (de-C_3) unit consisting of tower, overhead condenser reflux-drum, and bottoms reboiler.

The specification sales propane is Stream C_3 sales in Fig. 1.

The depropanizer bottoms go to a similar tower, reflux, and reboiler distillation column. This last distillation column is a debutanizer (de-C_4).

The tower overheads go to butane sales (Stream C_4 sales). The column bottoms are the light gasoline sales or C_{5+} sales.

The de-ethanizer overhead gas after recompression mixes with the refrigerated gas off the low-temperature separator. The stream then goes to the gas-gas shell side of the exchanger and subsequently the reciprocating compressor-pump tandem combination.

Fig. 1 shows an aerial cooler after the stabilizer overhead of the recompressor (comp de-C_2); however, it is not required.

Desulfurization

Fig. 1 shows the sweetening of the liquids with a mol-sieve unit operation on the bottom of the de-ethanizer reboiler product stream. A 13x Grade Z10-03 mol-sieve unit or a liquid amine contactor can sweeten the stabilized liquid NGL.

Preferable is a mol-sieve unit because it has a dry system that can be regenerated with hot fuel gas. A typical 13x Grade Z10-03 mol-sieve unit has two or three contactors to ensure 24-hr sweetening of sour NGL.

Gas-gas cooling

The solution gas from the inlet gas-gas exchanger enters two streams. One is the inlet of the tube side of the K1 exchanger (Stream 8, not shown in Table 1) and the other is the tube side of K2 exchanger (Stream 9, not shown in Table 1). About half of the 3.392 million cu m/day enters each exchanger.

The exit gas from the tube side of these exchangers feeds the K1 and K2 compressors. The compressor discharges back into the shell side of K1 and K2 exchangers. Utilizing parallel K1 and K2 exchangers ensures that the suction streams' temperatures feeding pumps Reda 1 and 2 are as low as possible.

A temperature cooler than 33° C. is optimal to ensure the multistage centrifugal pumps' lowest horsepower draw. In our case, this is 1,010 hp at 15,200 kPa-g (2,200 psig).

The K1 compressor train is for summer conditions or ambient temperature 3° C. cooler than the compressor cooler's discharge of 43° C. The lowest achievable temperature after the K1 exchanger is 38° C.

The corresponding pump requires 1,454 hp vs. the K2 exchanger's discharge of 32° C., which requires 1,064 hp. This increases the horsepoweer by 27%

RECYCLE GAS SENSITIVITY ANALYSIS Table 8

Component	Mole fraction
H_2	0.0000
He	0.0000
N_2	0.0166
CO_2	0.8125
H_2S	0.0119
C_1	0.0531
C_2	0.0304
C_3	0.0407
iC_4	0.0154
C_4	0.0073
C_5	0.0121

Because the simulations are mainly for refrigeration, cooling, and stabilization, Fig. 1 shows the solution-gas injection compressors with a single stage, above the K1 and K2 exchangers.

Pump performance

The process cools the streams from the K1 and 2 last stage discharge into the Reda pumps to 38° C. for the summer case (K1 compressor) and 32° C. for the winter case (K2 compressor).

This pump suction temperature causes pumping problems at less than 550 kg/cu m, which corresponds to temperatures greater than 32° C.

NGL yields

As discussed, the analyses looked at several alternatives for determining the process with the best economics for NGL recovery.

The first case looked at oil spiking at a maximum of 167 cu m/day at –23° C. The next case analyzed C_{3+} recovery at –23°, –27°, and –29° C.

Table 4 shows the best recoveries are at –29° C. The horsepower (4,610 vs. 2,200), however, doubles for 16% added recovery (256 vs. 215 cu m).

Table 4 shows the scenarios simulated to evaluate NGL yields for a 120-MMscfd recycle gas throughput.

To put NGL recovery in perspective, a calculation was made to determine the theoretical maximum liquid recover based on a flow of 3.3912 million cu m/day (Table 5). The recovery is 256/494 = 52%.

Economics

Table 6 shows the cost for installed refrigeration of 3.3912 million cu m/day. The costs are approximate and were obtained from equipment packagers and project execution experience.

Table 7 shows the revenue recovered from NGL sales.

Economics run from these costs and revenues indicate that the project would pay back in 2.3 years and have a present value of $73 million. Payments were $31.85 million/year and the economics assumed a 5%/year interest and no future value.

Also the economic analysis included a sensitivity case for a lower mol % recycle gas. The gas analysis in this case was from a mid-phase CO_2 injection recycle gas (Table 8) containing 82 mol% CO_2. This gas is much richer than the initial 92% CO_2 case.

Table 9 shows the simulations for predicting liquid recoveries with the same plant configuration as for the previous case. The table shows the much higher recoveries that lead to a 1-year payback.

Observations

From this evaluation several points were noted as follows:

- Depending on the refrigeration requirements, the process should include dense-phase pumping if possible. Pumping has a lower cost than compression if the process has enough cooling in summer conditions.
- An added advantage of the refrigeration is ethylene glycol dehydration for avoiding hydrates when chilling the gas to drop out liquids. The recycle gas, therefore, is dehydrated without the need of exotic piping for corrosion protection or a hydrate risk when depressurizing or compressing in a centrifugal compressor.
- The maximum recovery of the methane and ethane is insufficient to justify methyldiethanolamine treating to recover the 85,000 cu m/day (3 MMscfd) C_1 and C_2/120 MMscfd of recycle gas.
- A further refinement of the process simulations found that dropping the separator's temperatures permitted recoveries of 176 cu m/day of NGL for –23° C., 215 cu m/day for –27° C., and 256 cu m/day for –29° C. This is not the case for the oil-spiking case. It appears that the oil will not pick up additional NGL at less than –23° C.
- Installation of the NGL-recovery process equipment should be in modularized increments. The towers, heat exchangers, compressors, and chillers do not have efficient turndowns past ±25%.

Hence, the first phase of the project would install 2.832 million cu m/day (100 MMscfd) units followed by expansion of the refrigeration compression, stabilization, and associated gas compression in 2.832 million cu m/day increments. ✦

NGL COSTS RECOVERED, 82% CO_2 Table 9

Hydrocarbon cut	Rate $/cu m × cu m/day	Rate $/day	$ million/year
C_3,	295 × 170	50,000	
C_4s	400 × 222	88,800	
C_{5+}	345 × 206	71,000	
Total		**209,000**	**73.43**

The author

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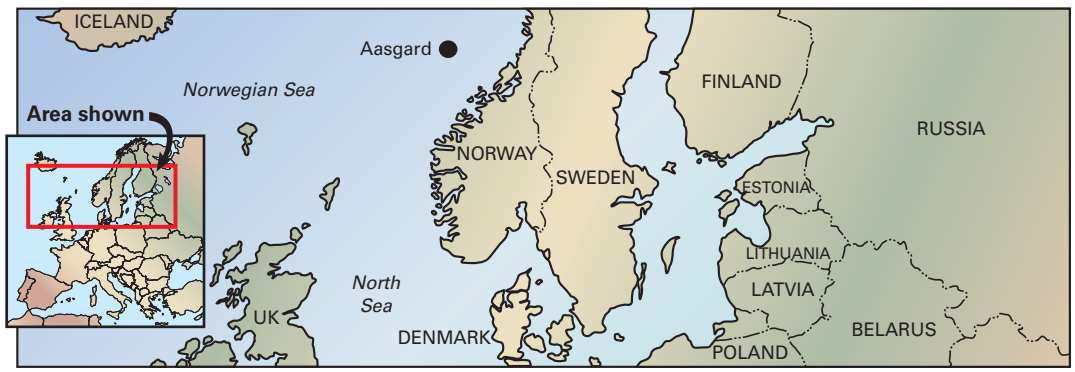
GUIDE TO WORLD CRUDES

AASGARD FIELD



Legend:

[1]ND = not detectable; HPLC = high performance liquid chromatography; DVPE = dry vapor pressure equivalent. [2]Corrected in accordance with EN 228. [3]Calculated density for 525+ fraction.

Statoil publishes Aasgard Blend assay

Statoil late last year published an assay of its Aasgard Blend, a commingling of production from Smorbukk, Smorbukk South, Midgard, Mikkel, Kristin, Ytterryta, and Tyrihans fields in the Norwegian Sea.

Aasgard field lies on the Halten Bank, about 200 km off mid-Norway and 50 km south of Heidrun field (map).

The field consists of Midgard, Smorbukk, and Smorbukk South discoveries. Midgard straddles Blocks 6507/11 and 6407/2, while the two other deposits lie in Block 6506/11.

Statoil reports that Aasgard ranks among the largest developments on the Norwegian Continental Shelf, embracing a total of 52 wells drilled through 16 seabed templates.

Saga Petroleum discovered Midgard in 1981, with Statoil finding Smorbukk and Smorbukk South in 1984 and 1985, respectively. The two companies unitized the three fields into a single production license in 1995, with Statoil as operator.

On Feb. 8, 1999, the Aasgard A oil production ship arrived on the field and became operational on May 19. Gas production from the semi-submersible Aasgard B platform began on Oct. 1, 2000.

The overall Aasgard development consists of:

- Development of the field.
- Aasgard transport gas pipeline from the field to processing at Karsto north of Stavanger.
- Karsto expansion.
- Europipe II gas trunkline from Karsto to Dornum on the German coast.

Crude oil, condensate, and natural gas are produced from Aasgard. Crude and condensate form Aasgard Blend, a light oil.

Average production of 200,000 b/d is pumped from storage tanks into shuttle tankers, which sail between the fields and the different refineries.

Gas from Aasgard flows through Aasgard transport to Karsto processing, which separates heavier components—ethane, propane, butane, and naphthas. Dry gas is piped to continental Europe.

The Aasgard development links the Halten Bank area to Norway's gas transport system in the North Sea.

Whole crude

Density at 15° C., kg/l.: 0.7928
Specific gravity at 60/60° F.: 0.7931
Gravity at 60/60° F., °API: 46.9
Dry oil density at 15° C., kg/l.: 0.7928
Sulfur, mass %: 0.188
Total acid number, mg KOH/g: <0.01
Reid vapor pressure, kPa: 65.7
Pour point, °C.: –33
Kinematic viscosity at 20° C., cst: 1.98
Kinematic viscosity at 50° C., cst: 1.42

Nitrogen, mg/kg: 300
Hydrogen sulfide, mass %: ND[1]
Vanadium, mg/kg: 1.0
Nickel, mg/kg: 0.1
Sodium, mg/kg: 1.3
Salt as NaCl, mg/l.: 5.5
Wax content, mass %: <5
Flash point, °C.: <10
Water content, mass %: <0.02
Mercury, µg/kg: 31

Pentanes to 65° C.

Yield on crude, mass %: 7.24
Yield on crude, vol %: 8.74
Density at 15° C., kg/l.: 0.6463
Specific gravity at 60/60° F.: 0.6463
Gravity at 60/60° F., °API: 87.4
Mercaptan sulfur, mg/kg: <3
n-Paraffins, mass %: 48.1
i-Paraffins, mass %: 44.1
Naphthenes, mass %: 6.1
Aromatics (incl. benzene), mass %: 1.7
n-Paraffins, vol %: 49.0
i-Paraffins, vol %: 44.6
Naphthenes, vol %: 5.1
Aromatics (incl. benzene), vol %: 1.3
Vapor pressure (DVPE), kPa: 107.8
Research octane number: 75.4
Motor octane number: 73.0
Research octane number, [2]75.2
Motor octane number, [2]72.8

65-90° C.

Yield on crude, mass %: 6.96
Yield on crude, vol %: 7.54
Density at 15° C., kg/l.: 0.7206
Specific gravity at 60/60° F.: 0.7208
Gravity at 60/60° F., °API: 64.8
Sulfur, mass %: <0.001
Mercaptan sulfur, mg/kg: <3
n-Paraffins, mass %: 26.3
i-Paraffins, mass %: 25.7
Naphthenes, mass %: 39.9
Aromatics (incl. benzene), mass %: 8.2
Benzene, mass %: 6.9
n-Paraffins, vol %: 28.5
i-Paraffins, vol %: 27.4
Naphthenes, vol %: 37.5
Aromatics (incl. benzene), vol %: 6.7
Benzene, vol %: 5.6
Vapor pressure (DVPE), kPa: 33.1
Research octane number: 67.5
Motor octane number: 65.6
Research octane number: [2]67.3
Motor octane number: [2]65.4
Nitrogen, mg/kg: <1

90-150° C.

Yield on crude, mass %: 20.04
Yield on crude, vol %: 20.58
Density at 15° C., kg/l.: 0.7601
Specific gravity at 60/60° F.: 0.7603
Gravity at 60/60° F., °API: 54.6
Sulfur, mass %: <0.001
Mercaptan sulfur, mg/kg: <3
n-Paraffins, mass %: 20.0
i-Paraffins, mass %: 21.1
Naphthenes, mass %: 37.8
Aromatics (incl. benzene), mass %: 21.1
Benzene, mass %: 0.5
n-Paraffins, vol %: 21.8
i-Paraffins, vol %: 22.5
Naphthenes, vol %: 37.2
Aromatics (incl. benzene), vol %: 18.4
Benzene, vol %: 0.4
Flash point, °C.: <10
Nitrogen, mg/kg: <1

150-180° C.

Yield on crude, mass %: 7.37
Yield on crude, vol %: 7.46
Density at 15° C., kg/l.: 0.7839
Specific gravity at 60/60° F.: 0.7842
Gravity at 60/60° F., °API: 48.9
Sulfur, mass %: 0.001
Mercaptan sulfur, mg/kg: <3
Copper corrosion: 1a
Total acid number, mg KOH/g: <0.01
n-Paraffins, mass %: 21.2
i-Paraffins, mass %: 25.1
Naphthenes, mass %: 29.3
Aromatics, mass %: 24.4
n-Paraffins, vol %: 23.0
i-Paraffins, vol %: 26.4
Naphthenes, vol %: 28.6
Aromatics, vol %: 22.0
Aromatics (HPLC)
Total, mass %: 22.0
Monoaromatics, mass %: 22.0

Test conditions: true boiling point distillation

Equipment

Distillation up to 375° C. is performed according to D-2892/90; from 375° C., according to internal HiVac method (Modified D-5236).

Conditions

Cut points are as follows:
- Atmospheric distillation: C_5-205° C. AET*
- 100 Torr: 205-240° C. AET
- 10 Torr: 240-320° C. AET
- 5 Torr: 320-375° C. AET
- 1—0.1 Torr: 375-525° C. AET

Volume

Volume expansion or contraction is normalized among fractions boiling at less than 150° C. in proportion to their yields. (Usually the "loss" is negative due to volume expansion.)

Holdup

Holdup at 375° C. AET is distributed as follows: 50% on the first fraction of the HiVac method (375-420° C.) and 50% in accordance with the mass-ratios of the fractions from 420° C. AET.

Loss

Loss up to 375° C. AET is distributed with two-thirds in the gas fraction and one-third in the first liquid fraction.

*AET = average equivalent temperature; Torr. ≈ 1 mmHg ≈ 19.3 lb_f/sq in.

Test methods: Aasgard Blend

Density at 15° C., kg/l.: D-4052/D-5002
Specific gravity at 60/60° F.

Total sulfur, mass %: D-4294
Total sulfur, mass %: D-5453 for sulfur content <0.01%
Hydrogen sulfide, pos/neg: lead acetate paper
Mercaptan sulfur, mg/kg: D-3227

n-Paraffins, mass and vol %, GC*
i-Paraffins, mass and vol %: GC
Naphthenes, mass and vol %: GC
Aromatics, mass and vol %: GC
Benzene, mass and vol %: GC
Aromatics (HPLC*), mass %: D-6591

Naphthalene, vol %: D-1840
Watson K: UOP 375
Vapor pressure (DVPE*), kPa: D-5191
Reid vapor pressure, kPa: D-323
Flash point (Pensky Martens), °C.: D-93

Freezing point, °C.: D-2386
Cloud point, °C.: D-5772
Pour point, °C.: D-5853/D-5950
Cold filter plugging point, °C.: IP 309

Kinematic viscosity at 20° C., cst: D-445
Kinematic viscosity at 40° C., cst: D-445
Kinematic viscosity at 50° C., cst: D-445
Kinematic viscosity at 80° C., cst: D-445
Kinematic viscosity at 100° C., cst: D-445

Aniline point, °C.: D-611
Research octane number: D-2699
Motor octane number: D-2700
Cetane index: D-976
Calculated cetane index: D-4737

Cetane number: D-613
Smoke point, mm: D-1322
Distillation of whole crude <375° C.: D-2892
Distillation of individual fractions: D-86
Distillation of ≥375°+ C.: Internal HiVac method (modified D-5236)

Total acid number, mgKOH/g: D-664
Copper corrosion: D-130
Nitrogen: fractions <420° C., mg/kg: D-4629
Nitrogen: fractions >420° C., mg/kg: D-4629 modified

Basic nitrogen, mass %: UOP 269

Vanadium, mg/kg: ICP*
Nickel, mg/kg: ICP
Sodium, mg/kg: ICP
Mercury, µg/kg: FIMS* (with in-house method)

Salt as NaCl, mg/l.: IP 265

Conradson carbon residue, mass % : D-189 ; or,
Carbon residue (micromethod), mass %: D-4530
Asphaltenes, mass %: IP 143

n-C_5 insolubles, mass % : D-4055
Ash, mass %: D-482

Penetration at 25° C., 0.1 mm: D-1321

Refractive index at 67° C.: Abbe refractometer
Wax content, mass %: UOP 46 (modified acetone precipitation)
Water content, mg/kg: D-4928

Compositional analysis of crude oil, mass %: D-5134

*GC = gas chromatograph; HPLC = high performance liquid chromatography; DVPE = dry vapor pressure equivalent; ICP = inductively coupled plasma; FIMS = flow-injection mercury system.

Diaromatics, mass %: <0.1
Polycyclic aromatics, mass %: <0.1
Naphthalenes, vol %: 0.03
Aniline point, °C.: 49.9
Smoke point, mm: 23.0
Flash point, °C.: 40.0
Freezing point, °C.: <–60
Cetane index (D-976): 30.7
Calculated cetane index (D-4737): 35.4
Kinematic viscosity at 20° C., cst: 1.08
Kinematic viscosity at 50° C., cst: 0.76
Nitrogen, mg/kg: <1
Distillation D-86 (50%), °C.: 160.1

180-240° C.

Yield on crude, mass %: 12.04
Yield on crude, vol %: 11.83
Density at 15° C., kg/l.: 0.8072
Specific gravity at 60/60° F.: 0.8075
Gravity at 60/60° F., °API: 43.7
Sulfur, mass %: 0.011
Mercaptan sulfur, mg/kg: <3
Copper corrosion: 1a
Total acid number, mg KOH/g: <0.01
Aromatics (HPLC)
Total, mass %: 20.7
Monoaromatics, mass %: 16.9
Diaromatics, mass %: 3.8
Polycyclic aromatics, mass %: <0.1
Naphthalenes, vol %: 2.46
Aniline point, °C.: 59.5
Smoke point, mm: 22.0
Freezing point, °C.: –50.0
Cloud point, °C.: <–51
Cold-filter plugging point, °C.: <–50
Pour point, °C.: <–48
Cetane number: 48.4
Cetane index (D-976): 43.4

Calculated cetane index (D-4737): 44.1
Kinematic viscosity at 20° C., cst: 1.83
Kinematic viscosity at 50° C., cst: 1.17
Nitrogen, mg/kg: <1
Distillation D-86 (50%), °C.: 204.3

240-320° C.

Yield on crude, mass %: 15.21
Yield on crude, vol %: 14.35
Density at 15° C., kg/l.: 0.8405
Specific gravity at 60/60° F.: 0.8409
Gravity at 60/60° F., °API: 36.8
Sulfur, mass %: 0.099
Total acid number, mg KOH/g: <0.01
Aromatics (HPLC)
Total, mass %: 24.3
Monoaromatics, mass %: 13.5
Diaromatics, mass %: 10.5
Polycyclic aromatics, mass %: 0.3
Aniline point, °C.: 71.8
Cloud point, °C.: –17
Cold-filter plugging point, °C.: –19
Pour point, °C.: –15
Cetane number, 56.5
Cetane index (D-976): 51.1
Calculated cetane index (D-4737): 54.8
Kinematic viscosity at 20° C., cst: 4.80
Kinematic viscosity at 50° C., cst: 2.47
Nitrogen, mg/kg: 12
Basic nitrogen, mass %: <0.001
Distillation D-86 (50%), °C.: 270.4

320-375° C.

Yield on crude, mass %: 7.52
Yield on crude, vol %: 6.89
Density at 15° C., kg/l.: 0.8650
Specific gravity at 60/60° F.: 0.8654
Gravity at 60/60° F., °API: 32.0
Sulfur, mass %: 0.370
Total acid number, mg KOH/g: 0.02
Aromatics (HPLC)
Total, mass %: 24.2
Monoaromatics, mass %: 13.3
Diaromatics, mass %: 7.9
Polycyclic aromatics, mass %: 3.0
Aniline point, °C.: 83.7
Watson K-factor: 11.9
Cloud point, °C.: 11
Cold-filter plugging point, °C.: 11
Pour point, °C.: 12
Cetane number: 61.1
Cetane index (D-976): 52.6
Calculated cetane index: 65.2
Conradson carbon residue, mass %: <0.10
Kinematic viscosity at 20° C., cst: 15.6
Kinematic viscosity at 50° C., cst: 6.15
Kinematic viscosity at 100° C., cst: 2.24
Nitrogen, mg/kg: 183
Basic nitrogen, mass %: 0.005
Refractive index at 67° C.: 1.464
Distillation D-86 (50%), °C.: 335.2

375-420° C.

Yield on crude, mass %: 5.01
Yield on crude, vol %: 4.50
Density at 15° C., kg/l.: 0.8824
Specific gravity at 60/60° F.: 0.8828
Gravity at 60/60° F, °API: 28.8
Sulfur, mass %: 0.417
Total acid number, mg KOH/g: 0.01
Aniline point, °C.: 93.0
Watson K-factor: 12.0
Pour point, °C.: 30
Conradson carbon residue, mass %: <0.10
Kinematic viscosity at 50° C., cst: 14.8
Kinematic viscosity at 100° C., cst: 4.62
Vanadium, mg/kg: <0.1
Nickel, mg/kg: <0.1
Nitrogen, mg/kg: 430
Basic nitrogen, mass %: 0.012
Refractive index at 67° C.: 1.473

420-525° C.

Yield on crude, mass %: 8.50
Yield on crude, vol %: 7.48
Density at 15° C., kg/l.: 0.9014
Specific gravity at 60/60° F.: 0.9019
Gravity at 60/60° F., °API: 25.4
Sulfur, mass %: 0.567
Total acid number, mg KOH/g: <0.01
Aniline point, °C.: 98.0
Watson K-factor: 12.0
Pour point, °C.: 39

Conradson carbon residue, mass %: <0.10
Kinematic viscosity at 50° C., cst: 40.0
Kinematic viscosity at 100° C., cst: 8.25
Vanadium, mg/kg: <0.1
Nickel, mg/kg: <0.1
Nitrogen, mg/kg: 890
Basic nitrogen, mass %: 0.021
Refractive index at 67° C.: 1.484

375°+ C.

Yield on crude, mass %: 19.66
Yield on crude, vol %: 17.01
Density at 15° C., kg/l.: 0.9167
Specific gravity at 60/60° F.: 0.9172
Gravity at 60/60° F., °API: 22.8
Sulfur, mass %: 0.740
Total acid number, mg KOH/g: 0.02
Aniline point, °C.: 96.5
Watson K-factor: 12.0
Pour point, °C.: 42
Conradson carbon residue, mass %: 3.46
Asphaltenes, mass %: <0.50
n-Pentane insolubles, mass %: 0.6
Ash, mass %: 0.017
Kinematic viscosity at 50° C., cst: 79.7
Kinematic viscosity at 100° C., cst: 13.1
Vanadium, mg/kg: 6.0
Nickel, mg/kg: 0.5
Nitrogen, mg/kg: 1,470
Basic nitrogen, mass %: 0.034
Penetration at 25° C., mm: 0.1
Refractive index at 67° C.: 1.501

525°+ C.

Yield on crude, mass %: 6.15
Yield on crude, vol %: 5.03
Density at 15° C., kg/l.: [3]0.9688
Specific gravity at 60/60° F.: 0.9694
Gravity at 60/60° F., °API: 14.5
Sulfur, mass %: 1.193
Aniline point, °C.: 99.5
Watson K-factor: 11.7
Pour point, °C.: 33
Conradson carbon residue, mass %: 11.0
Asphaltenes, mass %: 0.90
n-Pentane insolubles, mass %: 3.3
Ash, mass %: 0.026
Kinematic viscosity at 80° C., cst: 395
Kinematic viscosity at 100° C., cst: 136
Vanadium, mg/kg: 21
Nickel, mg/kg: 1.6
Nitrogen, mg/kg: 3,190
Basic nitrogen, mass %: 0.073
Penetration at 25° C., mm: >300

Composition, mass %

Normal paraffins

Methane: <0.01
Ethane: 0.03
Propane: 0.59
Butane: 2.43
Pentane: 2.71
Hexane: 2.27
Heptane: 1.97
Octane: 1.74
Nonane: 1.34
Total n-paraffins: 13.07

C_4 hydrocarbons

i-Butane: 0.74

C_5 hydrocarbons

Isoparaffins
2,2-Dimethylpropane: 0.01
i-Pentane: 1.98
Total C_5 i-paraffins: 2.00

Naphthenes
Cyclopentane: 0.24

C_6 hydrocarbons

Isoparaffins
2,2-Dimethylbutane: 0.06
2,3-Dimethylbutane: 0.18
2-Methylpentane: 1.28
3-Methylpentane: 0.75
Total C_6 i-paraffins: 2.27

Naphthenes
Methylcyclopentane (incl. 2,2-Dimethylpentane): 1.23
Cyclohexane: 1.75
Total C_6 naphthenes: 2.98

Aromatics
Benzene: 0.78

C_7 hydrocarbons

Isoparaffins
2,2,3-Trimethylbutane: 0.01
3,3-Dimethylpentane: 0.02
2,4-Dimethylpentane: 0.09
2-Methylhexane: 0.65
2,3-Dimethylpentane: 0.17
3-Methylhexane: 0.69
Total C_7 i-paraffins: 1.64

Naphthenes
cis-1,3-Dimethylcyclopentane: 0.24
trans-1,3-Dimethylcyclopentane: 0.22
trans-1,2-Dimethylcyclopentane: 0.43
Methylcyclohexane: 2.85
Ethylcyclopentane: 0.15
1,1-Dimethylcyclopentane: 0.12
Total C_7 naphthenes: 4.02

Aromatics
Toluene: 2.01

C_8 hydrocarbons

Isoparaffins
2,2,4-Trimethylpentane: <0.01
2,5-Dimethylhexane: 0.09
2,4-Dimethylhexane: 0.09
3,4-Dimethylhexane: 0.02
3,3-Dimethylhexane: 0.02
2,3-Dimethylhexane (incl. naphthenic compound): 0.11
2-Methyl-3-ethylpentane: 0.02
2-Methylheptane: 0.67
4-Methylheptane: 0.19
3-Methylheptane: 0.38
2,3,4-Trimethylpentane: 0.01
Total C_8 isoparaffins: 1.61

Naphthenes
1,1,3-Trimethylcyclopentane (incl. 2,2-Dimethylhexane): 0.12
trans, cis-1,2,4-Trimethylcyclopentane: 0.12
trans,cis-1,2,3-Trimethylcyclopentane: 0.11
trans-1,4-Dimethylcyclohexane: 0.20
1,1-Dimethylcyclohexane: 0.07
trans-1-Methyl-3-ethylcyclopentane: 0.04
cis-1-Methyl-3-ethylcyclopentane: 0.04

trans-1-Methyl-2-ethylcyclopentane: 0.10
trans-1,2-Dimethylcyclohexane: 0.23
2-Propylcyclopentane: 0.02
cis-1,2-Dimethylcyclohexane: 0.12
Ethylcyclohexane: 0.87
1-Propylcyclopentane: <0.01
cis,cis-1,2,4-Trimethylcyclopentane: 0.02
1-Methyl-1-ethylcyclopentane: 0.01
cis-1,3-Dimethylcyclohexane (incl. naphthenic compound): 0.54
Total C_8 naphthenes: 2.62

Aromatics
Ethylbenzene: 0.38
m-Dimethylbenzene (m-xylene): 1.06
p-Dimethylbenzene (p-xylene): 0.35
o-Dimethylbenzene (o-xylene): 0.44
Total C_8 aromatics: 2.23

C_9 hydrocarbons

Isoparaffins
3,5-Dimethylheptane: 0.18
4-Methyloctane: 0.17
2-Methyloctane: 0.25
3-Methyloctane: 0.30
2,3,4-Trimethylhexane: <0.01
Unidentified paraffin: 0.08
Total C_9 i-paraffins: 0.99

Naphthenes
1,1,3-Trimethylcyclohexane: 0.18
1-Methyl-2-propylcyclopentane: 0.08
1-Methyl-3-ethylcyclohexane: 0.19
1-Methyl-4-ethylcyclohexane: 0.11
1,1,4-Trimethylcyclohexane: 0.08
Unidentified Naphthenes: 0.06
Total C_9 naphthenes: 0.71

Total identified: 37.90
Total unidentified: 0.18

Total C_{10+}: 61.92

Editor's note: Statoil's assay report contained the following: "A commercial assay was carried out on a representative sample of the crude. The contents of this report are for guidance only and Statoil accepts no responsibility for any errors that it may contain." ✦

In-line EMAT expands IM capabilities

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Houston

Electromagnetic transducer technology in-line inspections are sufficiently sensitive to detect crack-like features as part of pipeline integrity management. A multiparameter correlation process allows classification and characterization of crack-like features with acceptable probability. Detection, sizing, and characterization capabilities of the EMAT technology can provide the basis for subsequent application of integrity-management programs

A technician prepares a 24-26-in. multidiameter EMAT in-line inspection tool for launch. Achieving full high-resolution coverage around the circumference of the pipeline requires equipping two measurement units with a sufficient number of sensors (Fig. 1).

Background

Gas and liquid pipeline operators are increasingly concerned aging pipelines may be subject to crack-like defects such as stress corrosion cracking and seam weld cracking. The US Office of Pipeline Safety issued an October 2003 advisory notice to all US pipeline owners and operators to evaluate their pipeline systems for the presence of risk factors associated with SCC (both high and near-neutral pH types). The advisory required operators to prioritize pipeline segments as high risk and develop an integrity-management plan to address potential threats if SCC and seam-weld defect conditions were found.

Integrity-management frameworks developed or already in place rely on in-line inspection data as a basis for the implemented strategies to mitigate and manage crack-like defects (SCC or seam-weld defects). The suitability of the selected technologies for particular integrity processes required proving by pull tests, field tests, and regular pipeline inspections.

This article provides insights into this process for the qualification of high-resolution EMAT technology on an intelligent in-line inspection tool.

Inspection technologies

The selection and qualification of a suitable inspection technology are part of the integrity-management development process. The operator chose a high-resolution EMAT in-line inspection tool in this case to address SCC and other possible forms of cracks in its gas pipelines. Literature addresses the basic concept of the high-resolution EMAT technology.[1-3]

This variety of in-line inspection tool typically consists of two measurement units equipped with a sufficient number of electromagnetic acoustic transducers to achieve complete coverage of the internal pipeline surface to be inspected (Fig. 1). High resolution allows addressing cracks and crack colonies with multiple channels, projecting the data set obtained onto the inner pipe-surface. EMAT response provides a detailed view of the dimensions and distribution of detected anomalies around the circumference and along the pipeline axis, supporting

Based on presentation to NACE Corrosion 2009 conference, Atlanta, Mar. 22-26, 2009.

subsequent evaluation.

Liquid-coupled ultrasonic inspection technology has an established qualifying process. The technology's sensitivity to subcritical flaws and sufficient depth and length sizing capability justify its use instead of hydrostatic testing.[4] A similar approach initiates the qualification process of EMAT technology for crack detection in gas pipelines.

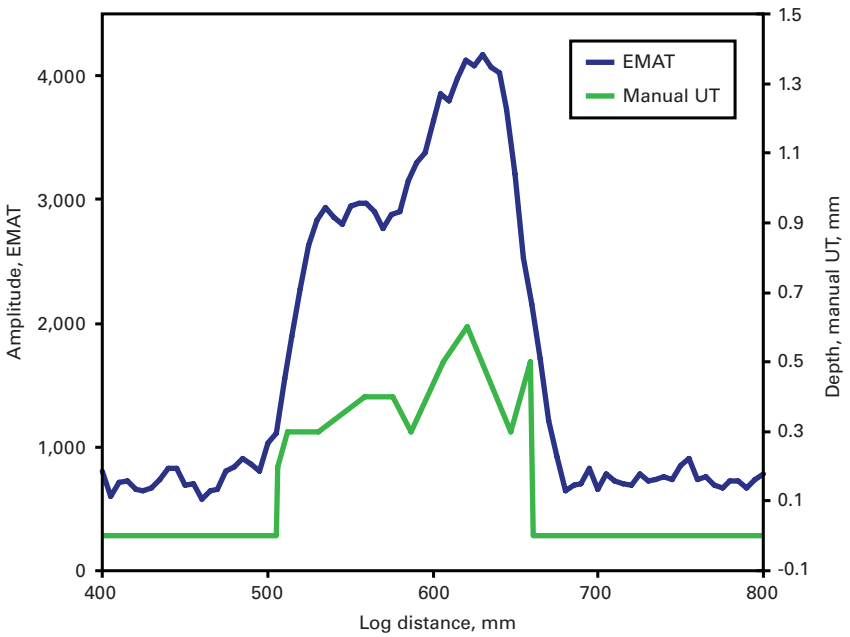
Sensitivity

The sensitivity threshold for individual cracks accepted throughout the pipeline industry equals 30 mm (1.18 in.) length and 1 mm (0.039 in.) depth. Limit-state assessments of pipelines typically present larger dimensions as critical, arguing these dimensions for sub-critical flaws are overly conservative.[4-6] A sensitivity analysis of EMAT technology meets the target for detecting sub-critical flaws.

ROSEN studied a combination of artificial and natural crack-like indications after introducing the EMAT tools to service,[7] finding flaws 20 mm long and 0.65 mm deep with a probability-of-detection of 92%. EMAT detected crack-like anomalies 20 mm long and 0.42 mm deep with a POD of 44%.

EMAT sensitivity

Fig. 2



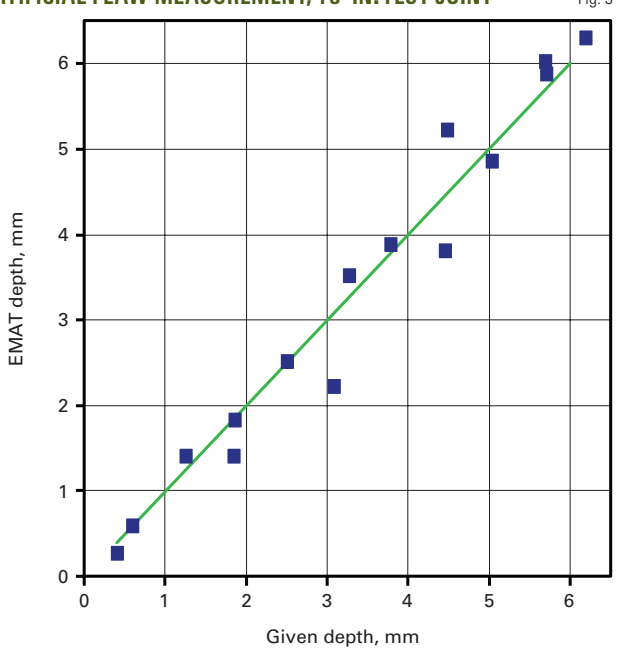
Increased defect length raises the likelihood of detecting shallower defects, as shown for a particular instance of mill-related surface breaking defect found during a pipeline survey. Fig. 2 shows data obtained during an excavation campaign following an EMAT survey, the depth profile derived from UT data taken manually in the ditch. The corresponding time integral of the EMAT amplitude shows a sufficient signal-to-noise ratio, illustrating the high sensitivity of the technology.

Depth sizing

API RP 579[8] requires the depth

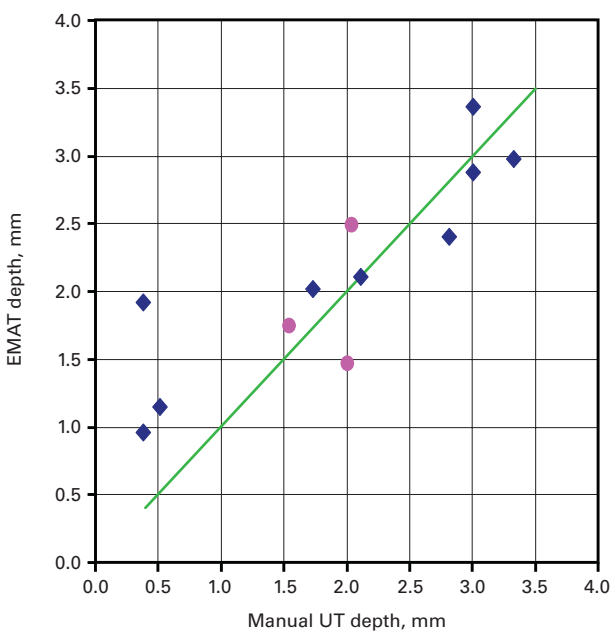
Artificial flaw measurement, 16-in. test joint

Fig. 3



Natural flaw measurement comparison

Fig. 4



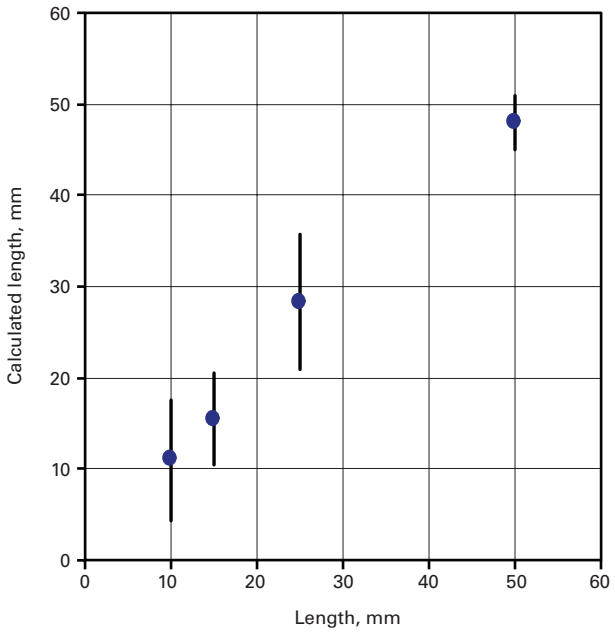
calculated for an individual crack or cluster of cracks be classified into four different depth classes: <12.5% WT, 12.5-25% WT, 25-40% WT, and >40% WT. A later integrity assessment will add a safety factor and consider the upper boundary of each depth class for analysis.

The depth value given for a cluster is typically the deepest value found within the cluster. The crack depth reported as a part of an EMAT inspection follows the API categorization scheme. The sizing model developed on the electromagnetic acoustic inspection data uses a quantitative multiparameter correlation process. Various parameters derived from the data sets—e.g., amplitude and frequency content of different wave modes—are correlated to the depth of a crack indication. Development of the sizing algorithm used artificial crack-like defects as well as natural cracks and SCC.

Figs. 3-4 show results of the sizing model for artificial and natural crack-like flaws respectively. Both present the scattering of the random error for the three defect populations. Accuracy in these examples measured ±0.64 mm with a confidence level of 90%. A systematic error exists between different pipe joints. An infield verification and pull-test program conducted on matching pipe samples addressed this error.

An electrodischarge machining technology created artificial flaws in 16 and 26-in. test joints. The natural defects lay in two joints of 16-in. and 24-in. OD. Accuracies achieved are similar to those found in established processes for crack evaluation with other inspection technologies.[5 6]

LENGTH-SIZING ACCURACY Fig. 5



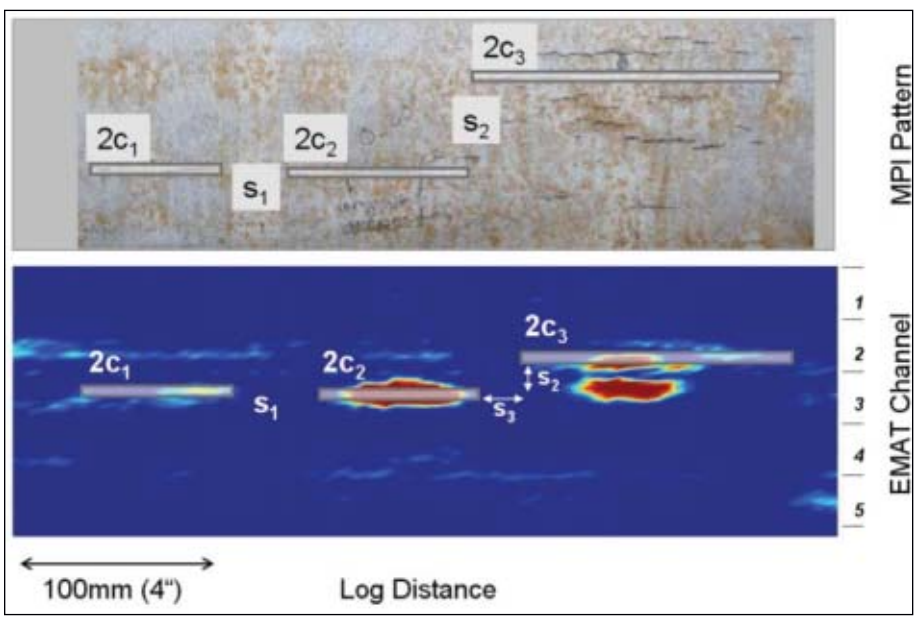
Length sizing

A threshold criterion used on the signal amplitude determines flaw length. Fig. 5 shows results from sizing artificial defects of different length and depth. Stable length sizing is possible for even short defects. The physical size of the applied shear wave, however, can cause a slightly larger scattering of length measurement for short features.

The length determination of cracks and crack fields is associated with clustering methods to find the fracture mechanical relevant total length. Magnetic particle inspection applied to a colony of cracks connected by superficial, shallow surface cracking (0.1-0.3 mm deep) would consider these cracks connected. Ultrasonic technologies, in general, respond only to flaws larger than the subcritical dimensions. Overcoming this situation requires a pattern analysis of the high-resolution data, taking the noise pattern of the reflection signal into account.

Clustering

Fracture mechanics methods simplify identification of the crack path on the surface. A single crack model can, for instance, represent branch cracks, a well established methodology described in several different standards (e.g., API RP 579). This standard classifies cracks close to each other by their lengths (2ci) and their distances from each other (si). A subsequent step applies



Applying fracture mechanics clustering methodology to MPI (top) and EMAT data yields these images (Fig. 6).

Equation

Crack colonies represented by a length ci (where i = 1,2), a circumferential separation of s1, and an axial separation of s2 are not interacting, if:

$s1 > c1 + c2$ OR $s2 > c1 + c2$

an interaction relation to classify the individual findings as interacting or noninteracting (see Equation box).

Such a clustering can apply to the lateral appearance of the crack colony visualized by MPI. Applying the clustering to EMAT data and MPI findings of the same area yields results of comparable quality (Fig. 6).

The upper part of the figure shows a photograph of MPI results of an SCC crack field in 16-in. OD pipe. The picture shows application of the clustering method for branched cracks according to API RP 579. The lower part of Fig. 6 applies the same process to EMAT data based on an automated length-sizing algorithm that uses threshold criteria. Table 1 summarizes the results. This calculation considers the three crack colonies as interacting, since the length of the colony is in every case larger than the minimum separation required for noninteraction.

Defect characterization

The detection sensitivity to a particular feature type is crucial in determining the suitability of an inspection technology. It is also imperative that the chosen inspection method be capable of identifying the particular defect type of a given feature. The classification process must use parameters allowing identification and categorization of crack-like features with acceptable probability.

The classification process does not rely on a single parameter, instead applying a multiparameter correlation model accounting for the distribution of the response of the individual parameters to a particular feature type. The MPC parameter for crack-like features can be derived from and tested against other feature types.

Fig. 7 shows the results of such tests. Crack features should show an MPC >0, while noncrack features should have an MPC <0. The probability of identification achieved for the feature population in this example equaled 91% (Table 2).

Coating assessment

The condition of the external pipeline coating is valuable information in the integrity assessment process. Coat-

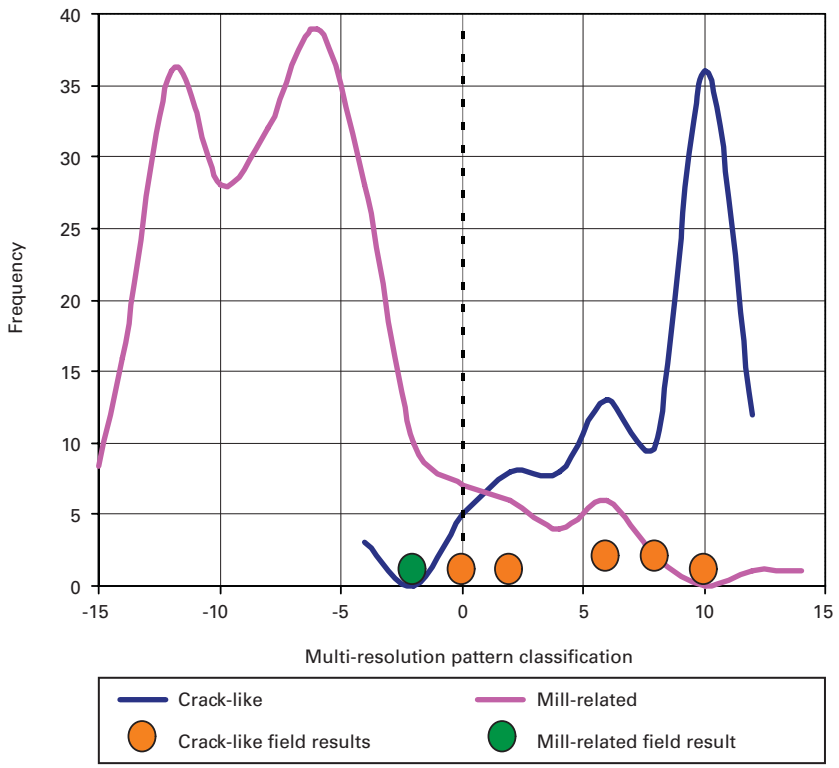
Anomaly measurement, MPI vs. EMAT

Table 1

Anomaly, Fig. 6	MPI	EMAT
2c1	63	73
2c2	90	79
2c3	152	133
s1	33	42
s2	46	36
s3	0	10
c1+c2	76	76
c2+c3	121	106

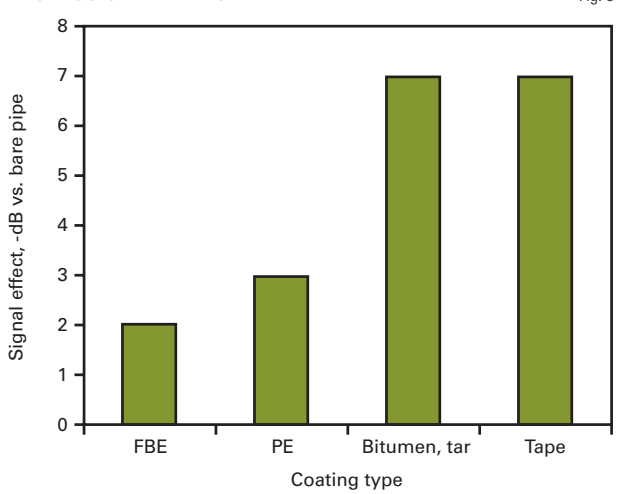
MPC applied to 315 defects

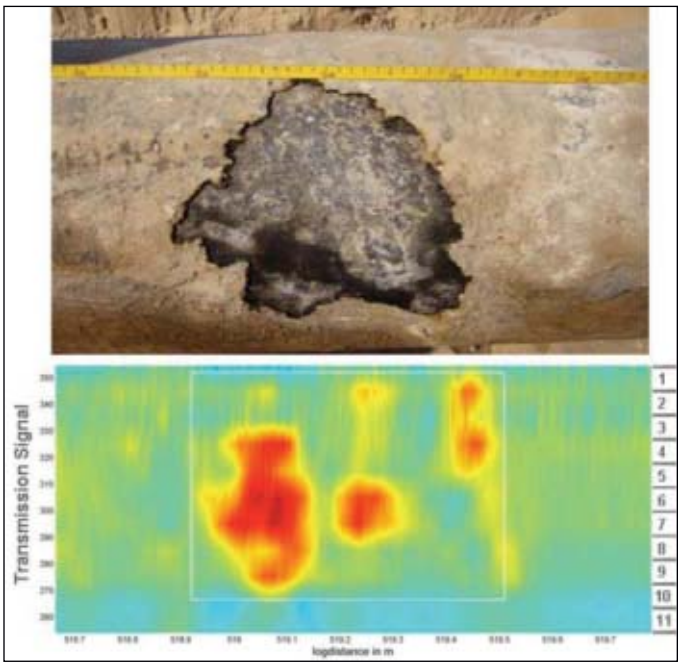
Fig. 7



Transmission amplitude

Fig. 8





These images show local disbondment of coal tar coating found during field inspection of a 16-in. OD pipeline (Fig. 9).

DATA BASIS SUMMARY, FIG. 7

Table 2

Classification	Other	Crack-like	Total
True	200	87	287
False	20	8	28
Total	**220**	**95**	**315**
Probability of identification, %	91	91.6	91

ing disbondment is a known precursor for stress corrosion cracking. Knowledge about a disbondment location combined with a crack indication in the survey data provides additional information more precisely locating any defects. Identifying the type of coating is also helpful, since some are more prone to SCC than others.[9]

The EMAT inspection system provides characteristics of both the coating type and the disbonded coating, deriving this information from the attenuation of the signal from the coating channel (transmission), which is independent from the crack channel (reflection). Fig. 8 details variation of the transmission amplitude as a function of different coating types. The differentiation between coal tar coating and fusion-bonded epoxy coating is reflected particularly well, supporting an integrity-related assessment.

A change in transmission amplitude also identifies disbonded areas, reporting them as individual features (Fig. 9). Using multiple channels for localization of defects and disbondment allows detailed reporting of the lateral dimensions and position of the disbonded area. ✦

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The authors

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Equipment/Software/Literature

Drillbit offers stabilization, new cutter design

The new Hughes Christensen Quantec Force line of polycrystalline diamond compact drillbits features newly engineered stabilization technology and next-generation cutters.

Bits promise higher penetration rates, increased footage, and reduced costs in a range of drilling environments.

The company says its drillbit has demonstrated stability by using updated design practices via a proprietary bit dynamics model to optimize the force distribution experienced while the bit is in service. This improvement has helped reduce the occurrence of destructive bit whirl, keeping the drilling process efficient and the cutting structure intact for faster and longer runs, the firm notes.

The PDC bit line also uses newly engineered and wear-resistant cutters. There are a variety of cutter choices, depending on the drilling application. One cutter type is specifically geared for abrasive formations, while another is engineered for drilling environments where both abrasion and impact-resistance are required. Bits are designed for all applications, including hard, abrasive formations as well as interbedded shales and sands. The cutters on the bit can be changed out depending on the formation requirements.

Source: **Baker Hughes Inc.,** 2929 Allen Parkway, Suite 2100, Houston, TX 77019.

New magnet tool removes as much as 200 lb of debris

The new MAGNOSTAR high-capacity magnet tool provides operators with a single piece tool specifically designed for high torque strings but that can also be used in conventional work strings.

The MAGNOSTAR magnet is a single piece mandrel with no internal connections. With its high strength, rare earth magnets, rated to 350° F., it can remove up to 200 lb of ferrous material.

The tool provides magnetic surface area for high volume ferrous debris extraction when circulation is not enough for wellbore cleanup. The tool is run in the well on the work string with other wellbore cleanup tools for a variety of applications, including: displacements, postperforating, prefracturing, multizone completions, milling, burning, fishing, and smart completions.

It can be run whenever there is a potential for ferrous debris in the wellbore.

To address one user's needs in Norway, the 7 in. tool was run-in-hole with several other of this company's tools in the cleanup string. The tool collected 13.2 lb of ferrous metal debris, most of which was small in size although large slivers as long as 6 in. were recovered.

It comes in common casing/lining sizes and weights—from 13⅜ in to 7 in. and has a casing compatible facing material to minimize casing wear.

Source: **M-I Swaco Wellbore Productivity,** Box 42842, Houston, TX 77242-2842.

Services/Suppliers

PAS Technologies Inc.,

North Kansas City, Mo., has named Thomas Tan vice-president of its global oil field business. Tan, based in Singapore, will support oil field strategic sales, marketing, and new business development initiatives in the Americas, Asia, Europe, and the Middle East. He also serves as senior vice-president of Asia-Pacific for PAS Technologies and as managing director of Asian Surface Technologies Pte. Ltd., the Singapore-based joint venture of PAS Technologies, SIA Engineering Co., and Pratt & Whitney. Tan has a bachelor of business degree in marketing from Royal Melbourne Institute of Technology University, Australia, and a diploma in electronics engineering from Caulfield Institute of Technology, Melbourne.


Tan

PAS Technologies Inc. specializes in repair and overhaul solutions for the oil field, aerospace, and industrial markets, including gates and seats used in high-wear, high-heat, and corrosive environments in oil field operations.

Seismic Micro-Technology,

Houston, has opened a sales and support office in Abu Dhabi, the company's third such international office opening in the past 15 months, including Moscow and Calgary. Andrew Burr, director for Middle East and South Asia, will lead the Abu Dhabi office and oversee all aspects of technical support and sales operations.

SMT provides geoscience software to the oil and gas industry.

GeoBio Energy Inc.,

Seattle, has signed a letter of intent to acquire H&M Precision Products Inc., Farmington, NM. H&M provides oil and gas well field services and sells proprietary chemical blends used to maintain, clean, and improve the operating efficiency of natural gas and oil wells. The acquisition is the first step in a broad strategy to combine and consolidate companies in the oil and gas services sector during the next 12-36 months. Several additional acquisition targets are being identified.

GeoBio Energy's business model emphasizes the acquisition and operation of existing companies in the oil and gas services and energy industry.

Cal Dive International Inc.,

Houston, has appointed Bruce P. Koch executive vice-president, CFO, and treasurer of the company. He replaces G. Kregg Lunsford, who was named executive vice-president, Eastern Hemisphere, based in Singapore. Koch brings more than 25 years of financial, accounting, tax, treasury, information technology, and merger and acquisition experience. He worked 19 years at Nabors Industries Ltd., serving as corporate controller, vice-president of finance, and, most recently, CFO.

Cal Dive provides an integrated offshore construction solution to its customers, including manned diving, pipelay and pipe burial, platform installation, and platform salvage services to the offshore oil and natural gas industry.

Imports of crude and products

	Districts 1-4 12-25 2009	Districts 1-4 12-18 2009	District 5 12-25 2009	District 5 12-18 2009	Total US 12-25 2009	Total US 12-18 2009	Total US *12-26 2008
	1,000 b/d						
Total motor gasoline	723	830	30	18	753	848	1,145
Mo. gas. blending comp.	548	618	25	18	573	636	971
Distillate	237	313	0	22	237	335	150
Residual	356	316	31	50	387	366	427
Jet fuel-kerosine	49	33	16	44	65	77	54
Propane-propylene	220	179	14	11	234	190	149
Other	90	(63)	48	33	138	(30)	243
Total products	**2,223**	**2,226**	**164**	**196**	**2,387**	**2,422**	**3,139**
Total crude	**7,307**	**6,902**	**720**	**805**	**8,027**	**7,707**	**9,249**
Total imports	**9,530**	**9,128**	**884**	**1,001**	**10,414**	**10,129**	**12,388**

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

Purvin & Gertz LNG netbacks—Jan. 1, 2010

Receiving terminal	Liquefaction plant: Algeria	Malaysia	Nigeria	Austr. NW Shelf	Qatar	Trinidad
	$/MMbtu					
Barcelona	6.65	5.32	5.82	5.21	5.13	5.74
Everett	7.08	4.86	6.69	4.93	5.44	7.39
Isle of Grain	4.25	2.16	3.63	2.06	2.71	3.65
Lake Charles	3.40	1.47	3.17	1.64	1.88	4.02
Sodegaura	5.55	7.48	5.81	7.17	6.50	4.87
Zeebrugge	6.35	4.57	5.94	4.46	5.19	5.97

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	13,886	59,283	41,493	10,427	68,970	14,025	4,874
PADD 2	89,289	50,721	24,801	7,922	29,046	1,149	20,706
PADD 3	156,348	70,558	39,636	13,595	45,153	17,967	24,870
PADD 4	16,587	5,851	1,842	488	3,044	200	[1]1,880
PADD 5	49,898	29,551	25,683	9,593	13,068	3,839	—
Dec. 25, 2009	**326,008**	**215,964**	**133,455**	**42,025**	**159,281**	**37,180**	**52,330**
Dec. 18, 2009	**327,546**	**216,330**	**133,583**	**40,991**	**161,336**	**37,041**	**53,996**
Dec. 26, 2008[2]	**318,737**	**208,103**	**113,468**	**37,389**	**136,031**	**35,808**	**55,784**

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

Refinery report—Dec. 25, 2009

District	Refinery operations: Gross inputs	Refinery operations: Crude oil inputs	Refinery output: Total motor gasoline	Refinery output: Jet fuel, kerosine	Refinery output: Fuel oils: Distillate	Refinery output: Fuel oils: Residual	Refinery output: Propane–propylene
	1,000 b/d						
PADD 1	1,074	1,085	2,505	92	308	69	49
PADD 2	3,210	3,195	2,231	206	921	53	239
PADD 3	6,947	6,756	2,428	720	1,848	354	661
PADD 4	436	436	312	20	143	7	[1]49
PADD 5	2,525	2,407	1,552	484	490	110	—
Dec. 25, 2009	**14,192**	**13,879**	**9,028**	**1,522**	**3,710**	**593**	**998**
Dec. 18, 2009	**14,151**	**13,777**	**8,963**	**1,439**	**3,806**	**562**	**994**
Dec. 26, 2008[2]	**14,521**	**14,190**	**8,939**	**1,274**	**4,542**	**549**	**977**
	17,681 Operable capacity		**80.3% 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

	*1-1-10	*1-2-09	Change	Change, %
	$/bbl			
SPOT PRICES				
Product value	86.36	46.80	39.56	84.5
Brent crude	77.27	35.71	41.56	116.4
Crack spread	9.09	11.09	–2.00	–18.1
FUTURES MARKET PRICES				
One month				
Product value	86.47	47.36	39.10	82.6
Light sweet crude	79.07	42.50	36.57	86.0
Crack spread	7.40	4.87	2.53	52.0
Six month				
Product value	91.06	56.67	34.39	60.7
Light sweet crude	82.05	51.92	30.13	58.0
Crack spread	9.02	4.75	4.27	90.0

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

OGJ GASOLINE PRICES

	Price ex tax 12-30-09	Pump price* 12-30-09	Pump price 12-31-08
	¢/gal		
(Approx. prices for self-service unleaded gasoline)			
Atlanta	224.6	256.0	166.9
Baltimore	216.2	258.1	162.5
Boston	215.3	257.2	166.9
Buffalo	205.9	269.1	169.5
Miami	221.2	274.1	172.2
Newark	217.2	250.1	161.2
New York	206.8	270.0	176.2
Norfolk	210.4	248.1	160.5
Philadelphia	214.4	265.1	175.8
Pittsburgh	212.5	263.2	179.2
Wash., DC	225.2	267.1	182.2
PAD I avg	215.4	261.6	170.3
Chicago	230.8	285.9	179.1
Cleveland	228.3	274.7	160.8
Des Moines	211.0	251.4	161.4
Detroit	226.4	278.0	168.1
Indianapolis	220.3	270.4	167.1
Kansas City	203.8	239.5	156.0
Louisville	216.9	257.8	162.1
Memphis	201.2	241.0	154.8
Milwaukee	215.7	267.0	163.1
Minn.-St. Paul	212.5	258.1	160.1
Oklahoma City	190.4	225.8	148.5
Omaha	203.7	249.4	152.8
St. Louis	200.0	235.7	162.7
Tulsa	188.6	224.0	155.8
Wichita	193.5	236.9	154.5
PAD II avg	209.5	253.0	160.5
Albuquerque	210.9	248.1	166.5
Birmingham	211.9	251.2	163.1
Dallas-Fort Worth	206.7	245.1	161.4
Houston	207.8	246.2	152.1
Little Rock	201.9	242.1	159.5
New Orleans	213.8	252.2	163.8
San Antonio	210.7	249.1	159.1
PAD III avg	209.1	247.7	160.8
Cheyenne	218.0	250.4	140.5
Denver	211.4	251.8	147.9
Salt Lake City	203.0	245.9	150.5
PAD IV avg	210.8	249.4	146.3
Los Angeles	229.3	295.1	180.0
Phoenix	218.6	256.0	158.7
Portland	232.8	276.2	186.0
San Diego	228.4	294.2	190.7
San Francisco	234.4	300.2	186.0
Seattle	235.2	291.1	181.7
PAD V avg	229.8	285.5	180.5
Week's avg.	**214.0**	**258.8**	**164.9**
Dec. avg.	**214.4**	**259.2**	**171.1**
Nov. avg.	**218.8**	**263.6**	**215.5**
2009 to date	**187.6**	**233.0**	—
2008 to date	**278.8**	**323.1**	—

*Includes state and federal motor fuel taxes and state sales tax. Local governments may impose additional taxes.
Source: Oil & Gas Journal.
Data available in OGJ Online Research Center.

REFINED PRODUCT PRICES

	12-25-09 ¢/gal		12-25-09 ¢/gal
Spot market product prices			
Motor gasoline (Conventional-regular)		Heating oil No. 2	
New York Harbor	197.83	New York Harbor	202.45
Gulf Coast	193.70	Gulf Coast	197.70
Los Angeles	207.50	Gas oil	
Amsterdam-Rotterdam-Antwerp (ARA)	190.79	ARA	196.33
Singapore	199.76	Singapore	194.29
Motor gasoline (Reformulated-regular)		Residual fuel oil	
New York Harbor	196.33	New York Harbor	164.60
Gulf Coast	193.95	Gulf Coast	169.71
Los Angeles	213.00	Los Angeles	186.57
		ARA	164.23
		Singapore	176.02

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

BAKER HUGHES RIG COUNT

	1-1-10	1-2-09
Alabama	5	3
Alaska	7	13
Arkansas	34	50
California	26	36
Land	25	35
Offshore	1	1
Colorado	41	93
Florida	0	1
Illinois	0	0
Indiana	3	2
Kansas	20	20
Kentucky	1	2
Louisiana	185	177
N. Land	128	91
S. Inland waters	11	8
S. Land	11	25
Offshore	35	53
Maryland	0	0
Michigan	0	0
Mississippi	6	18
Montana	6	9
Nebraska	1	0
New Mexico	49	60
New York	2	4
North Dakota	65	73
Ohio	7	12
Oklahoma	95	159
Pennsylvania	64	20
South Dakota	0	0
Texas	485	747
Offshore	3	7
Inland waters	0	0
Dist. 1	21	15
Dist. 2	18	28
Dist. 3	33	53
Dist. 4	31	80
Dist. 5	73	149
Dist. 6	58	119
Dist. 7B	12	25
Dist. 7C	47	51
Dist. 8	96	95
Dist. 8A	19	28
Dist. 9	35	43
Dist. 10	39	54
Utah	19	32
West Virginia	22	20
Wyoming	39	67
Others—HI-1; NV-4; OR-1; TN-1	7	5
Total US	**1,189**	**1,623**
Total Canada	**209**	**230**
Grand total	**1,398**	**1,853**
US Oil rigs	418	346
US Gas rigs	759	1,267
Total US offshore	39	68
Total US cum. avg. YTD	**1,189**	**1,623**

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

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

SMITH RIG COUNT

Proposed depth, ft	Rig count	1-1-10 Percent footage*	Rig count	1-2-09 Percent footage*
0-2,500	89	1.1	91	4.3
2,501-5,000	59	66.1	101	55.4
5,001-7,500	124	28.2	241	17.8
7,501-10,000	238	4.6	395	2.7
10,001-12,500	248	12.9	342	2.3
12,501-15,000	168	2.3	353	0.2
15,001-17,500	171	—	149	—
17,501-20,000	67	—	73	—
20,001-over	32	—	37	—
Total	**1,196**	**10.2**	**1,782**	**6.9**
INLAND	20		23	
LAND	1,137		1,711	
OFFSHORE	39		48	

*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]1-1-10	[2]1-2-09
	1,000 b/d	
(Crude oil and lease condensate)		
Alabama	22	20
Alaska	724	697
California	646	647
Colorado	70	67
Florida	6	4
Illinois	25	25
Kansas	114	109
Louisiana	1,449	1,197
Michigan	18	19
Mississippi	64	63
Montana	87	83
New Mexico	167	156
North Dakota	230	199
Oklahoma	181	178
Texas	1,430	1,354
Utah	67	61
Wyoming	150	142
All others	70	74
Total	**5,520**	**5,095**

[1]OGJ estimate. [2]Revised.
Source: Oil & Gas Journal.
Data available in OGJ Online Research Center.

US CRUDE PRICES

	1-1-10 $/bbl*
Alaska-North Slope 27°	64.51
South Louisiana Sweet	82.50
California-Midway Sunset 13°	70.65
Lost Hills 30°	77.70
Wyoming Sweet	69.86
East Texas Sweet	77.75
West Texas Sour 34°	73.25
West Texas Intermediate	78.25
Oklahoma Sweet	78.25
Texas Upper Gulf Coast	71.25
Michigan Sour	70.25
Kansas Common	74.75
North Dakota Sweet	67.00

*Current major refiner's posted prices except North Slope lags 2 months. 40° gravity crude unless differing gravity is shown.
Source: Oil & Gas Journal.
Data available in OGJ Online Research Center.

WORLD CRUDE PRICES

$/bbl[1]	12-25-09
United Kingdom-Brent 38°	72.91
Russia-Urals 32°	72.08
Saudi Light 34°	71.97
Dubai Fateh 32°	72.64
Algeria Saharan 44°	73.43
Nigeria-Bonny Light 37°	74.35
Indonesia-Minas 34°	76.84
Venezuela-Tia Juana Light 31°	71.54
Mexico-Isthmus 33°	71.43
OPEC basket	72.79
Total OPEC[2]	72.34
Total non-OPEC[2]	70.96
Total world[2]	71.75
US imports[3]	69.94

[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]

	12-25-09	12-18-09	12-25-08	Change, %
	bcf			
Producing region	1,044	1,067	891	**17.2**
Consuming region east	1,779	1,869	1,603	**11.0**
Consuming region west	453	464	403	**12.4**
Total US	**3,276**	**3,400**	**2,897**	**13.1**
	Oct. 09	**Oct. 08**	**Change, %**	
Total US[2]	**3,807**	**3,399**	**12.0**	

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

Statistics

WORLDWIDE CRUDE OIL AND GAS PRODUCTION

	Oct. 2009	Sept. 2009	10 month average production 2009	10 month average production 2008	Change vs. previous year Volume	Change vs. previous year %	Oct. 2009	Sept. 2009	Cum. 2009
	Crude, 1,000 b/d						Gas, bcf		
Argentina	616	604	606	607	–1	–0.1	110.5	116.5	1,183.97
Bolivia	40	40	40	40	—	–0.6	40.0	40.0	405.00
Brazil	1,991	1,993	1,942	1,809	132	7.3	33.0	31.0	296.00
Canada	2,524	2,486	2,542	2,581	–40	–1.5	403.8	389.2	4,238.10
Colombia	680	680	656	577	79	13.7	35.0	35.0	310.00
Ecuador	460	460	473	500	–27	–5.4	2.0	2.0	20.00
Mexico	2,602	2,599	2,607	2,816	–208	–7.4	222.0	210.7	2,143.38
Peru	111	112	105	76	29	38.5	11.0	11.3	101.00
Trinidad	103	101	107	113	–6	–5.0	118.6	107.3	1,140.96
United States	5,382	5,327	5,263	4,932	331	6.7	1,870.0	1,776.0	18,341.00
Venezuela[1]	2,240	2,240	2,159	2,358	–199	–8.4	72.0	70.0	692.00
Other Latin America	83	83	83	83	—	—	5.5	5.4	54.70
Western Hemisphere	**16,832**	**16,725**	**16,584**	**16,492**	**92**	**0.6**	**2,923.5**	**2,794.5**	**28,926.10**
Austria	18	19	19	17	1	8.1	4.8	5.1	46.17
Denmark	237	256	264	286	–22	–7.7	19.3	23.9	220.01
France	18	19	18	20	–2	–7.5	2.5	2.5	26.48
Germany	51	54	56	60	–5	–7.6	41.4	39.8	424.05
Italy	87	78	82	102	–20	–19.8	22.0	20.0	220.50
Netherlands	24	25	26	34	–9	–24.7	140.0	130.0	1,960.00
Norway	2,077	1,923	2,062	2,160	–97	–4.5	285.0	255.1	2,986.84
Turkey	48	47	45	41	4	10.1	—	—	—
United Kingdom	1,300	1,126	1,335	1,410	–75	–5.3	150.0	137.4	1,797.94
Other Western Europe	4	4	3	4	—	–9.7	1.3	0.3	10.32
Western Europe	**3,864**	**3,549**	**3,911**	**4,134**	**–224**	**–5.4**	**666.3**	**614.1**	**7,692.31**
Azerbaijan	1,050	1,030	1,035	915	121	13.2	55.0	45.0	385.00
Croatia	13	13	14	15	–1	–7.2	4.2	4.3	49.77
Hungary	13	14	14	15	–1	–4.7	7.1	6.7	70.75
Kazakhstan	1,500	1,400	1,308	1,205	103	8.5	100.0	100.0	1,000.00
Romania	90	90	90	93	–3	–3.2	19.0	18.0	185.00
Russia	10,100	10,070	9,877	9,755	122	1.3	1,550.0	1,400.0	14,700.00
Other FSU	400	400	440	405	35	8.6	350.0	350.0	3,250.00
Other Eastern Europe	41	42	43	48	–5	–10.5	18.0	17.7	187.70
Eastern Europe and FSU	**13,208**	**13,060**	**12,821**	**12,450**	**371**	**3.0**	**2,103.3**	**1,941.8**	**19,828.22**
Algeria[1]	1,240	1,220	1,239	1,380	–141	–10.2	245.0	240.0	2,460.00
Angola[1]	1,900	1,870	1,774	1,901	–127	–6.7	6.0	6.0	52.00
Cameroon	70	74	74	85	–11	–13.3	—	—	—
Congo (former Zaire)	25	25	25	25	—	—	—	—	—
Congo (Brazzaville)	240	240	240	240	—	—	—	—	—
Egypt	650	650	645	675	–30	–4.4	120.0	115.0	1,210.00
Equatorial Guinea	320	320	320	320	—	—	0.1	0.1	0.60
Gabon	240	240	227	234	–7	–3.0	0.3	0.3	3.04
Libya[1]	1,520	1,550	1,551	1,726	–175	–10.1	38.0	37.0	372.00
Nigeria[1]	1,900	1,850	1,791	1,952	–161	–8.2	95.0	90.0	876.00
Sudan	500	500	500	488	12	2.5	—	—	—
Tunisia	78	78	82	85	–2	–2.8	8.3	8.4	81.55
Other Africa	221	221	221	221	—	—	9.4	8.6	88.40
Africa	**8,904**	**8,839**	**8,689**	**9,332**	**–643**	**–6.9**	**522.0**	**505.4**	**5,143.59**
Bahrain	30	30	30	29	—	0.9	30.0	28.0	264.82
Iran[1]	3,660	3,700	3,739	3,924	–185	–4.7	285.0	275.0	2,855.00
Iraq[1]	2,500	2,500	2,402	2,434	–32	–1.3	22.0	22.0	203.00
Kuwait[1,2]	2,270	2,230	2,273	2,612	–339	–13.0	36.0	34.0	362.00
Oman	800	820	806	720	86	11.9	50.0	50.0	551.00
Qatar[1]	770	760	765	856	–91	–10.6	220.0	215.0	2,207.00
Saudi Arabia[1,2]	8,280	8,190	8,186	9,303	–1,117	–12.0	220.0	215.0	2,153.00
Syria	360	360	371	387	–16	–4.1	18.0	17.0	175.00
United Arab Emirates[1]	2,280	2,270	2,270	2,628	–358	–13.6	135.0	130.0	1,310.00
Yemen	280	280	276	308	–33	–10.6	0.0	0.0	0.00
Other Middle East	—	—	—	—	—	–8.2	9.7	10.1	92.97
Middle East	**21,230**	**21,140**	**21,117**	**23,201**	**–2,084**	**–9.0**	**1,025.7**	**996.1**	**10,173.79**
Australia	470	454	466	454	13	2.8	130.2	109.2	1,240.28
Brunei	145	145	148	160	–12	–7.7	35.0	35.0	346.36
China	3,838	3,837	3,760	3,805	–45	–1.2	253.7	243.1	2,460.79
India	685	665	661	675	–15	–2.1	126.9	116.4	1,033.15
Indonesia[1]	860	860	856	860	–4	–0.4	200.0	195.0	1,995.00
Japan	15	14	16	17	–1	–6.6	9.5	8.8	99.48
Malaysia	740	740	735	758	–23	–3.0	140.0	135.0	1,375.00
New Zealand	52	61	49	57	–7	–13.0	10.0	12.0	119.90
Pakistan	63	63	63	66	–3	–4.4	120.7	118.0	1,220.81
Papua New Guinea	35	35	37	42	–5	–10.8	1.0	0.9	9.60
Thailand	221	221	238	228	10	4.2	35.9	37.0	342.24
Vietnam	325	325	297	277	20	7.1	20.0	20.0	200.00
Other Asia-Pacific	48	96	48	42	7	15.8	94.5	91.5	931.00
Asia-Pacific	**7,496**	**7,515**	**7,375**	**7,441**	**–66**	**–0.9**	**1,177.3**	**1,121.9**	**11,373.61**
TOTAL WORLD	**71,533**	**70,827**	**70,497**	**73,051**	**–2,554**	**–3.5**	**8,418.2**	**7,973.7**	**83,137.63**
OPEC	29,020	28,840	28,622	32,433	–3,811	–11.8	1,376.0	1,336.0	15,662.00
North Sea	3,632	3,326	3,682	3,874	–192	–5.0	496.2	455.3	5,591.03

[1]OPEC member. [2]Kuwait and Saudi Arabia production each include half of Neutral Zone. Totals may not add due to rounding.
Source: Oil & Gas Journal. Data available in OGJ Online Research Center.

Imports of crude and products

	Districts 1-4		District 5		Total US		
	1-1 2010	12-25 2009	1-1 2010	12-25 2009	1-1 2010	12-25 2009	*1-2 2009
	1,000 b/d						
Total motor gasoline	725	723	59	30	784	753	852
Mo. gas. blending comp.	535	548	47	25	582	573	649
Distillate	289	237	0	0	289	237	307
Residual	333	356	31	31	364	387	322
Jet fuel-kerosine	53	49	49	16	102	65	56
Propane-propylene	153	220	14	14	167	234	243
Other	301	90	8	48	309	138	784
Total products	**2,389**	**2,223**	**208**	**164**	**2,597**	**2,387**	**3,213**
Total crude	**7,321**	**7,307**	**1,034**	**720**	**8,355**	**8,027**	**10,485**
Total imports	**9,710**	**9,530**	**1,242**	**884**	**10,952**	**10,414**	**13,698**

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

Purvin & Gertz LNG netbacks—Jan. 8, 2010

Receiving terminal	Liquefaction plant					
	Algeria	Malaysia	Nigeria	Austr. NW Shelf	Qatar	Trinidad
	$/MMbtu					
Barcelona	6.65	5.26	6.59	5.15	5.88	6.50
Everett	6.18	3.95	5.78	4.02	4.53	6.49
Isle of Grain	4.55	2.39	3.90	2.28	2.96	3.93
Lake Charles	3.44	1.43	3.21	1.62	1.89	4.09
Sodegaura	5.48	7.46	5.73	7.47	6.74	4.77
Zeebrugge	6.65	4.50	6.10	4.38	5.14	6.17

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

Crude and product stocks

District	Crude oil	Motor gasoline		Jet fuel, kerosine	Fuel oils		Propane-propylene
		Total	Blending comp.[1]		Distillate	Residual	
	1,000 bbl						
PADD 1	13,042	59,250	40,777	10,261	67,711	13,369	5,013
PADD 2	89,234	52,545	25,592	8,024	30,046	1,129	19,368
PADD 3	160,678	70,325	38,734	13,194	45,020	18,585	23,852
PADD 4	15,436	5,762	1,771	458	2,790	211	[1]1,536
PADD 5	48,947	31,819	27,769	9,731	13,481	3,887	—
Jan. 1, 2010	**327,337**	**219,701**	**134,643**	**41,668**	**159,048**	**37,181**	**49,769**
Dec. 25, 2009	**326,008**	**215,964**	**133,455**	**42,025**	**159,281**	**37,180**	**52,469**
Jan. 2, 2009[2]	**325,419**	**211,437**	**115,480**	**37,374**	**137,821**	**33,878**	**56,333**

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

Refinery report—Jan. 1, 2010

District	REFINERY OPERATIONS		REFINERY OUTPUT				
	Gross inputs	Crude oil inputs	Total motor gasoline	Jet fuel, kerosine	Fuel oils		Propane-propylene
					Distillate	Residual	
	1,000 b/d						
PADD 1	1,061	1,051	2,458	88	342	52	47
PADD 2	3,381	3,370	2,493	224	1,025	35	255
PADD 3	6,730	6,512	2,417	662	1,827	347	716
PADD 4	475	472	282	25	144	6	[1]58
PADD 5	2,473	2,387	1,421	449	471	133	—
Jan. 1, 2010	**14,120**	**13,792**	**9,071**	**1,448**	**3,809**	**573**	**1,076**
Dec. 25, 2009	**14,192**	**13,879**	**9,028**	**1,522**	**3,710**	**593**	**998**
Jan. 2, 2009[2]	**14,892**	**14,522**	**9,115**	**1,464**	**4,550**	**488**	**1,058**
	17,681 Operable capacity		**79.9% utilization rate**				

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

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

OIL&GAS JOURNAL online research center

OGJ crack spread

	*1-8-10	*1-9-09	Change	Change, %
	$/bbl			
SPOT PRICES				
Product value	90.18	53.10	37.08	69.8
Brent crude	79.93	44.91	35.02	78.0
Crack spread	10.25	8.19	2.06	25.2
FUTURES MARKET PRICES				
One month				
Product value	90.57	54.51	36.06	66.1
Light sweet crude	82.37	44.51	37.86	85.1
Crack spread	8.20	10.00	-1.80	-18.0
Six month				
Product value	94.42	62.21	32.22	51.8
Light sweet crude	85.00	55.93	29.07	52.0
Crack spread	9.42	6.28	3.14	50.0

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

Statistics

OGJ GASOLINE PRICES

	Price ex tax 1-6-10	Pump price* 1-6-10	Pump price 1-7-09
	¢/gal		
(Approx. prices for self-service unleaded gasoline)			
Atlanta	227.9	259.3	162.2
Baltimore	220.1	262.0	158.1
Boston	218.4	260.3	162.9
Buffalo	209.1	272.3	163.8
Miami	224.4	277.3	166.7
Newark	221.1	254.0	154.3
New York	210.1	273.3	172.7
Norfolk	214.3	252.0	154.1
Philadelphia	217.6	268.3	171.9
Pittsburgh	215.0	265.7	176.3
Wash., DC	227.7	269.6	180.7
PAD I avg	218.7	264.9	165.8
Chicago	242.8	297.9	192.3
Cleveland	237.8	284.2	177.5
Des Moines	220.7	261.1	171.1
Detroit	235.7	287.3	178.6
Indianapolis	228.6	278.7	177.6
Kansas City	214.7	250.4	165.3
Louisville	225.6	266.5	171.3
Memphis	210.5	250.3	163.5
Milwaukee	225.0	276.3	175.0
Minn.-St. Paul	220.4	266.0	169.3
Oklahoma City	199.8	235.2	154.1
Omaha	213.4	259.1	161.5
St. Louis	210.1	245.8	166.2
Tulsa	197.9	233.3	159.5
Wichita	202.2	245.6	162.8
PAD II avg	219.0	262.5	169.7
Albuquerque	212.8	250.0	160.8
Birmingham	213.0	252.3	158.3
Dallas-Fort Worth	208.6	247.0	159.1
Houston	209.9	248.3	151.3
Little Rock	203.8	244.0	159.8
New Orleans	216.3	254.7	158.5
San Antonio	213.2	251.6	155.6
PAD III avg	211.1	249.7	157.6
Cheyenne	217.0	249.4	140.8
Denver	217.1	257.5	150.2
Salt Lake City	204.0	246.9	152.4
PAD IV avg	212.7	251.3	147.8
Los Angeles	236.5	302.3	186.6
Phoenix	223.9	261.3	162.8
Portland	239.9	283.3	192.6
San Diego	235.5	301.3	197.5
San Francisco	241.5	307.3	192.6
Seattle	238.4	294.3	189.2
PAD V avg	236.0	291.6	186.9
Week's avg.	**219.6**	**264.4**	**167.5**
Dec. avg.	**214.4**	**259.2**	**171.1**
Nov. avg.	**218.8**	**263.6**	**215.5**
2010 to date	**187.6**	**233.0**	—
2009 to date	**121.9**	**167.5**	—

*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

	12-25-09 ¢/gal		12-25-09 ¢/gal
Spot market product prices			
Motor gasoline (Conventional-regular)		Heating oil No. 2	
New York Harbor	197.83	New York Harbor	202.45
Gulf Coast	193.70	Gulf Coast	197.70
Los Angeles	207.50	Gas oil	
Amsterdam-Rotterdam-Antwerp (ARA)	190.79	ARA	196.33
Singapore	199.76	Singapore	194.29
Motor gasoline (Reformulated-regular)		Residual fuel oil	
New York Harbor	196.33	New York Harbor	164.60
Gulf Coast	193.95	Gulf Coast	169.71
Los Angeles	213.00	Los Angeles	186.57
		ARA	164.23
		Singapore	176.02

Source: DOE Weekly Petroleum Status Report. Data available in OGJ Online Research Center. **NOTE: No new data at press time.**

BAKER HUGHES RIG COUNT

	1-8-10	1-9-09
Alabama	3	3
Alaska	7	13
Arkansas	36	49
California	26	35
Land	25	34
Offshore	1	1
Colorado	43	91
Florida	0	1
Illinois	0	0
Indiana	3	2
Kansas	21	22
Kentucky	1	3
Louisiana	188	183
N. Land	126	94
S. Inland waters	11	10
S. Land	12	23
Offshore	39	56
Maryland	0	0
Michigan	0	0
Mississippi	8	14
Montana	6	10
Nebraska	0	0
New Mexico	50	60
New York	2	4
North Dakota	67	68
Ohio	7	12
Oklahoma	98	155
Pennsylvania	66	22
South Dakota	0	0
Texas	498	713
Offshore	2	6
Inland waters	0	1
Dist. 1	20	11
Dist. 2	19	27
Dist. 3	33	50
Dist. 4	35	62
Dist. 5	73	143
Dist. 6	60	114
Dist. 7B	12	20
Dist. 7C	47	57
Dist. 8	106	91
Dist. 8A	18	26
Dist. 9	33	46
Dist. 10	40	59
Utah	23	32
West Virginia	22	26
Wyoming	38	61
Others—HI-1; NV-4; OR-1; TN-1	7	10
Total US	**1,220**	**1,589**
Total Canada	**342**	**360**
Grand total	**1,562**	**1,949**
US Oil rigs	427	341
US Gas rigs	781	1,239
Total US offshore	42	70
Total US cum. avg. YTD	**1,205**	**1,606**

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

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

SMITH RIG COUNT

Proposed depth, ft	Rig count	1-8-10 Percent footage*	Rig count	1-9-09 Percent footage*
0-2,500	85	1.1	72	1.3
2,501-5,000	53	71.6	91	52.7
5,001-7,500	134	18.6	224	17.8
7,501-10,000	237	4.6	361	1.9
10,001-12,500	240	13.7	315	1.9
12,501-15,000	183	2.1	326	—
15,001-17,500	177	—	159	—
17,501-20,000	66	—	71	—
20,001-over	31	—	36	—
Total	**1,206**	**9.2**	**1,655**	**6.1**
INLAND	19		24	
LAND	1,148		1,580	
OFFSHORE	39		51	

*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]1-8-10	[2]1-9-09
	1,000 b/d	
(Crude oil and lease condensate)		
Alabama	22	20
Alaska	724	692
California	645	649
Colorado	70	67
Florida	6	3
Illinois	25	24
Kansas	114	109
Louisiana	1,444	1,235
Michigan	17	18
Mississippi	63	63
Montana	87	83
New Mexico	167	157
North Dakota	229	196
Oklahoma	182	178
Texas	1,427	1,359
Utah	67	61
Wyoming	151	142
All others	70	75
Total	**5,510**	**5,131**

[1]OGJ estimate. [2]Revised.
Source: Oil & Gas Journal.
Data available in OGJ Online Research Center.

US CRUDE PRICES

	1-8-10 $/bbl*
Alaska-North Slope 27°	64.51
South Louisiana Sweet	85.75
California-Midway Sunset 13°	74.20
Lost Hills 30°	72.45
Southwest Wyoming Sweet	73.25
East Texas Sweet	78.75
West Texas Sour 34°	74.25
West Texas Intermediate	79.25
Oklahoma Sweet	79.25
Texas Upper Gulf Coast	72.25
Michigan Sour	71.25
Kansas Common	78.25
North Dakota Sweet	64.00

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

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

WORLD CRUDE PRICES

$/bbl[1]	12-25-09
United Kingdom-Brent 38°	72.91
Russia-Urals 32°	72.08
Saudi Light 34°	71.97
Dubai Fateh 32°	72.64
Algeria Saharan 44°	73.43
Nigeria-Bonny Light 37°	74.35
Indonesia-Minas 34°	76.84
Venezuela-Tia Juana Light 31°	71.54
Mexico-Isthmus 33°	71.43
OPEC basket	72.79
Total OPEC[2]	72.34
Total non-OPEC[2]	70.96
Total world[2]	71.75
US imports[3]	69.94

[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. **NOTE: No new data at press time.**

US NATURAL GAS STORAGE[1]

	1-1-10	12-25-09	1-1-09	Change, %
	bcf			
Producing region	1,003	1,044	900	**11.4**
Consuming region east	1,686	1,779	1,547	**9.0**
Consuming region west	434	453	390	**11.3**
Total US	**3,123**	**3,276**	**2,837**	**10.1**
	Oct. 09	**Oct. 08**	**Change %**	
Total US[2]	**3,807**	**3,399**	**12.0**	

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

INTERNATIONAL RIG COUNT

Region	Dec. 2009 Land	Dec. 2009 Off.	Dec. 2009 Total	Dec. 08 Total
WESTERN HEMISPHERE				
Argentina	55	—	55	70
Bolivia	4	—	4	3
Brazil	32	34	66	59
Canada	310	2	313	361
Chile	4	—	4	1
Colombia	31	—	31	42
Ecuador	10	—	10	13
Mexico	98	24	122	111
Peru	7	1	8	7
Trinidad	—	3	3	4
United States	1,136	37	1,172	1,782
Venezuela	38	11	49	78
Other	1	—	1	1
Subtotal	**1,726**	**112**	**1,838**	**2,531**
ASIA-PACIFIC				
Australia	7	10	17	26
Brunei	1	3	4	4
China-offshore	—	29	29	20
India	75	29	104	82
Indonesia	47	11	58	61
Japan	3	—	3	2
Malaysia	—	13	13	19
Myanmar	3	2	5	2
New Zealand	5	—	5	4
Papua New Guinea	2	—	2	2
Philippines	3	—	3	3
Taiwan	—	—	—	—
Thailand	5	10	15	12
Vietnam	—	8	8	4
Other	—	—	—	1
Subtotal	**151**	**115**	**266**	**242**
AFRICA				
Algeria	27	—	27	27
Angola	2	3	5	6
Congo	2	1	3	3
Gabon	2	—	2	1
Kenya	—	—	—	—
Libya	15	1	16	15
Nigeria	4	4	8	7
South Africa	—	—	—	1
Tunisia	3	1	4	3
Other	4	1	5	4
Subtotal	**59**	**11**	**70**	**67**
MIDDLE EAST				
Abu Dhabi	7	3	10	12
Dubai	0	1	1	2
Egypt	37	12	49	60
Iran	—	—	—	—
Iraq	—	—	—	—
Jordan	—	—	—	1
Kuwait	17	—	17	11
Oman	47	1	48	52
Pakistan	18	—	18	21
Qatar	1	7	8	10
Saudi Arabia	55	12	67	74
Sudan	—	—	—	—
Syria	19	—	19	20
Yemen	12	—	12	15
Other	2	—	2	1
Subtotal	**215**	**36**	**251**	**279**
EUROPE				
Croatia	—	1	1	—
Denmark	—	3	3	3
France	1	—	1	1
Germany	4	1	5	10
Hungary	2	—	2	3
Italy	3	1	4	4
Netherlands	3	2	5	5
Norway	—	22	22	25
Poland	3	—	3	1
Romania	7	—	7	18
Turkey	6	—	6	6
UK	—	14	14	22
Other	9	2	11	6
Subtotal	**38**	**46**	**84**	**104**
Total	**2,189**	**320**	**2,509**	**3,223**

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

OIL IMPORT FREIGHT COSTS*

Source	Discharge	Cargo	Cargo size, 1,000 bbl	Freight (Spot rate) worldscale	$/bbl
Caribbean	New York	Dist.	200	113	1.30
Caribbean	Houston	Resid.	380	102	1.31
Caribbean	Houston	Resid.	500	105	1.35
N. Europe	New York	Dist.	200	160	2.95
N. Europe	Houston	Crude	400	101	2.72
W. Africa	Houston	Crude	910	76	2.34
Persian Gulf	Houston	Crude	1,900	37	2.14
W. Africa	N. Europe	Crude	910	80	1.81
Persian Gulf	N. Europe	Crude	1,900	36	1.51
Persian Gulf	Japan	Crude	1,750	62	2.08

*Dec. 2009 average.
Source: Drewry Shipping Consultants Ltd. Data available in OGJ Online Research Center.

WATERBORNE ENERGY INC. US LNG IMPORTS

Country	Dec. 2009	Nov. 2009	Dec. 2008	Change from a year ago, %
	MMcf			
Algeria	—	—	—	—
Egypt	14,530	11,680	8,610	68.8
Equatorial Guinea	—	—	—	—
Nigeria	—	2,980	—	—
Norway	—	2,980	2,980	—
Qatar	4,660	8,500	—	—
Trinidad and Tobago	18,190	13,690	19,040	–4.5
Total	**37,380**	**39,830**	**30,630**	**22.0**

Source: Waterborne Energy Inc.
Data available in OGJ Online Research Center.

PROPANE PRICES

	Nov. 2009	Dec. 2009	Nov. 2008	Dec. 2008
	¢/gal			
Mont Belvieu	107.60	119.04	73.79	61.03
Conway	108.68	120.30	79.93	70.62
Northwest Europe	122.49	131.48	71.47	69.55

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

MUSE, STANCIL & CO. REFINING MARGINS

	US Gulf Coast	US East Coast	US Mid-west	US West Coast	North-west Europe	South-east Asia
	$/bbl					
Dec. 2008						
Product revenues	83.18	80.42	80.95	85.48	83.38	79.81
Feedstock costs	–77.67	–76.59	–73.26	–71.51	–75.77	–78.82
Gross margin	5.51	3.83	7.69	13.97	7.61	0.99
Fixed costs	–2.16	–2.49	–2.43	–2.83	–2.43	–1.89
Variable costs	–1.77	–1.23	–1.58	–2.69	–3.33	–1.01
Cash operating margin	**1.58**	**0.11**	**3.68**	**8.45**	**1.85**	**–1.91**
Nov. 2009	0.06	–0.95	2.64	4.85	2.03	–2.59
YTD avg.	3.03	0.20	5.75	10.32	1.66	–0.70
2008 avg.	9.09	–22.64	11.53	12.96	6.77	3.13
2007 avg.	12.60	–14.84	18.66	20.41	6.05	2.32
2006 avg.	12.54	–2.86	14.97	23.64	6.10	0.93

Source: Muse, Stancil & Co. See OGJ, Jan. 15, 2001, p. 46
Data available in OGJ Online Research Center.

MUSE, STANCIL & CO. GASOLINE MARKETING MARGINS

Oct. 2009	Chicago*	Houston	Los Angeles	New York
	¢/gal			
Retail price	277.93	249.03	297.39	279.61
Taxes	55.29	38.40	59.34	50.46
Wholesale price	204.30	202.54	217.72	211.63
Spot price	192.32	190.70	197.52	195.84
Retail margin	18.24	8.09	20.33	17.52
Wholesale margin	11.98	11.84	20.20	15.79
Gross marketing margin	**30.22**	**19.93**	**40.53**	**33.31**
Sept. 2009	15.85	11.82	41.23	27.59
YTD avg.	23.54	22.12	26.10	29.95
2008 avg.	33.11	32.15	27.22	41.81
2007 avg.	26.96	23.12	19.05	31.10
2006 avg.	19.74	19.94	18.03	27.90

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

MUSE, STANCIL & CO. ETHYLENE MARGINS

	Ethane	Propane	Naphtha
	¢/lb ethylene		
Dec. 2009			
Product revenues	46.61	81.24	100.45
Feedstock costs	–29.84	–67.87	–103.15
Gross margin	16.77	13.37	–2.70
Fixed costs	–5.38	–6.36	–7.19
Variable costs	–3.74	–4.37	–5.79
Cash operating margin	**7.65**	**2.64**	**–15.68**
Nov. 2009	8.88	7.59	–16.12
YTD avg.	12.93	9.63	–13.72
2008 avg.	21.00	22.89	–5.91
2007 avg.	14.41	14.14	–7.42
2006 avg.	19.54	22.45	1.36

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

MUSE, STANCIL & CO. US GAS PROCESSING MARGINS

Dec. 2009	Gulf Coast	Mid-continent
	$/Mcf	
Gross revenue		
Gas	4.98	4.67
Liquids	1.25	3.51
Gas purchase cost	5.55	6.27
Operating costs	0.07	0.15
Cash operating margin	**0.61**	**1.76**
Nov. 2009	0.73	2.00
YTD avg.	0.41	1.14
2008 avg.	0.45	1.61
2007 avg.	0.44	1.47
2006 avg.	0.26	0.97
Breakeven producer payment % of liquids	48%	48%

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

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Directory Numbers (latest counts)

Directory	Listings	HQ Offices	Personnel	Emails	Phone	Fax	Website
Pipeline	22,584	7,955	67,162	52,951	46,409	21,868	6,328
Refining & Gas Processing	20,873	8,726	58,369	45,344	39,455	20,031	6,462
Petrochemical	18,882	8,264	50,755	38,598	35,863	19,268	5,911
Liquid Terminals	8,457	2,983	28,325	22,693	19,142	8,933	2,637
Gas Utility	13,768	6,645	47,288	37,118	31,035	15,903	4,873
Electric Utility	27,586	13,117	81,906	62,193	49,642	25,432	9,160
Drilling & Well Servicing	15,275	6,745	37,279	28,303	23,639	12,974	3,691
Offshore E&P	9,197	3,842	30,382	25,032	16,240	8,518	3,313
International E&P	10,796	4,647	25,495	16,684	16,869	7,459	2,818
United States & Canada E&P	38,595	23,500	81,713	51,098	54,145	27,242	6,758
Texas E&P	11,760	7,820	31,857	22,614	19,578	9,921	3,101
Houston & Gulf Coast E&P	10,403	6,307	32,722	24,387	18,347	9,409	3,626
Mid Continent & Eastern US E&P	12,370	8,407	29,854	18,954	20,142	8,900	2,576
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Authors say crisis forces remain at work on oil price

If you think stability has returned to the oil market, two Rice University researchers have a message that should slosh your coffee: The crisis isn't over.

The latest oil-price gyration, say Mahmoud A. El-Gamal and Amy Myers Jaffe, was part of a lingering triangle of forces that have shaken economies in the past.

El-Gamal, chair of the Rice economics department, and Jaffe, director of the

The Editor's Perspective

by Bob Tippee, Editor

Energy Forum of the James A. Baker III Institute for Public Policy at Rice, treat the subject in a new book from Cambridge University Press: Oil, Dollars, Debt, and Crises. They discussed their thesis recently at the Baker Institute.

Two of the three forces they identify have received new attention lately: financial trading and oil markets.

"Financial investors think of energy as an asset class," El-Gamal said. In 2004, with demand for the physical commodity rising, oil was one of a relatively few tradable assets with prices moving enough to offer attractive returns, he said.

Oil also seemed to provide protection against a dollar weakening under the strain of US trade imbalances with China. So big financial investors, hedge funds, borrowed heavily to buy oil derivatives in what El-Gamal called a "double bet."

The increased buying amplified the upswing in oil prices through mid-2008 and the downswing that followed in a slumping economy.

As Jaffe explained the phenomenon, "dollar pessimism" grew with the US trade deficit. And the trade deficit grew because the US had no way to avoid buying oil of escalating price.

"It was very clear in 2007 that we were on a collision course with a crisis," she said.

Although the oil industry seems to be "breathing a sigh of relief because the down cycle only lasted 6 months," she said, instability lingers.

Past crises coincided with the third force noted by the coauthors: geopolitical upset, such as the Yom Kippur War in 1973 and the Iranian Revolution in 1979.

In financial and oil markets following the most recent disorder, E-Gamal warned, "The dynamics that caused the crisis are still in place."

And, Jaffe pointed out, "Iranians are back in the street."

(Online Jan. 8, 2010; author's e-mail: bobt@ogjonline.com)

Market Journal

by Sam Fletcher, Senior Writer

Cold weather saps distillates surplus

Colder weather across much of the northern hemisphere in late December and early January accelerated the burn-off of a global distillate fuel surplus.

"A blast of cold weather was not a necessary condition for global distillate inventories to fall back within bounds, but it will certainly help to speed the process along," said analysts at Barclays Capital Research, a division of Barclays Bank PLC, London. "While average December temperatures hit multiyear lows in some key heating oil-consuming areas in Europe and Asia, the US winter has so far been distinctly cold, but the difference from normal conditions has been less extreme."

The oil home-heating customer-weighted degree day count for December was 1034, which is 28 degree days colder than normal and 46 degree days more than last year. While US weather in December was colder than many expected, Barclays analysts said, "It has not totally reversed the degree day deficit for the season as a whole, given the relatively late onset of winter."

Nevertheless, they reported Jan. 6, "In the US alone, the surplus of distillate above its 5-year average has fallen by more than a third from 40.1 million bbl to 26.5 million bbl over the past 6 weeks. The first estimate using whole-year data is that US oil demand fell by 696,000 b/d in 2009. We expect an increase of 150,000 b/d in 2010, with recent macroeconomic data suggesting upside risks to that forecast."

The Energy Information Administration said commercial US crude inventories increased 1.3 million bbl to 327.3 million bbl in the week ended Jan. 1—above average for the time of year. US gasoline stocks were up 3.7 million bbl to 219.7 million bbl. Distillate fuel inventories decreased 300,000 bbl to 159 million bbl.

"While much of the burning up of excess global distillate inventories has been taking place elsewhere, the US has been playing a more significant part recently. In the latest data, the US surplus of distillates above the 5-year average shrank by 3.4 million bbl to 26.5 million bbl. Six weeks ago, the surplus stood at 40.1 million bbl, and hence, more than a third of that surplus has been burnt off in remarkably quick order. Heating oil inventories have been falling faster than normal over the past month, and the rate of decline has been particularly marked in the key mid-Atlantic states," said Barclays analysts.

"The total build in US inventories of crude and products (as ever excluding the 'other oils' category) has now fallen below 50 million bbl for the first time in over 11 months, with the oil product element of the surplus falling by 4.7 million bbl over the past week to now stand at just 28.3 million bbl, the lowest surplus since last March," they said.

But if the global distillate surplus is to continue a rapid decline after winter, demand for diesel must grow in this quarter. Barclays Capital expects this quarter to "show some significant sequential improvements in trucking mileages and, hence, in diesel demand." They said, "In turn, that should allow economics to fairly swiftly complete the winnowing of distillate inventories that weather has accelerated."

'Strong' market

The oil market made a "strong start" in 2010 with the 2009 highs at the front of the price curve topped in early January. Barclays analysts see "plenty of support" to keep prices "well above $70/bbl" in the first quarter.

Consensus forecasts for the average price for West Texas Intermediate for 2010 are in the range of $75/bbl, with the lowest call at $65/bbl. But Barclays Capital retains its 11-month-old call for $85/bbl "with upside risks." If oil dropped below $70/bbl for an extended period, it would cause investment shortfalls and project delays that would likely exacerbate "an already tight medium-term picture."

The Organization of Petroleum Exporting Countries is "capable of dampening forays" above $100/bbl. So the "extreme upside risks" are primarily geopolitical, "at least until supply side tightness takes equilibrium prices significantly higher in coming years," analysts said. A series of "what have been relatively slow-burning issues" seem likely to "come closer to the boil," they said.

As for demand, the economic recovery of members of the Organization for Economic Cooperation and Development "will be closely followed, as will the extent to which emerging demand growth continues its recent frenetic pace," analysts said. "On the supply side, Russia and Brazil are likely, as ever, to be the main wildcards in terms of the variance between output expectations and actual outcomes."

(Online Jan. 11, 2010; author's e-mail: samf@ogjonline.com)

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Note: Every effort has been made to ensure the data on this map are accurate and current as of Jan. 1, 2010. Please send corrections and comments to warrent@pgjonline.com

LNG importing countries, 2008

Country	Million tonnes	Tcf	Part of total, %	Change from 2007, %
Japan	69.15	3.37	40.2	3.4
Korea	29.05	1.41	16.9	11.2
Spain	22.00	1.07	12.8	18.6
France	9.35	0.46	5.4	-2.8
Taiwan	9.15	0.45	5.3	9.8
India	8.30	0.40	4.8	5.3
US	7.00	0.34	4.1	-55.0
Turkey	3.91	0.19	2.3	-4.7
China	3.37	0.16	2.0	13.5
Mexico	2.65	0.13	1.5	42.4
Belgium	2.31	0.11	1.3	11.6
Portugal	2.05	0.10	1.2	-2.8
Italy	1.10	0.05	0.6	-36.6
UK	0.80	0.04	0.5	-21.1
Greece	0.74	0.04	0.4	8.8
Puerto Rico	0.57	0.03	0.3	13.2
Dominican Rep.	0.35	0.02	0.2	-16.6
Argentina	0.31	0.02	0.2	--
Total	172.16	8.38	100.0	0.8

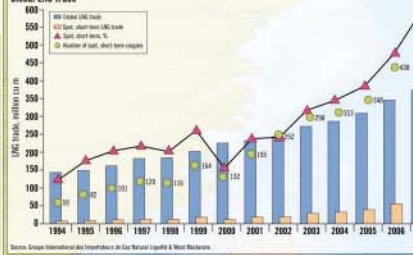
Source: Groupe International des Importateurs de Gaz Naturel Liquéfié, Paris

LNG exporting countries, 2008

Country	Million tonnes	Tcf	Part of total, %	Change from 2007, %
Qatar	30.27	1.47	17.6	3.3
Malaysia	22.39	1.09	13.0	-1.1
Indonesia	20.14	0.98	11.7	-1.8
Nigeria	16.86	0.82	9.8	0.8
Algeria	16.02	0.78	9.3	-10.3
Australia	15.41	0.75	9.0	1.5
Trinidad & Tobago	13.00	0.63	7.6	-3.7
Egypt	9.98	0.49	5.8	-0.2
Oman	8.91	0.43	5.2	-6.3
Brunei	7.02	0.34	4.1	-0.6
Abu Dhabi	5.77	0.28	3.4	-1.2
Equatorial Guinea	3.34	0.16	1.9	202.8
Norway	1.63	0.08	0.9	1,180.5
US	0.73	0.04	0.4	-18.2
Libya	0.41	0.02	0.2	-30.7
Total	171.82	8.37	100.0	-0.9

Source: Groupe International des Importateurs de Gaz Naturel Liquéfié, Paris

Global LNG trade



Source: Groupe International des Importateurs de Gaz Naturel Liquéfié & West Blackstone

Legend

LNG liquefaction plant
- Existing site
- Existing and operating
- Under construction
- Approved

LNG receiving terminal
- Existing site
- Existing offshore site
- Existing and operating
- Under construction
- Approved
- ( ) Total after expansion
- LNG trade route

LNG conversions[1]

	LNG, million tonnes	LNG, billion cu m	Gas, billion cu m[2]	Gas, billion cu ft[2]
Million tonnes, LNG	1	0.0024	1.38	48.7
Billion cu m, LNG	417	1	575	20,292
Billion cu m, gas	0.725	0.0017	1	35.3
Billion cu ft, gas	0.0205	0.00005	0.0283	1

[1]Based on conversion factors published by the US Department of Energy.
[2]At gas conversions are at standard conditions. Molecular weight of LNG is 17.184.

Data sources: Oil & Gas Journal, Platts, International Energy Agency, Paris; World LNG Conference, IGU, Chicago; company websites and media releases.

Worldwide natural gas reserves

Proved reserves (est.) Jan. 1, 2009

Eastern Europe, FSU

Country	bcf
Albania	30
Azerbaijan	30,000
Belarus	100
Bulgaria	200
Croatia	1,000
Czech Republic	140
Georgia	300
Hungary	286
Kazakhstan	85,000
Kyrgyzstan	200
Lithuania	---
Poland	5,820
Romania	2,225
Russia	1,680,000
Serbia	1,700
Slovakia	500
Tajikistan	200
Turkmenistan	94,000
Ukraine	39,000
Uzbekistan	65,000
Total Eastern Europe, FSU	2,005,781

Middle East

Country	bcf
Abu Dhabi	196,500
Bahrain	3,250
Dubai	4,000
Iran	991,600
Iraq	111,940
Israel	1,075
Jordan	213
Kuwait	62,860
Neutral Zone	1,000
Oman	30,000
Qatar	891,945
Ras al Khaimah	1,200
Saudi Arabia	257,970
Sharjah	10,700
Syria	8,500
Yemen	16,900
Total Middle East	2,591,653

Western Europe

Country	bcf
Austria	570
Denmark	2,165
France	245
Germany	6,200
Greece	70
Ireland	350
Italy	3,325
Netherlands	50,000
Norway	81,680
Spain	90
Turkey	300
United Kingdom	12,110
Total Western Europe	157,105

Africa

Country	bcf
Algeria	159,000
Angola	9,530
Benin	40
Cameroon	4,770
Chad	---
Congo (former Zaire)	35
Congo Brazzaville	3,200
Egypt	58,500
Equatorial Guinea	1,300
Ethiopia	880
Gabon	1,000
Ghana	800
Ivory Coast	1,000
Libya	54,380
Madagascar	---
Mauritania	1,000
Morocco	53
Mozambique	4,500
Namibia	2,200
Nigeria	184,160
Rwanda	2,000
Somalia	200
South Africa	---
Sudan	3,000
Tanzania	230
Tunisia	2,300
Total Africa	494,878

Asia-Pacific

Country	bcf
Afghanistan	1,750
Australia	30,000
Bangladesh	5,000
Brunei	13,800
China	80,000
China, Taiwan	220
India	37,960
Indonesia	106,000
Japan	738
Malaysia	83,000
Myanmar	10,000
New Zealand	1,200
Pakistan	31,296
Papua New Guinea	8,000
Philippines	3,480
Thailand	11,198
Viet Nam	6,800
Total Asia-Pacific	430,412

Western Hemisphere

Country	bcf
Argentina	15,600
Barbados	5
Belize	---
Bolivia	26,500
Brazil	12,890
Canada	57,906
Chile	3,460
Colombia	3,739
Cuba	2,500
Ecuador	315
Guatemala	---
Mexico	13,162
Peru	11,842
Suriname	---
Trinidad and Tobago	18,770
United States	237,726
Venezuela	170,920
Total Western Hemisphere	575,335
Total world	6,254,363
Total OPEC	3,216,020

UNITED KINGDOM

Status	Location	Start-up, year	Principal owner	Capacity, million tpy
O	Teesside (GasPort)	1997	ExxonMobil Energy	3.0
O	Isle of Grain	2005, 2009	National Grid Transco	8.0
C	Isle of Grain expansion	2010-11		5.0
O	Milford Haven	2009	South Hook LNG (QP, ExxonMobil, Total)	7.8 (15.6)
A	Milford Haven	2009	Dragon LNG (BG, Petronas, Atlantic)	4.4 (8.8)
A	Mainey Island, offshore	2013	Port Meridian Deepwater (Hoegh LNG)	5.0

UNITED STATES

Status	Location	Start-up, year	Principal owner	Capacity, million tpy
O	Everett, Mass.	1971	Suez	3.1
O	Northeast Gateway, offshore Mass.	2008	Excelerate Energy	3.8
O	Elba Island, Ga.	1978-80; 2001	Southern LNG (El Paso)	11.4
O	Lake Charles, La.	1982-83; 1989; 2006	Trunkline (Southern Union)	11.0
O	Cove Point, Md.	1978-80; 2003; 2009	Dominion Cove Point	13.0
O	Gulf Gateway, offshore Louisiana	2005	Excelerate Energy	3.2
O	Freeport, Tex.	2008	Michael Smith, ConocoPhillips	11.4
O	Hackberry, La.	2009	Cameron LNG (Sempra)	11.4
C	Hackberry, La., expansion	2011		8.7
O	Sabine Pass, La.	2008, 2009	Cheniere Energy	20.5
C	Sabine Pass, Tex.	2010	Quinte Pass (ExxonMobil, GP)	15.2
C	Neptune LNG, offshore Mass.	2010	Suez LNG	3.8
C	Pascagoula, Miss.	2011	Gulf LNG Energy: El Paso, Sonangol, & Orient Energy	5.0
A	Corpus Christi, Tex.	TBD	Cheniere Energy	8.8
A	Corpus Christi, Tex.	TBD	Vista del Sol (ExxonMobil)	3.4
A	Corpus Christi, Tex.	TBD	Ingleside Energy (Occidental)	3.4
A	Port Arthur, Tex.	TBD	Sempra Energy	11.4
A	Cameron, La.	TBD	Creole Trail (Cheniere)	25.1

CANADA

Status	Location	Start-up, year	Principal owner	Capacity, million tpy
O	St. John, NB	2009	Canaport LNG (Irving Oil, Repsol)	7.5

MEXICO

Status	Location	Start-up, year	Principal owner	Capacity, million tpy
O	Altamira, Tamaulipas	2006	Shell, Total	3.8
O	Ensenada, Baja California	2008	Energía Costa Azul (Sempra)	7.5
A	Ensenada, Baja California expansion	TBD		7.5
C	Manzanillo	2011	Terminal de GNL, Samsung, Korea Gas, Mitsui	3.8

FRANCE

Status	Location	Start-up, year	Principal owner	Capacity, million tpy
O	Fos-sur-Mer (Fos Tonkin)	1972	GDF Suez	8.1
O	Montoir de Bretagne	1982	GDF Suez	7.5
C	Montoir de Bretagne expansion	2011		1.0
A	Montoir de Bretagne expansion	2014		2.9
O	Fos-Cavaou	2010	GDF Suez, Total	6.0

SPAIN

Status	Location	Start-up, year	Principal owner	Capacity, million tpy
O	Barcelona	1968, 2006	Enagas	12.5
O	Huelva	1988, 2008	Enagas	8.8
O	Cartagena	1989, 2008	Enagas	8.8
C	El Musel, Gijon	2012	Enagas	5.1
C	Bilbao	2013	BBG (Enagas, Vesterbik, Repsol, EVE)	5.1
O	El Ferrol (Mugardos)	2007	Reganosa Group, Union Fenosa, Endesa, Sonatrach, Vazul companies	2.9
O	Sagunto	2007, 2009	Union Fenosa, Iberdrola, Endesa, Oman Oil	6.3

PORTUGAL

Status	Location	Start-up, year	Principal owner
O	Sines	2004	Galp Energia

ALGERIA

Status	Location	Owners	Start-up, year, train
O	Arzew	Sonatrach	1973; GL1Z, 6 trains; 1981 revamp
O	Arzew	Sonatrach	1981; GL2Z, 6 trains; 1996 revamp
A	Arzew	Sonatrach	2013; GL1Z, 1 train
O	Arzew	Sonatrach	1964; GL4Z, 3 trains
O	Skikda	Sonatrach	2013; GL1K, 1 train; 1972-81; GL2K, 2 trains
O	Skikda	Sonatrach	2013; Rem. single train to replace 3 trains

NIGERIA

Status	Location	Owners
O	Bonny Island	Nigeria LNG (NNPC, Shell, Total, Eni)
O	Bonny Island	Nigeria LNG (NNPC, Shell, Total, Eni)
O	Bonny Island	Nigeria LNG (NNPC, Shell, Total, Eni)

DOMINICAN REPUBLIC

Status	Location	Start-up, year	Principal owner	Capacity, million tpy
O	Andres	2003, 2015	AES Corp	1.8

PUERTO RICO

Status	Location	Start-up, year	Principal owner	Capacity, million tpy
O	Penuelas	2000	Gas Natural (GNF International Power Mitsui)	2.7

TRINIDAD & TOBAGO

Status	Location	Owners	Start-up, year, train	Capacity, million tpy
O	Point Fortin	Atlantic LNG (BP, BG, Suez, Repsol, NGC)	1999, Train 1	3.30
O	Point Fortin	Atlantic LNG (BP, BG, Repsol)	2002, Train 2; 2003, Train 3	6.60
O	Point Fortin	BG, BP, Repsol, NGC	2006	5.20

BRAZIL

Status	Location	Start-up, year	Principal owner	Capacity, million tpy
O	Pecem (FRSU)	2008	Petrobras	1.5
O	Guanabara Bay (FRSU)	2009	Petrobras	3.5

PERU

Status	Location	Owners	Start-up, year, train	Capacity, million tpy
O	Melchorita	Hunt Oil, SK Corp, Repsol, Marubeni	2010	4.4

CHILE

Status	Location	Start-up, year	Principal owner	Capacity, million tpy
O	Quintero	2010	ENAP, BG, Metrogas, Endesa	2.5
O	Mejillones	2010	Codelco, GDF Suez	1.5

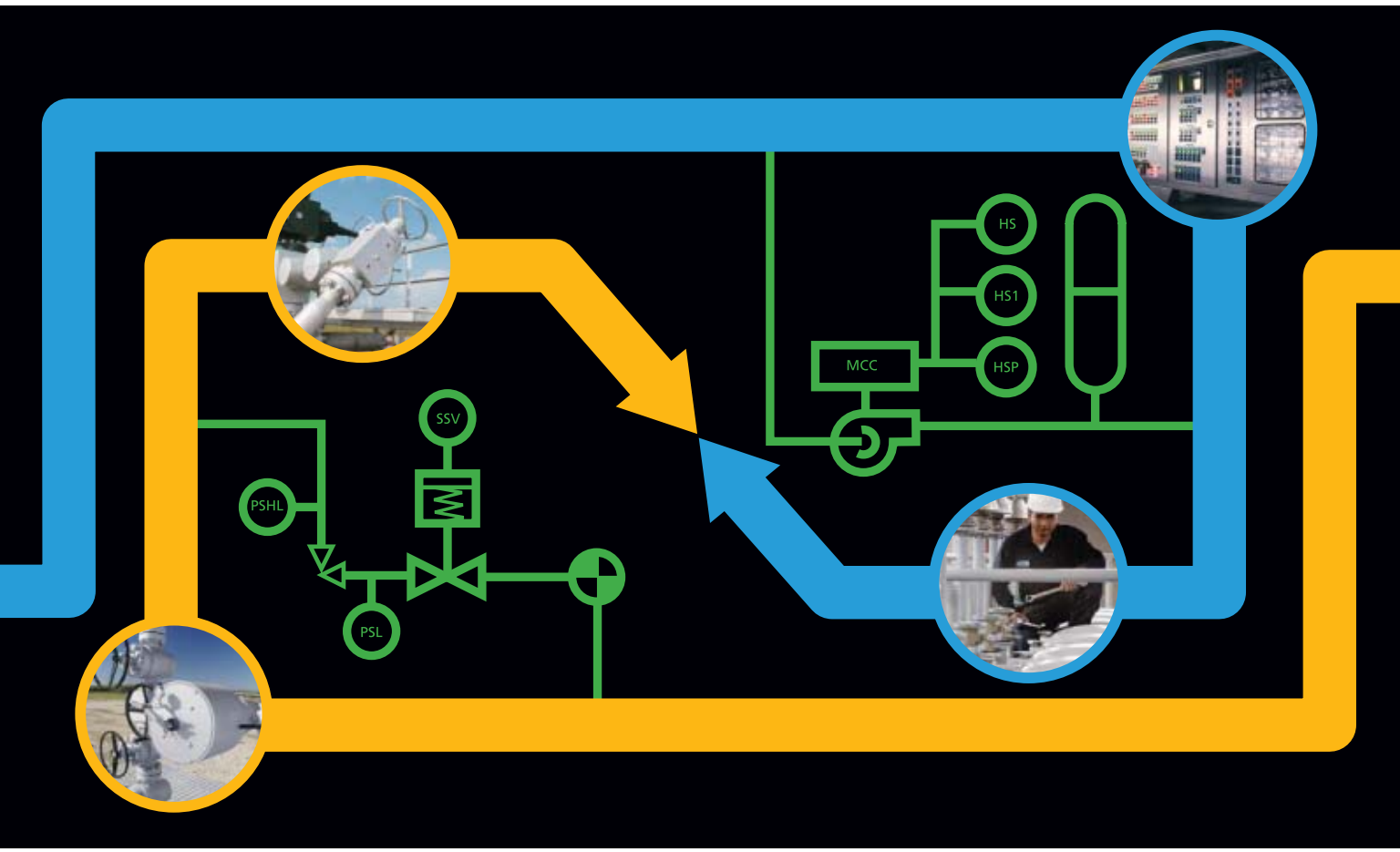
ARGENTINA

Status	Location	Start-up, year	Principal owner	Capacity, million tpy
O	Bahia Blanca (GasPort)	2008	Excelerate	3.0-6.0

EQUATOR

Trinidad

Peru



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