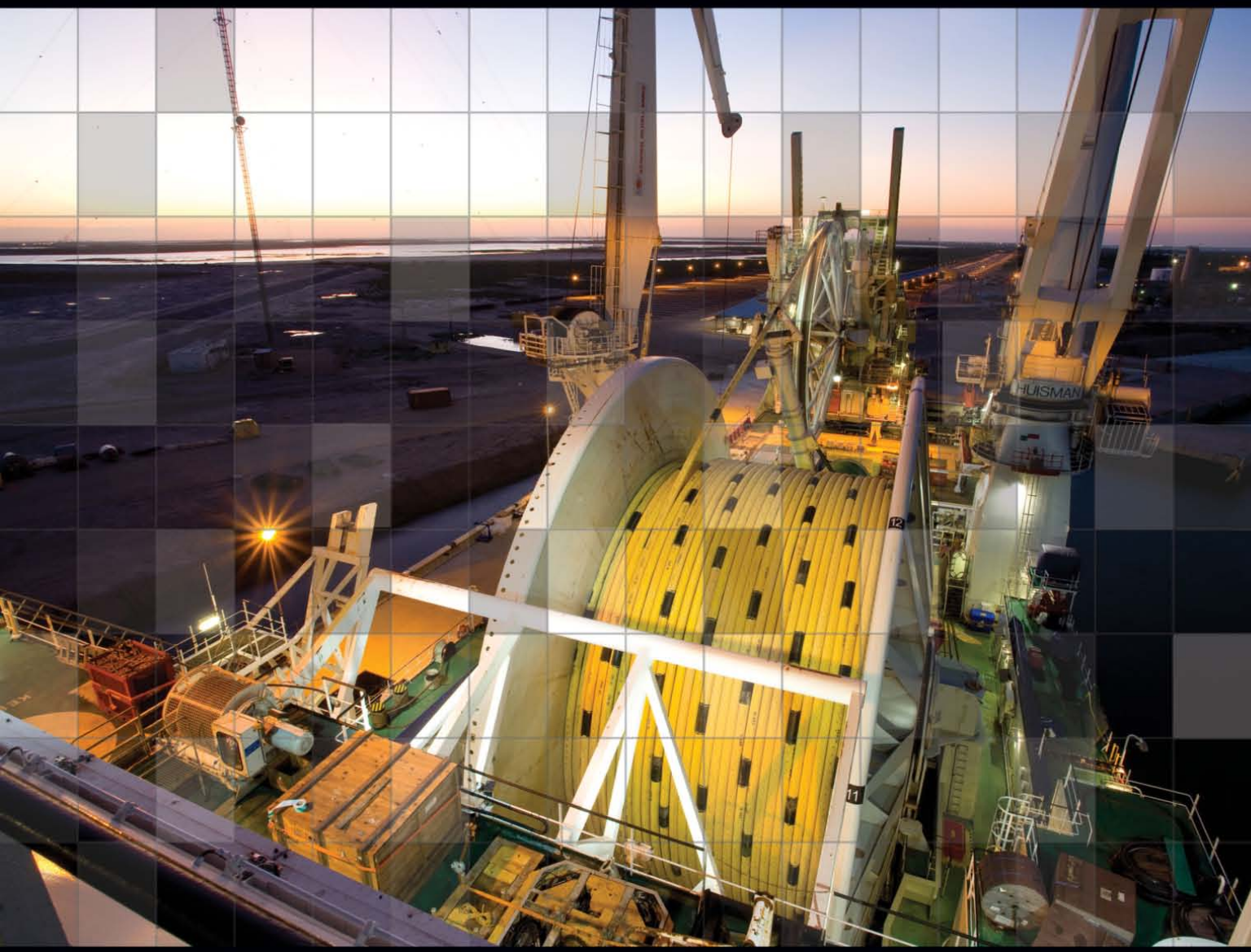
Week of Jan. 11, 2010/US$10.00

# OIL & GAS JOURNAL®

International Petroleum News and Technology / www.ogjonline.com




## OGJ Focus: Drilling and Production

Third-quarter 2009 earnings slump
Umiat: a North Slope giant primed for oil development
Separations technology improves amine system
Operators underusing potential pipeline rehabilitation

OIL&GAS JOURNAL®

Jan. 11, 2010
Volume 108.1

## OGJ Focus: Drilling and Production



### Equations

$$SF = \left(\frac{\rho_{bottom}}{\rho_{bottom} + \rho_{top}}\right) \quad (1)$$

$$W_{TSP} = W_{dry} \times \left(\frac{\rho_p - \rho_l}{\rho_p}\right) \quad (2)$$

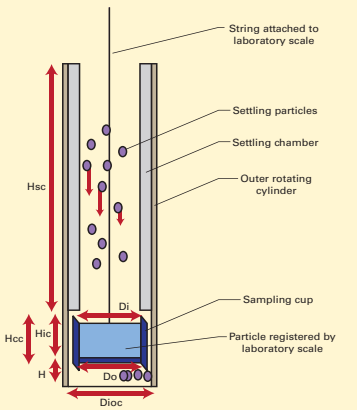
$$R_s = \frac{W_{SM}}{W_{TSP}} \quad (3)$$

$$A_{coir} = \frac{D_i^2}{D_o^2} \quad (4)$$

$$R_{SA} = \frac{W_{SM}}{W_{TSP} \times A_{coir}} \quad (5)$$

Settling measurement principle

Fig. 1




Equipment setup

Fig. 3


## Regular Features



## Cover

The Seven Ocean rigid reeled pipelay vessel at the Subsea 7 pipeline fabrication facility in Port Isabel, Tex., has onboard part of the 8-in. insulated flowline for Marathon Oil Corp.'s subsea Droshky development in Gulf of Mexico's Green Canyon Block 244. Water depth at Droshky is about 2,900 ft. The vessel laid two parallel 18-mile flowlines from Droshky to Shell Exploration & Production Co.'s Bullwinkle fixed platform. Marathon expects first oil and gas production from Droshky in mid-2010. The article in the OGJ Focus: Drilling and Production section, p. 39, describes the design of equipment for determining, at the rig site, drilling fluid weight material sag. Photo from Marathon.

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## General Interest



## Exploration & Development



## Technology



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OGJ Newsletter

Jan. 11, 2010

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## General Interest — Quick Takes

### China, Venezuela sign round of energy agreements

China and Venezuela signed five agreements, one concerning refining and two touching on exploration and development of oil fields in the Orinoco Belt.

At the signing ceremony in Caracas, China National Offshore Oil Corp. (CNOOC) agreed to help the Venezuelan government assess oil reserves in the Boyaca 3 oil block in the Orinoco belt.

Venezuela's state-owned Petroleos de Venezuela SA (PDVSA) and China Petroleum & Chemical Corp. (Sinopec) also signed an agreement to establish a mixed company to develop the Junin 8 Block.

CNPC and PDVSA agreed to set up a mixed company to develop a 400,000-b/d refinery in Cabruta that will refine oil from the Junin Block 8.

The two countries also signed an oil export agreement, which could see up to 560,000 b/d heading to China in 2010, as well as a deepwater technical advice agreement between CNOOC and PDVSA.

Analyst IHS Global Insight said the agreements indicate growing ties in the oil sector between the two countries, with Venezuela seeking to diversify exports away from the US and to secure finances to develop new oil reserves.

Global Insight also said China is keen to take advantage of the fall in crude oil prices and global demand over the past year to secure long-term supply deals from producer states like Venezuela as its own import dependence rises.

Earlier this year, Russia and Venezuela, during Venezuelan President Hugo Chavez's 2-day visit to Moscow, signed a similar package of energy agreements, including one to develop the Latin American country's Orinoco belt and its 235 billion bbl of heavy oil reserves (OGJ Online, Sept. 11, 2009).

### Indonesia drops plan for cost recovery payments

Unable to attract enough investors to develop new oil and gas blocks, the Indonesian government plans to abandon its recently adopted practice of capping the annual cost recovery payment reimbursed to contractors.

"The policy of capping cost recovery is not appropriate. This is not supposed to be capped. We will fix this matter," said Coordinating Economic Minister Hatta Rajasa, referring to plans by the government to reimburse all contractor cost items within the scope of the cost recovery payment rules.

"We have corrected this," Hatta said. "The most important thing is not to cap the payment, but how to avoid moral hazard [in the payment]."

Under Indonesia's production-sharing contract regime, Jakarta must refund investors' full exploration costs once fields enter production.

However, to head off a potential budget shortfall, members of Indonesia's House of Representatives, urged the government's upstream watchdog BPMigas to reduce the cost recovery given to oil and gas contractors.

"For now, BPMigas should limit the amount of cost recovery," to $10 billion from $11.05 billion, said Suharso Manoarfa, vice-chairman of the House's budget committee, in a hearing with the government and the central bank (OGJ Online, July 28, 2009).

After allegations of insufficient transparency in the reimbursement process, Indonesia's parliament eventually imposed restrictions on cost recovery payments in 2009, capping the total budget for the scheme at $11.05 billion in 2009 and setting the cap at $12 billion for 2010.

However, these restrictions recently were singled out as a major contributory factor behind falling investment in the country. As a result, plans were announced by Evita Legowo, director general at the energy ministry, to encourage the finance ministry to abandon the caps.

"We as the player in this business fully support the government's decision," said Budi Basuki, president director of Medco E&P Indonesia.

While the decision to drop the caps may be welcomed by Budi and other members of the country's oil and gas industry, analyst BMI doubts the measure will do anything to improve Indonesia's efforts to attract investment.

"Although this is a step in the right direction, we doubt that it will be sufficient to stem the fall in upstream investment, and we expect the results of the country's next licensing round to be disappointing," said BMI.

### Russia, Turkmenistan revise gas contract

Russia and Turkmenistan have agreed to new terms on gas trade while their presidents, Dmitry Medvedev and Gurbanguly Berdimuhamedov, signed a broader agreement on strategic energy cooperation.

Turkmenistan sells gas to Russia under the 25-year Interstate Cooperation Agreement signed on Apr. 10, 2003.

Under the revised contract, Russian purchases of up to 30 billion cu m/year of Turkmen gas—about two-thirds the level of recent years—will resume Jan. 1, under a price formula based on the European gas market.

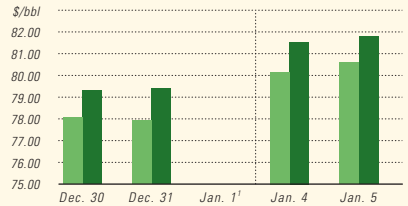
Medvedev said it will be the first link of Russian purchases of Turkmen gas to European prices.

Deliveries of Turkmen gas to Russia ceased 9 months ago after the rupture of the main Turkmen export pipeline. Turkmenistan blamed Russia for the incident, which came amid pricing disputes.

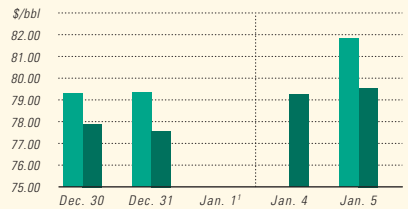
The energy-cooperation agreement will cover joint pipeline construction, according to a senior Russian official.

# Industry Scoreboard

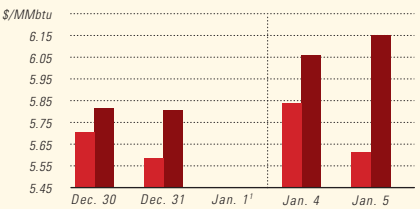
## IPE BRENT / NYMEX LIGHT SWEET CRUDE



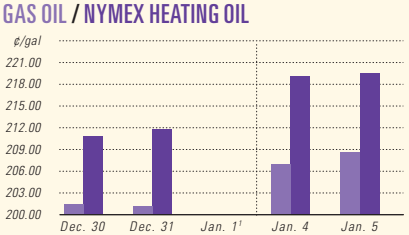

## WTI CUSHING / BRENT SPOT



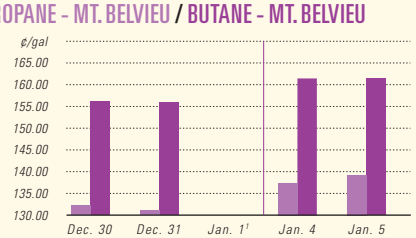

## NYMEX NATURAL GAS / SPOT GAS - HENRY HUB



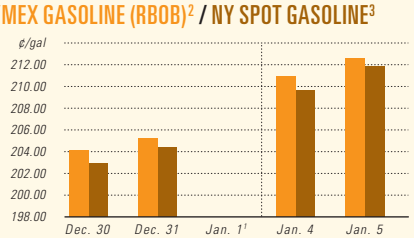

## IPE GAS OIL / NYMEX HEATING OIL




## PROPANE - MT. BELVIEU / BUTANE - MT. BELVIEU




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




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

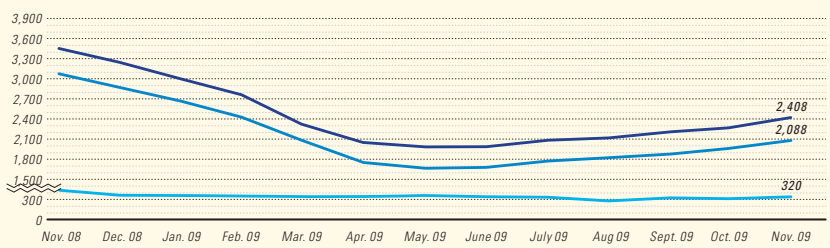
## US INDUSTRY SCOREBOARD — 1/11

| Latest week 12/11 | 4 wk. average | 4 wk. avg. year ago[1] | Change, % | YTD average[1] | YTD avg. year ago[1] | Change, % |
|---|---|---|---|---|---|---|
| *Demand, 1,000 b/d* | | | | | | |
| Motor gasoline | 8,991 | 8,918 | 0.8 | 9,009 | 8,992 | 0.2 |
| Distillate | 3,670 | 3,818 | –3.9 | 3,606 | 3,952 | –8.8 |
| Jet fuel | 1,464 | 1,413 | 3.6 | 1,414 | 1,544 | –8.4 |
| Residual | 497 | 662 | –24.9 | 526 | 617 | –14.7 |
| Other products | 4,283 | 4,296 | –0.3 | 4,078 | 4,407 | –7.5 |
| TOTAL DEMAND | 18,905 | 19,107 | –1.1 | 18,633 | 19,512 | –4.5 |
| *Supply, 1,000 b/d* | | | | | | |
| Crude production | 5,537 | 5,044 | 9.8 | 5,303 | 4,946 | 7.2 |
| NGL production[2] | 2,084 | 1,858 | 12.2 | 2,011 | 2,070 | –2.9 |
| Crude imports | 8,004 | 9,625 | –16.8 | 9,031 | 9,778 | –7.6 |
| Product imports | 2,680 | 3,090 | –13.3 | 2,736 | 3,130 | –12.6 |
| Other supply[3] | 1,668 | 1,661 | 0.4 | 1,664 | 1,585 | 5.0 |
| TOTAL SUPPLY | 19,973 | 21,278 | –6.1 | 20,745 | 21,509 | –3.6 |
| *Refining, 1,000 b/d* | | | | | | |
| Crude runs to stills | 14,341 | 14,408 | –0.5 | 14,399 | 14,648 | –1.7 |
| Input to crude stills | 14,641 | 14,991 | –2.3 | 14,741 | 15,024 | –1.9 |
| % utilization | 82.9 | 85.1 | — | 83.5 | 85.3 | — |

| Latest week 12/11 | Latest week | Previous week[1] | Change | Same week year ago[1] | Change | Change, % |
|---|---|---|---|---|---|---|
| *Stocks, 1,000 bbl* | | | | | | |
| Crude oil | 332,387 | 336,076 | –3,689 | 321,289 | 11,098 | 3.5 |
| Motor gasoline | 217,213 | 216,334 | 879 | 203,959 | 13,254 | 6.5 |
| Distillate | 164,363 | 167,317 | –2,954 | 133,523 | 30,840 | 23.1 |
| Jet fuel–kerosine | 41,013 | 42,546 | –1,533 | 37,916 | 3,097 | 8.2 |
| Residual | 36,474 | 36,222 | 252 | 35,930 | 544 | 1.5 |
| *Stock cover (days)[4]* | | | Change, % | | Change, % | |
| Crude | 23.9 | 24.2 | –1.2 | 21.8 | 9.6 | |
| Motor gasoline | 24.1 | 24.0 | 0.4 | 22.7 | 6.2 | |
| Distillate | 45.8 | 47.3 | –3.2 | 33.9 | 35.1 | |
| Propane | 39.9 | 43.6 | –8.5 | 43.9 | –9.1 | |
| *Futures prices[5]* **12/18** | | | Change | | Change | % |
| Light sweet crude ($/bbl) | 71.77 | 71.53 | 0.24 | 44.71 | 27.06 | 60.5 |
| Natural gas, $/MMbtu | 5.57 | 5.09 | 0.48 | 5.58 | –0.01 | –0.2 |

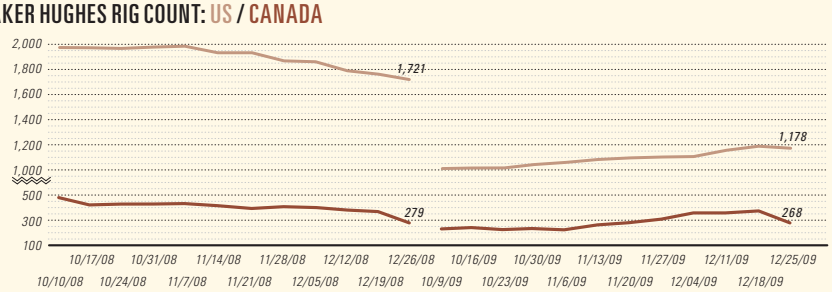
[1]Based on revised figures. [2]Includes adjustments for fuel ethanol and motor gasoline blending components. [3]Includes other hydrocarbons and alcohol, refinery processing gain, and unaccounted for crude oil. [4]Stocks divided by average daily product supplied for the prior 4 weeks. [5]Weekly average 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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Earlier this month, Turkmenistan signed a long-term agreement for the supply of gas to China. At the time, Russia's Prime Minister Vladimir Putin said the agreement would not upset relations between his country and Turkmenistan (OGJ Online, Dec. 7, 2009). ✦

## Exploration & Development — *Quick Takes*

### Dana Gas makes ninth discovery in Nile Delta

Dana Gas reported a natural gas discovery with its Orchid-1 well in the West Manzala concession of the Nile Delta. The find marks the firm's ninth discovery in the region in recent months.

Dana said Orchid-1 was drilled 1.3 km west of its Azhar-1 well, and was spudded on Dec. 15, 2009, reaching a total depth of 1,700 m in the Pliocene Kafr El Sheikh formation.

The well found 8.4 m of net pay of excellent sand reservoir of Kafr El Sheikh formation, and tested dry gas at 12.6 MMscfd.

Dana said it is currently studying the options for producing Orchid-1 through either its El Wastani or South El Manzala gas plants.

"The preliminary estimated recoverable reserves of the Orchid discovery range between 10-50 bcf of dry gas, pending further appraisal," the firm said.

Dana said the find follows its eight previous gas discoveries in Egypt announced in 2009: Salma-1, West Manzala-2, Azhar-1, Tulip-1, Sharabas-1, Sama-1, Faraskur-1, and Marzouk-2.

As a result of the finds, Dana said it has successfully achieved its yearend production target for Egypt operations by delivering a production rate "in excess of 40,000 boe/d."

Overall, Dana Gas Egypt said it has delivered an average production rate of 34,750 boe/d during 2009. Compared to 2008, this represents an increase of 27% on the end of year production rate and is a 20% increase on the average daily production rate.

### Devonian zones indicate oil in Gaspe, Quebec

Petrolia, Rimouski, Que., reported light oil on drillstem tests in two formations of Devonian age at its Tar Point exploratory well on Quebec's Gaspe Peninsula.

The indicated discovery is 11 km southeast of the company's undeveloped 2006 Haldimand oil and gas discovery just southeast of Gaspe town. That well yielded 47° gravity oil (OGJ, July 10, 2006, p. 38).

The Tar Point well went to TD 2,434 m in tight, oil saturated sandstones, and Petrolia set casing to 2,201 m.

A drillstem test at 2,045-2,201 m in a highly fractured limestone in the Indian Cove formation of early Devonian age yielded a small flow of gas and 184 l. of fluid, mainly composed of drilling mud and light oil. A production test is planned in January.

Another drillstem test at 1,528-84 m in the Devonian York River formation produced a small flow of air at surface, 58.33 m (213 l.) of drilling mud with minor gas, and gassy mud with black oil from the sample chamber. The zone indicated low permeability, but Petrolia said it might frac the interval depending on results of work to be carried out at Haldimand in early 2010.

The two wells are 220 miles north of gas production at McCully field near Sussex, NB.

Petrolia holds interests in 3.7 million acres of leases or 18% of Quebec territory including Anticosti Island in the Gulf of St. Lawrence.

### Origin group makes oil, gas find off Tasmania

The Origin Energy Ltd. group has made a natural gas and oil discovery in its Rockhopper-1 wildcat in Bass basin permit T/18P off northern Tasmania. The size and commercial significance of the find will be assessed following wireline logs and a test program.

Wireline pressure data has confirmed multiple hydrocarbon zones within interbedded sands and shales of the Lower Eastern View Coal Measures in the prospect. Selective wireline sampling also recovered oil from some sands and liquid-rich gas from others.

The thickness of individual sands varies from 1 m to 5 m. Reservoir quality also appears to be variable.

No definitive water-bearing sands were encountered in the target horizons and the joint venture is now contemplating drilling a sidetrack into a down-flank location to establish hydrocarbon column heights.

The well has been drilled by the Kan Tan semisubmersible and is close to the Trefoil and Yolla gas fields.

Origin of Sydney has 39%. Other partners are AWE, Sydney, 47.5%, CalEnergy Gas 8.5%, and Innamincka Petroleum, Brisbane 5%.

### New Brunswick shale gas play draws attention

PetroWorth Resources Inc., Calgary, divested all interests in Alberta natural gas wells to concentrate activity in eastern Canada.

The decision is based on recent shale gas developments adjacent to PetroWorth's 41,000-acre Rosevale block in New Brunswick.

The company holds 129,000 acres, including Rosevale, south of Moncton that bracket Stoney Creek oil and gas field.

The Rosevale block lies east of McCully gas field and an emerging gas play in Mississippian Frederick Brook shale, in which Apache Canada Ltd. has joined Corridor Resources Inc., Halifax (OGJ Online, Dec. 8, 2009). ✦

## Drilling & Production — *Quick Takes*

### Rigless ESP nears commercial installation

ConocoPhillips has scheduled its first commercial installation of a rigless electric submersible pump during the second or third quarter, according to Artificial Lift Co. Ltd.

ALC in cooperation with ConocoPhillips developed the rigless ESP during the last 5 years.

A paper given at the 2009 SPE ATCE in New Orleans (Patterson, J.C., et al., "First 4.5-in. Through-Tubing ESP with Downhole Wet

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CAMERON

Connect," Paper No. SPE 123996) said ConocoPhillips was interested in developing the rigless pump in order to lower the cost for replacing pumps in sanded up wells in the West Sak Unit on Alaska's North Slope.

The paper noted that wireline-conveyed through-tubing pump sections have been available but these still needed a workover rig to deploy or retrieve the pump's motor, which was run on tubing.

The rigless ESP has a slim ALC designed permanent-magnet motor connected to the pump section that a wireline unit can deploy or retrieve in 4.5-in. tubing with a 3.833-in. drift ID.

The initial pump installation still needs a workover rig for deploying the electric cable conventionally on the tubing string. A wet connector in the bottomhole assembly of the tubing string links the cable to the wet-connector system on the ESP.

ALC also said the production engineering and well services department of Saudi Aramco has plans to install a rigless ESP in early 2010.

## Concession awarded for Adriatic gas field

Production from Guendalina natural gas field in the northern Adriatic Sea will start by June 2011 under a concession awarded this month to operator Eni SPA by the Italian Ministry of Economic Development, according to 20% interest holder Mediterranean Oil & Gas PLC (MOG).

MOG earlier expected production to begin in the last quarter of 2010 (OGJ, May 18, 2009, p. 34).

It now says Eni expects to begin development this month or in February, install the platform in 20 m of water 25 km off Ravenna, Italy, this year, and complete the drilling of two wells in the first half of 2011.

MOG says Eni studies indicate Guendalina production will be about 20 MMcfd. Proved and probable reserves are 22 bcf.

## Statoil to upgrade Snorre complex

Statoil ASA will invest more than 5 billion kroner to ensure increased production and continued profitability from its Snorre field. The field "has the largest remaining reserves of Statoil's fields on the Norwegian Continental Shelf," said Torstein Hole, senior vice-president of the firm's western exploration and production operations in Norway.

"A number of extensive modifications have been carried out in recent years to make the installations more robust for increased production and an extended lifetime up until the year 2040," Hole said in an article published on Statoil's web site. "We are the NCS field carrying out most modifications in 2009-10. Total capital expenditure for Snorre in 2009 and 2010 amounts to 5 billion kroner, of which health, safety, and environmental measures account for over 50%," he said.

The flotel "Safe Scandinavia" is to arrive at Snorre A next summer and will increase the field's sleeping capacity for 6 months for more workers for additional projects and maintenance. The accommodation quarters on Snorre will be upgraded in that period, with more single-occupant rooms to be built and noise-reduction measures implemented.

The two platforms at the Snorre field will be upgraded and the present fire and gas alarm will be replaced with a modernized system at a cost of 450 million kroner. Apply Sorco AS was awarded the main contract for the upgrade.

"We will get a completely revamped, modern system with a much improved coverage compared to the current one. This will make the platform's warning system more robust and will represent a big safety improvement," said Hole.

The comprehensive project will extend 3 years to 2012. "While the platform is in full operation, and the current warning system is operative, some 1,700 detectors will be removed and 2,000 new ones installed; 36 km of cable will be taken out and 47 km of new cable installed," Hole said. ✦

# Processing — *Quick Takes*

## FEED pact let for Venezuelan ethylene plant

A Brazilian-Venezuelan joint venture has let a reimbursable front-end engineering design (FEED) contract to Technip for a 1.3 million tonne/year ethylene plant at Jose, Venezuela.

The JV is Polimerica, owned 49% each by Venezuela's state-owned Pequiven and Braskem of Sao Paulo, Brazil. Coramer, Caracas, and Sojitz, Tokyo, hold 1% each.

The ethylene plant is to be part of a petrochemical complex Pequiven and Braskem plan to build at Jose through two JVs they agreed to form in 2007 (OGJ Online, Apr. 19, 2007).

One JV is to build the ethane cracker covered by the new contract as well as a 1.1 million tpy polyethylene plant. The other JV is to build a 450,000 tpy polypropylene plant.

Technip said FEED activities for the ethylene plant are to be completed by second quarter 2011.

## CBF NGL plant to be expanded at Mont Belvieu

Targa Resources Partners LP, Houston, plans to expand capacity of its majority-owned Cedar Bayou Fractionators LP (CBF) natural gas liquids fractionation facility at nearby Mont Belvieu, Tex.

The maximum gross fractionation capacity of the facility is to be expanded by 60,000 b/d to 275,000 b/d, increasing the partnership's maximum gross NGL fractionation capacity along the Texas and Louisiana Gulf Coast to 439,000 b/d.

The CBF expansion is to be supported by a long-term firm space fractionation agreement at market-based fees with Oneok Partners LP. CBF and Oneok executed a letter of intent with completion of final documentation and board approvals expected in the near future.

The expansion will increase Targa Resources' fee-based percentage of operating income, said Rene Joyce, chief executive of the partnership's general partner and of Targa Resources.

The expansion should be operational in the first quarter of 2011, subject to regulatory approvals, with no disruption of existing operations during construction. Total cost for the expansion will be significantly lower than a greenfield fractionation facility because the new capacity will be integrated with existing frac-

tionation capacity, utilities, infrastructure, and footprint at Mont Belvieu.

The partnership's total capital expenditures for 2010 are budgeted for $130 million with maintenance capital expenditures accounting for 25%. Expected expenditures include the CBF fractionation expansion as well as other projects in its gas gathering and processing and NGL logistics and marketing businesses. The 2010 capital expenditure forecast does not include "growth opportunities under development that are uncertain with respect to timing and other factors," officials said. ✦

## Transportation — *Quick Takes*

### Putin launches first phase of ESPO oil line

Russian Prime Minister Vladimir Putin, eyeing the emergence of new markets in Asia-Pacific, launched the first phase of the East Siberia-Pacific Ocean (ESPO) oil pipeline.

"It is a strategic project, which enables us to enter the growing markets of the Asia-Pacific region," Putin said in a ceremony at the port of Kozmino on Russia's Pacific Coast.

At the ceremony, Putin initiated the loading of the first tanker, The Moscow University, which was set to deliver the ESPO-brand crude to Hong Kong, according to Nikolai Tokarev, president of Russia's pipeline monopoly OAO Transneft.

In October, officials at Russia's energy ministry said the new ESPO-brand crude will be light and medium-sour, superior to Urals export blend but inferior to Siberian Light (OGJ Online, Oct. 12, 2009).

Transneft last month completed the first 2,757-km stretch of the pipeline which runs from Taishet in the Irkutsk region to Skovorodino near the Chinese border.

At Skovorodino, oil is currently being loaded on to railcars for transport to Kozmino, which lies 2,100 km further east. The rail connection will be phased out in 2012 when Transneft completes the second section of the pipeline from Skovorodino to Kozmino.

The first phase of the line is capable of carrying up to 30 million tonnes/year of oil, about half of it earmarked for China via a 67-km pipeline spur from Skovorodino to the Chinese border, and the other half destined for export from Kozmino. The full ESPO line will eventually carry up to 80 million tpy of oil.

The first phase of the ESPO project cost $12.1 billion, while another $2 billion was spent on construction of the Kozmino terminal.

Transneft will spend another $10 billion to build the pipeline extension to Kozmino, which analysts said will become Russia's third largest seaborne oil outlet after Primorsk on the Baltic Sea and Novorossiisk on the Black Sea.

### Mackenzie Valley pipeline gets federal approval

Canada's federal Joint Review Panel approved the Mackenzie Valley natural gas pipeline after considering its environmental and social effects.

The JRP was created in 2001 to streamline regulatory processes around the pipeline. In 2006, it launched public hearings in the Northwest Territories with the expectation of submitting a report by mid-2007. However, the deadline was extended at least twice as the panel analyzed its findings.

The pipeline would stretch more than 750 miles to transport Mackenzie River Delta gas to Alberta and beyond. Plans call for initial capacity of 1.2 bcfd, expandable to 1.9 bcfd.

Imperial Oil Ltd. (34.4%), ConocoPhillips Canada (15.7%), Shell Canada (11.4%), and ExxonMobil Canada (5.2%) launched the project in 2000. The consortium also includes aboriginal partners, known as the Aboriginal Pipeline Group Inc., consisting of five First Nations tribes and their financial backer TransCanada Pipelines Inc., which seeks to move the gas south to US markets.

TransCanada Corp. Chief Executive Officer Hal Kvisle estimates the regulatory delays contributed $3 billion (Can.) to the project's $16.2 billion total cost. Costs include $7.8 billion for the Mackenzie Valley mainline, $3.5 billion for the gas gathering system, and $4.9 billion for anchor-field development (OGJ, Feb. 9, 2009, p. 54).

### FERC issues final EIS for proposed Bison pipeline

A proposed 301-mile natural gas pipeline in Wyoming, Montana, and North Dakota would result in some significant environmental impacts that could be mitigated to acceptable levels, the US Federal Energy Regulatory Commission said on Dec. 29.

The 30-in. Bison Pipeline Project—which a TransCanada Corp. subsidiary plans to build from the Powder River basin to a connection with the Northern Border Pipeline in Morton County, ND—would be designed to transport as much as 477 MMcfd of gas, FERC's staff said as it issued a final EIS environmental impact statement on the proposed project.

It said environmental impacts would be significantly reduced if the proposed project, which includes one compressor station, two meter stations, 19 mainline valves, and three pig launching and receiving facilities, is built and operated under applicable laws and regulations, Bison's stated mitigation plan, and additional measures recommended in the EIS.

The pipeline would be colocated with existing utility rights-of-way for about 53 miles, or 17.6% of its total route, FERC said. "The proposed route has been significantly influenced by agency recommendations to avoid sensitive wildlife habitats and vegetation types," it indicated. "Bison has been responsive to landowner requests for minor route modifications and has adopted many of these into the proposed route evaluated in this final EIS."

Bison Pipeline LLC, the TransCanada subsidiary planning to build the project, said its daily capacity could be expanded to 1 bcf, and that future development plans include expansion and extension of the pipeline into Rocky Mountain basins. It plans to begin construction in 2010 after receiving the necessary regulatory approvals, with a proposed Nov. 15 in-service date. ✦

## Letters

### 'Peak oil' a myth

In "Oil, gas supply trends point to tight spots, higher prices," Rafael Sandrea observed, "Global crude oil production has…remained flat at 71 million b/d since 2004" and went on to comment that three-digit oil prices may be "lurking on the horizon" (OGJ, Nov. 23, 2009, p. 37). Indeed, all too often projections of future oil demand and production are made without fully considering the impact of oil prices.

Over 50 years ago M. King Hubbert made an important contribution to our understanding of oil production trends saying that for any given geographical area, from an individual oil-producing region to the planet as a whole, the rate of petroleum production tends to follow a bell-shaped curve. "Peak oil" occurs when production can no longer be increased to meet demand.

He correctly predicted that production of oil from conventional sources would peak in the continental US in the period 1965-70. In fact, oil production will peak and then decline in any petroleum region, province, or single country as long as producers continue to find and produce large reserves of comparatively low-cost crude in other areas. Hubbert went on to predict a worldwide oil peak in "about half a century" but did suggest that the actions of the Organization of Petroleum Exporting Countries might flatten the global production curve, delaying the peak for perhaps 10 years.

During his era of cheap oil it is understandable that Hubbert failed to appreciate the impact that rising oil prices would have on consumption and, consequentially, on oil production. Worldwide "peak oil" is a myth stemming from the failure to recognize that a worldwide shortage of any commodity in demand results in higher prices, thereby stifling demand.

Projections of future world oil production cannot simply be linked to demand but must factor in the price of oil which triggers a complex set of interrelationships. Higher oil prices provide a strong incentive to use less energy, and demand weakens. Oil exploration accelerates, and oil reserves increase accordingly. Alternative energy sources become more attractive.

All of these responses to higher oil prices push "peak oil" further into the future. Thus, "peak oil" is like the desert mirage that recedes as one approaches it. Although rising oil prices have the feedback effect of suppressing demand and increasing petroleum reserves, this cannot go on indefinitely. But the assumption that world oil production will peak and then decline is illusory and only prevails in the absence of rising oil prices.

Today, in the context of world petroleum production and factoring in rising oil prices, "peak oil" becomes "plateau oil." There will be no abrupt peaking of world oil production followed by a decline as postulated by Hubbert. Instead, there will be an extended period when oil continues to be available at "prevailing prices." Over time, prevailing prices will fluctuate along a rising trend line, thereby prolonging "plateau oil."

The key, of course, is the impact that rising oil prices will inevitably have in discouraging oil consumption and in the development of alternative energy sources. This scenario will continue to play out over an extended period until oil production, even at elevated prices, can no longer meet demand and production gradually declines from its plateau.

Oil reserves are finite. The production of most OPEC producers has topped out; they do not have the capability of significantly increasing production. Ongoing exploration and recent discoveries of immense presalt hydrocarbon reserves in deepwater offshore areas assure continuing crude oil supplies. This will not be cheap oil but will require heavy capital investments to develop, bring on line, and maintain on production. The resulting higher crude oil prices will also improve the economics of extracting oil from tar sands and perhaps oil shale, thus adding new but costly reserves.

Clearly, the petroleum industry is not perched on the edge of oblivion. There will be no abrupt decline in production in accordance with Hubbert's "bell-shaped curve" prediction. Instead, the world faces a period of "plateau oil," a time when the demand for oil moderates in response to higher oil prices and production levels off accordingly.

This can be seen in world crude oil production levels which have remained relatively stable in the range of 72-74 million b/d since 2004 following years of growth. We have entered a new period where the rising oil prices increasingly dampen demand and where world production no longer rises annually to accommodate demand but begins to stabilize.

The challenge is to see how long this leveling-off period can be maintained. The industry's future is in the hands and minds of those geologists and engineers who can see opportunities and capitalize on them. Those who can find and produce oil in increasingly hostile environments will prosper. The earth's finite oil reserves are being gradually depleted but are by no means near exhaustion.

*Thomas Wyman*
*Palo Alto, Calif.*

## Calendar

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

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### 2010

### JANUARY

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World Future Energy Summit, Abu Dhabi, +971 2 4090 445, +971 2 444 3768 (fax), e-mail: ludoiva.sarram@reedexpo.ae, website: www.worldfutureenergysummit.com. 18-21.

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

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.

✦IADC 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.

Journally Speaking

# Is this the year?

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

Energy prognostications at this time of the year are as common as weather forecasts but often less accurate. In either case, the future becomes history more rapidly and painfully than we like, reminding us how myopic and ignorant we remain.

So it is for 2010 and its likely role in the evolution of energy sources to fuel global economic activity.

Not everyone agrees this activity and the human-derived carbon fuels that now run it are at fault for the current climate crisis—or even that such a crisis exists. This is not the place for that debate. For better or worse, consensus among world governments and scientists is pushing toward less dependence on carbon fuels.

It is possible that 2010 may stand in history a bit more brightly than other years, as a time when human efforts toward reducing carbon fuels turned a corner and thereby turned the world's climate away from disaster.

Certainly, the past year yielded examples of such efforts. And it's important for oil and gas companies that many of those efforts employed natural gas as the fuel to reduce carbon emissions.

## Skies and roads

In October, a Qatar Airways Airbus A340-600 completed the first commercial passenger flight using a fuel made from natural gas. Flying from London to Doha in 6 hr, the aircraft used Rolls-Royce Trent 556 engines.

Shell developed and produced the equal blend of synthetic gas-to-liquids kerosine and conventional oil-based kerosine. The hybrid fuel burns with lower sulfur dioxide and particulates than conventional oil-based kerosine, says the company.

Prospects for a cleaner burning fuel should hearten ship owners and operators as well as airlines, given the pressures on ocean-trading vessels to reduce emissions.

Shell says Qatar will lead the world in producing GTL kerosine starting in 2012, when the first commercial quantities from Pearl GTL are to be produced. Pearl will produce about 1 million tonnes/year, "enough to power a typical commercial airliner for half a billion kilometers," the company says.

In the US in November, a joint venture of Waste Management Inc. and Linde North America began producing a clean motor-vehicle fuel at Waste Management's Altamont landfill near Livermore, Calif.

The process employs a scaled-down version of a mixed-refrigerant LNG technology Linde installed at Statoil's Snohvit 4.1-tpy LNG plant near Hammersmith off Norway. The Altamont plant converts landfill gas—mostly methane—to more transportable LNG that is then revaporized and burned in Waste Management's collection trucks.

Built and operated by Linde, the plant can produce up to 13,000 gpd of LNG, enough to fuel 300 of Waste Management's 485 LNG waste and recycling collection vehicles in 20 California communities, says Linde. Since commissioning in September, the plant had produced 200,000 gal of LNG by November.

Steve Eckhardt, head of business development, alternative energy, for Linde, told OGJ that the process eliminates the need for methane flaring at the landfill and reduces overall carbon emissions, compared with diesel fuel, by 20-30%/year. The site continues to operate a small carbon dioxide flare, he said.

Finally, last month AT&T awarded Clean Energy Fuels Corp. a contract to convert 463 Ford E-250 vans to run on CNG. Clean Energy's subsidiary BAF Technologies Inc. will do the work for delivery in second-quarter 2010. BAF was already converting 600 vans for AT&T that were to be delivered by Jan. 1.

In December, Clean Energy said AT&T had requested BAF to obtain CNG cylinders for 463 more conversions to be completed in third-quarter 2010, "although no formal order" had been made.

In addition to its CNG capacity, Clean Energy owns and operates two LNG production plants with combined capacities to produce 260,000 gpd of LNG with capacity to expand to 340,000 gpd.

## The future?

Do projects such as these represent the future? That seems beyond question. More importantly, will they merge with a growing flood of similar projects to contribute to global reduction in greenhouse-gas emissions?

If they do and 2010 becomes the pivotal year for such a wave of cleaner fuels, OGJ editors stand in a unique and enviable position to observe this evolution. Their mission is to cover oil and gas operations in the context not only of the integrated industry segments but also the wider world.

Cleaner hydrocarbon fuels—such as those mentioned above—promise that industry has many decades of life left. ✦

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Editorial

# Health care and energy

The political shenanigans contorting reform of US health care show, yet again, the towering virtue of governmental self-restraint. To question state activism, of course, is to risk being branded as a reflexive government-hater. Yet it requires no such predisposition to see that legislation affecting all Americans has been corrupted. And it requires no such predisposition to want to shoo political vultures away from other crucial issues—such as energy.

On health care, Democratic lawmakers began with the lavish ambitions of President Barack Obama and have been contending with reality ever since. Inevitably, as details emerged about costs and consequences, public support for politically misshapen bills in the House and Senate—though not, perhaps, for reform itself—melted away. The House hurriedly and narrowly passed a bill on Nov. 7, and the Senate passed its more moderate version of the legislation on Dec. 24, with no votes to spare.

## Appalling deals

Passage required appalling political deals. The signature ugliness so far has been exemption from incremental Medicaid costs for Nebraska, granted to win support of Democratic Sen. Ben Nelson. If it survives, the constitutionally questionable bribe will make other states demand similar treatment, opening a new funding crisis.

Synthesizing a bill that both houses of Congress can pass—and that Obama can call a triumph—won't be easy. At this writing, House and Senate leaders were ready to bypass conference reconciliation of the bills and instead to meet with White House officials, in private, to configure the Senate measure for votes on the floors of both houses. More Nebraska-type deals will be needed.

Senate Majority Leader Harry Reid of Nevada sees nothing in this to regret. "I don't know if there is a senator that doesn't have something in this bill that was important to them," he said in a press conference after the Senate's payoff to the Cornhusker State. Midterm elections next November will show whether voters share Reid's cynical view of political routine.

Process notwithstanding, the product falls short of Obama's grand hopes. The legislation's centerpiece public option, a turn toward the liberal dream of nationalized health care, is dilute and might not survive. Its ballyhooed savings depend on budgetary tricks. And its flirtation with federal spending for abortion has become heavy political baggage.

Health care reform deserves better than this. But no issue can receive constructive treatment in the hands of self-righteous politicians pushing extreme reform against popular doubt. Energy certainly cannot.

After it finishes with health care, Congress very likely will turn to energy, which in the current political milieu means rejecting oil, gas, and uncleansed coal in favor of uncompetitive but politically preferred alternatives. Stated reasons to impose such reform are the twin fancies of climate-change mitigation and energy independence. Unstated reasons include the chance to dispense favors to political friends hawking economically hopeless energy.

Americans already have witnessed the mess that results when Congress applies to energy the squalid machinery at work on health care reform. The Energy Policy Act of 2005—a thornbush of political favors celebrated as a flower of bipartisanship—reinstated fuel choice by government. A sorry product of that mistake, compounded by later legislation, is a futilely aggressive biofuels program dependent on cost-blind subsidies and consumption mandates.

Now on the energy agenda is a cap-and-trade system for controlling emissions of greenhouse gases—and for enriching suppliers of carbon-free energy and traders of emission credits. Democratic leaders plan to press the issue despite public reluctance strengthened by failure of international climate-change talks last month in Copenhagen, evidence that the scientific case for managing greenhouse gas emissions has been distorted by politics, a frigid Northern Hemisphere winter, and the folly of raising energy costs in a struggling economy.

## Buying votes

Congressional crusaders for energy reform won't be dissuaded by a wary public, of course. They'll just buy the votes they need. And energy policy will become as grotesque as health care is turning out to be—and as costly.

On health care and energy, the government would serve America better by taking no action at all. ✦

# Third-quarter 2009 earnings fall sharply from 2008 peaks

*Marilyn Radler*
*Senior Editor-Economics*

*Laura Bell*
*Statistics Editor*

Lower oil and natural gas prices and depressed refining margins resulted in a sharp reduction in the third-quarter 2009 earnings of oil and gas producers and refiners.

The combined earnings of three samples of companies were down across the board for the third quarter and first 9 months of 2009. OGJ looked at groups of US-based oil and gas producers, Canadian producers and pipeline operators, and service and supply firms, each of which posted declines as compared to the year-earlier periods.

In the third quarter of 2009, the front-month futures price of oil on the New York Mercantile Exchange averaged $68.25/bbl, down from $118.22/bbl in the corresponding 2008 period. Meanwhile, gas futures on the NYMEX averaged $3.441/MMbtu in the third quarter of 2009, down from $8.987/MMbtu a year earlier.

## US operators

The sample of oil and gas producers based in the US posted a combined 74% decline in earnings in the third quarter of 2009 compared with a year earlier. For the first 9 months of the year, earnings fell 86%.

Commenting on the integrated firms' third-quarter results in light of the sharp drop in oil prices in the recent quarter as compared with the same period in 2008, the Centre for Global Energy Studies (CGES) said, "The real significance of these figures is that the companies' downstream elements failed to offset the performance of their upstream components, as one would expect to happen in integrated enterprises."

### US OIL AND GAS FIRMS' THIRD QUARTER 2009 REVENUES, EARNINGS (CONTINUED ON P. 19)

Table 1

| | Revenues | | Net income | | Revenues | | Net income | |
|---|---|---|---|---|---|---|---|---|
| | 3rd quarter | | | | Nine months | | | |
| | 2009 | 2008 | 2009 | 2008 | 2009 | 2008 | 2009 | 2008 |
| | Million $ (US) | | | | | | | |
| Anadarko Petroleum Corp. | 2,740.0 | 6,149.0 | 206.0 | 2,174.0 | 6,080.0 | 11,913.0 | (341.0) | 2,489.0 |
| Apache Corp. | 2,332.4 | 3,364.9 | 442.0 | 1,190.8 | 6,059.6 | 10,452.8 | (870.2) | 3,657.6 |
| Approach Resources Inc. | 8.8 | 22.0 | (3.1) | 19.8 | 28.8 | 65.2 | (2.9) | 23.5 |
| ATP Oil & Gas Corp. | 75.0 | 118.3 | (5.5) | 36.5 | 237.8 | 537.1 | (2.0) | 71.5 |
| Basic Earth Science Systems Inc.[1] | 3.5 | 6.1 | 0.5 | 2.3 | 2.0 | 2.7 | 0.3 | 0.9 |
| Berry Petroleum Co. | 143.5 | 227.0 | 19.0 | 53.3 | 426.6 | 596.8 | 41.0 | 145.5 |
| Bill Barrett Corp. | 148.8 | 164.4 | 0.7 | 35.3 | 432.4 | 471.1 | 37.7 | 99.1 |
| Brigham Exploration Co. | 19.9 | 47.2 | 0.5 | 15.3 | 48.9 | 97.3 | (125.5) | 18.3 |
| Cabot Oil & Gas Corp. | 207.0 | 244.8 | 38.9 | 70.0 | 645.8 | 713.3 | 112.0 | 167.6 |
| Carrizo Oil & Gas Inc. | 23.8 | 58.5 | (4.8) | 65.7 | 81.2 | 179.5 | (136.4) | 47.6 |
| Cheniere Energy Inc. | 56.3 | 4.1 | (42.5) | (71.6) | 95.5 | 6.5 | (138.3) | (261.9) |
| Chesapeake Energy Corp. | 1,811.0 | 7,491.0 | 192.0 | 3,322.0 | 5,480.0 | 8,648.0 | (5,306.0) | 1,600.0 |
| Chevron Corp. | 46,625.0 | 78,867.0 | 3,846.0 | 7,925.0 | 122,960.0 | 227,802.0 | 7,461.0 | 19,130.0 |
| Clayton Williams Energy Inc. | 62.4 | 147.0 | (13.6) | 94.6 | 180.7 | 475.1 | (73.1) | 80.9 |
| CNX Gas Corp. | 165.7 | 216.9 | 35.5 | 67.4 | 505.6 | 583.4 | 123.4 | 181.6 |
| Comstock Resources Inc. | 67.4 | 163.8 | (12.6) | 224.6 | 200.7 | 463.6 | (29.7) | 348.3 |
| ConocoPhillips | 41,305.0 | 71,373.0 | 1,503.0 | 5,188.0 | 109,215.0 | 201,278.0 | 3,641.0 | 14,766.0 |
| Continental Resouces Inc. | 170.2 | 293.6 | 34.9 | 105.3 | 418.6 | 824.7 | 21.8 | 320.5 |
| Credo Petroleum Corp.[2] | 2.8 | 5.6 | 0.3 | 3.3 | 7.3 | 14.3 | (14.2) | 4.0 |
| Delta Petroleum Corp. | 23.9 | 72.0 | (101.0) | 48.7 | 105.5 | 217.6 | (311.9) | 4.3 |
| Denbury Resources Inc. | 225.4 | 407.5 | 26.9 | 157.5 | 612.6 | 1,141.8 | (78.7) | 344.6 |
| Dorchester Minerals LP. | 10.7 | 24.5 | 4.4 | 18.6 | 29.2 | 74.7 | 12.9 | 57.2 |
| El Paso Corp. | 981.0 | 1,598.0 | 82.0 | 452.0 | 3,438.0 | 4,020.0 | (775.0) | 878.0 |
| Encore Acquisition Co. | 186.0 | 337.5 | (1.8) | 237.4 | 463.8 | 967.7 | (69.2) | 218.0 |
| EOG Resources Inc. | 1,006.8 | 3,263.9 | 4.2 | 1,556.3 | 3,026.1 | 5,493.4 | 146.2 | 1,975.0 |
| EQT Corp. | 218.4 | 297.8 | 2.9 | 96.2 | 925.8 | 1,167.6 | 101.5 | 222.1 |
| Exco Resources Inc. | 130.9 | 429.4 | 433.3 | (146.3) | 479.3 | 1,217.8 | (738.3) | (572.1) |
| ExxonMobil Corp. | 82,260.0 | 137,737.0 | 4,871.0 | 15,366.0 | 220,745.0 | 392,663.0 | 13,519.0 | 38,443.0 |
| Forest Oil Corp. | 177.1 | 474.6 | 172.3 | 429.0 | 554.1 | 1,368.7 | (968.3) | 356.3 |
| Frontier Oil Corp. | 1,200.6 | 2,198.3 | (15.1) | 72.3 | 3,148.7 | 5,150.6 | 108.2 | 177.6 |
| Gasco Energy Inc. | 4.4 | 11.2 | (2.9) | 21.0 | 14.3 | 35.1 | (50.6) | 15.8 |
| Helix Energy Solutions Group Inc. | 216.0 | 607.7 | 4.0 | 60.2 | 1,281.6 | 1,579.6 | 211.7 | 224.7 |
| Hess Corp. | 7,384.0 | 11,386.0 | 352.0 | 775.0 | 21,011.0 | 33,815.0 | 382.0 | 2,434.0 |
| HKN Inc. | 3.1 | 5.6 | (0.6) | (3.0) | 9.2 | 19.0 | (1.9) | 0.5 |
| Holly Corp. | 1,490.0 | 1,720.0 | 31.0 | 52.0 | 3,180.0 | 4,944.0 | 77.0 | 73.0 |
| Key Energy Services | 237.7 | 535.6 | (125.0) | 48.5 | 811.1 | 1,494.0 | (142.6) | 126.7 |
| LINN Energy LLC. | 90.4 | 1,091.7 | (83.7) | 1,082.6 | 194.0 | 391.1 | (232.8) | 111.1 |
| Lucas Energy Inc.[1] | 0.4 | 1.0 | (0.5) | (0.5) | 0.9 | 2.3 | (0.8) | 0.8 |
| Marathon Oil Corp. | 14,477.0 | 23,301.0 | 413.0 | 2,064.0 | 38,073.0 | 63,429.0 | 1,108.0 | 3,569.0 |
| Murphy Oil Corp. | 5,183.7 | 8,167.5 | 188.9 | 584.4 | 13,185.2 | 23,021.2 | 518.8 | 1,612.6 |

## US OIL AND GAS FIRMS' THIRD QUARTER 2009 REVENUES, EARNINGS (CONTINUED FROM P. 18)

| | Revenues | | Net income | | Revenues | | Net income | |
|---|---|---|---|---|---|---|---|---|
| | 3rd quarter | | | | Nine months | | | |
| | 2009 | 2008 | 2009 | 2008 | 2009 | 2008 | 2009 | 2008 |
| | Million $ (US) | | | | | | | |
| Newfield Exploration Co. | 375.0 | 680.0 | 78.0 | 724.0 | 924.0 | 1,887.0 | (655.0) | 416.0 |
| Noble Energy Inc. | 621.0 | 1,098.0 | 107.0 | 974.0 | 1,553.0 | 3,328.0 | (139.0) | 1,045.0 |
| Occidental Petroleum Corp. | 4,126.0 | 7,119.0 | 941.0 | 2,309.0 | 10,951.0 | 20,413.0 | 2,012.0 | 6,518.0 |
| Parallel Petroleum Corp. | 21.2 | 56.2 | (1.1) | 58.7 | 59.3 | 156.2 | (31.1) | 26.7 |
| Penn Virginia Corp. | 195.2 | 385.6 | (69.4) | 151.2 | 578.2 | 995.2 | (88.8) | 173.9 |
| Petrohawk Energy Corp. | 237.9 | 305.0 | (40.2) | 305.5 | 728.7 | 824.5 | (1,061.9) | 157.1 |
| PetroQuest Energy Inc. | 50.3 | 78.3 | 5.7 | 18.0 | 165.0 | 247.7 | (50.9) | 56.5 |
| Pioneer Natural Resources Co. | 410.1 | 602.9 | 1.8 | 3.2 | 1,247.8 | 1,816.0 | (96.5) | 294.8 |
| Plains Exploration & Production Co. | 312.2 | 719.5 | 39.3 | 493.1 | 819.4 | 2,075.3 | 88.2 | 859.6 |
| Quest Resource Inc. | 24.0 | 57.0 | (16.7) | 154.4 | 77.7 | 158.6 | (126.3) | 14.9 |
| Questar Corp. | 599.8 | 760.0 | 98.8 | 206.6 | 2,132.0 | 2,586.3 | 245.0 | 569.5 |
| Quicksilver Resources Inc. | 206.7 | 236.3 | 2.2 | (2.6) | 598.6 | 591.8 | (585.6) | 91.3 |
| Range Resources Corp. | 203.6 | 622.7 | (29.8) | 285.0 | 660.5 | 979.8 | (37.1) | 257.4 |
| Rosetta Resources Inc. | 64.5 | 130.0 | 5.7 | (99.4) | 217.5 | 412.8 | (228.4) | (32.6) |
| Southwestern Energy Co. | 502.9 | 683.0 | 118.2 | 218.4 | 1,521.3 | 1,811.5 | (193.6) | 464.3 |
| St. Mary Land & Exploration Co. | 185.8 | 324.1 | (4.4) | 87.0 | 590.2 | 1,043.1 | (100.4) | 214.4 |
| Stone Energy Corp. | 202.7 | 172.4 | 51.1 | 34.1 | 515.1 | 634.9 | (147.6) | 179.2 |
| Sunoco Inc. | 8,695.0 | 15,152.0 | (286.0) | 576.0 | 22,339.0 | 42,435.0 | (256.0) | 646.0 |
| Swift Energy Co. | 96.3 | 213.8 | 7.5 | 61.9 | 255.5 | 675.4 | (53.4) | 192.2 |
| Tesoro Petroleum Corp. | 4,742.0 | 8,682.0 | 33.0 | 259.0 | 12,203.0 | 24,175.0 | 39.0 | 181.0 |
| Toreador Resources Corp. | 5.2 | 9.6 | (12.5) | 0.2 | 13.1 | 29.5 | (20.5) | (70.1) |
| Ultra Petroleum | 155.2 | 297.6 | (8.3) | (149.0) | 453.5 | 877.0 | (546.4) | 349.2 |
| Unit Corp. | 167.4 | 375.6 | 31.4 | 92.3 | 532.6 | 1,067.1 | (84.0) | 263.5 |
| VAALCO Energy Inc. | 29.3 | 55.5 | 5.1 | 25.0 | 82.7 | 153.1 | (7.0) | 42.9 |
| Valero Energy Corp. | 19,489.0 | 35,960.0 | (629.0) | 1,152.0 | 51,238.0 | 100,545.0 | (574.0) | 2,147.0 |
| W&T Offshore Inc. | 167.0 | 289.8 | (1.3) | 78.2 | 434.9 | 1,107.3 | (238.0) | 292.6 |
| Warren Resources Inc. | 16.4 | 33.9 | 2.2 | 15.8 | 43.2 | 91.6 | (13.5) | 43.0 |
| Whiting Petroleum Corp. | 269.3 | 388.4 | 35.9 | 112.4 | 663.3 | 998.3 | (101.1) | 255.2 |
| Williams Cos. Inc. | 2,098.0 | 3,201.0 | 194.0 | 421.0 | 5,929.0 | 10,022.0 | 139.0 | 1,460.0 |
| XTO Energy Inc. | 2,288.0 | 2,125.0 | 500.0 | 521.0 | 6,722.0 | 5,734.0 | 1,482.0 | 1,561.0 |
| **Total** | **258,033.0** | **443,446.2** | **13,651.7** | **52,579.5** | **688,644.0** | **1,235,209.6** | **15,783.2** | **111,831.7** |

[1]2nd quarter. [2]3rd quarter July 31.

GGES said, "In the case of Chevron [Corp.] and ExxonMobil [Corp.], the downstream figures are dramatically worse. Usually, one would expect refinery operations to ameliorate the losses resulting from a falling oil price, due to improved margins, but in this instance downstream profits have also been squeezed, particularly in the [Organization for Economic Cooperation and Development], most likely because the steep run up in oil prices since March 2009 has not been mirrored by similar increases in oil product prices."

Chevron reported third-quarter earnings of $3.8 billion—a 52% decline from a year ago. The major's upstream earnings were down 41% from a year ago, and the company's downstream segment earnings fell to $194 million from $1.8 billion in the comparable quarter in 2008. Chemical earnings climbed to $164 million in the recent quarter from $70 million, Chevron reported.

ExxonMobil reported that its upstream earnings, excluding special items, were $4 billion, down $5.3 billion from the third quarter of 2008. Lower oil and gas realizations accounted for the majority of the decline, reducing earnings by $4.9 billion. Higher operating costs reduced earnings by $300 million.

Downstream earnings of $325 million were down $2.7 billion from the third quarter of 2008. Lower refining margins drove the decline, ExxonMobil said, reducing earnings by $2.6 billion.

## CANADIAN OIL AND GAS FIRMS' THIRD QUARTER 2009 REVENUES, EARNINGS

Table 2

| | Revenues | | Net income | | Revenues | | Net income | |
|---|---|---|---|---|---|---|---|---|
| | 3rd quarter | | | | Nine months | | | |
| | 2009 | 2008 | 2009 | 2008 | 2009 | 2008 | 2009 | 2008 |
| | Million $ (Can.) | | | | | | | |
| Canadian Natural Resources Ltd. | 2,823.0 | 4,583.0 | 658.0 | 2,835.0 | 7,759.0 | 13,662.0 | 1,125.0 | 3,215.0 |
| Crew Energy Inc. | 42.7 | 63.1 | (7.4) | 15.2 | 119.4 | 138.5 | (28.7) | 21.5 |
| Enbridge Inc. | 2,628.7 | 4,368.5 | 305.5 | 150.1 | 9,278.9 | 12,207.8 | 1,260.0 | 1,062.5 |
| EnCana Corp. | 4,163.5 | 11,638.8 | 26.8 | 3,811.7 | 13,142.9 | 25,430.7 | 1,315.3 | 5,221.3 |
| Husky Energy Inc. | 3,903.0 | 7,715.0 | 338.0 | 1,274.0 | 11,469.0 | 20,000.0 | 1,096.0 | 3,520.0 |
| Imperial Oil Ltd. | 5,965.8 | 10,207.7 | 586.8 | 1,490.1 | 16,664.9 | 27,503.4 | 1,121.1 | 3,452.3 |
| Ivanhoe Energy Inc. | 8.6 | 28.1 | (28.0) | 10.8 | 20.1 | 33.4 | (53.3) | (21.7) |
| Nexen Inc. | 1,393.0 | 2,344.0 | 122.0 | 886.0 | 3,980.0 | 6,541.0 | 277.0 | 1,896.0 |
| Suncor Energy Inc. | 5,847.0 | 56.0 | 929.0 | 815.0 | 11,121.0 | 14,198.0 | 689.0 | 2,352.0 |
| Talisman Energy Inc. | 1,536.0 | 2,661.0 | 30.0 | 1,425.0 | 4,683.0 | 7,625.0 | 548.0 | 2,317.0 |
| TransCanada Corp. | 2,253.0 | 2,137.0 | 345.0 | 390.0 | 6,760.0 | 6,287.0 | 993.0 | 1,163.0 |
| **Total** | **30,564.4** | **45,802.2** | **3,305.7** | **13,102.9** | **84,998.1** | **133,626.8** | **8,342.3** | **24,198.9** |

## SERVICE-SUPPLY COMPANIES' THIRD QUARTER 2009 REVENUES, EARNINGS

Table 3

| | Revenues — 3rd quarter | | Net income — 3rd quarter | | Revenues — Nine months | | Net income — Nine months | |
|---|---|---|---|---|---|---|---|---|
| | 2009 | 2008 | 2009 | 2008 | 2009 | 2008 | 2009 | 2008 |
| | Million $ (US) | | | | | | | |
| Baker Hughes Inc. | 2,232.0 | 3,010.0 | 55.0 | 429.0 | 7,236.0 | 8,678.0 | 337.0 | 1,203.0 |
| BJ Services Inc. | 878.2 | 1,510.6 | (9.9) | 168.1 | 4,121.9 | 5,359.1 | 149.9 | 609.4 |
| Bronco Drilling Co. Inc. | 16.2 | 73.0 | (42.7) | (0.9) | 94.4 | 205.1 | (51.5) | 11.6 |
| Cameron International Corp. | 1,231.8 | 1,504.8 | 124.9 | 163.0 | 3,758.9 | 4,324.6 | 378.2 | 434.7 |
| Diamond Offshore Drilling Inc. | 908.4 | 900.4 | 364.1 | 310.5 | 2,740.5 | 2,640.9 | 1,100.2 | 1,017.2 |
| Dril-Quip Inc. | 132.3 | 138.2 | 27.4 | 25.1 | 407.2 | 398.9 | 80.5 | 76.5 |
| Foster Wheeler Ltd. | 1,216.4 | 1,718.4 | 96.0 | 128.8 | 3,789.7 | 5,215.1 | 297.7 | 428.6 |
| Gulfmark Offshore Inc. | 90.8 | 124.6 | 12.7 | 45.4 | 304.2 | 289.9 | 61.8 | 124.5 |
| Halliburton Co. | 3,588.0 | 4,853.0 | 266.0 | 675.0 | 10,989.0 | 13,369.0 | 911.0 | 1,772.0 |
| Hornbeck Offshore Services Inc. | 90.1 | 109.1 | 13.8 | 33.3 | 297.6 | 311.1 | 41.1 | 81.2 |
| Nabors Industries Ltd. | 803.6 | 1,440.3 | 29.5 | 194.0 | 2,824.3 | 4,065.3 | (38.3) | 582.4 |
| Noble Corp. | 905.6 | 862.0 | 426.1 | 382.5 | 2,770.7 | 2,536.3 | 1,232.2 | 1,142.4 |
| Oceaneering International Inc. | 484.0 | 515.8 | 49.8 | 55.0 | 1,369.8 | 1,451.7 | 142.3 | 148.4 |
| Parker Drilling Co. | 181.4 | 227.5 | 7.1 | 17.8 | 577.1 | 617.5 | 13.6 | 62.9 |
| Patterson-UTI Energy Inc. | 176.2 | 608.5 | (18.6) | 108.7 | 633.0 | 1,639.4 | (20.1) | 267.6 |
| Pioneer Drilling Co. | 74.4 | 174.2 | (9.2) | 24.2 | 244.3 | 440.2 | (14.8) | 55.2 |
| Pride International Inc. | 386.1 | 463.3 | 35.6 | 189.1 | 1,277.4 | 1,212.4 | 318.6 | 616.4 |
| Rowan Cos. Inc. | 393.4 | 527.1 | 78.4 | 114.1 | 1,370.4 | 1,599.7 | 306.7 | 333.3 |
| RPC Inc. | 132.2 | 237.2 | (10.4) | 25.8 | 435.4 | 649.1 | (17.5) | 63.0 |
| Schlumberger Ltd. | 5,430.0 | 7,259.0 | 789.0 | 1,526.0 | 16,958.0 | 20,295.0 | 2,338.0 | 4,285.0 |
| Smith International Inc. | 1,879.0 | 2,849.3 | 43.7 | 282.9 | 6,234.8 | 7,714.5 | 251.2 | 781.7 |
| Weatherford International | 2,149.9 | 2,540.8 | 83.0 | 383.0 | 6,400.9 | 6,965.9 | 307.2 | 1,044.0 |
| **Total** | **23,380.0** | **31,647.1** | **2,411.3** | **5,280.4** | **74,835.5** | **89,978.7** | **8,125.0** | **15,141.0** |

Petroleum product sales of 6.3 million b/d were 387,000 b/d lower than last year's third quarter, mainly reflecting asset sales and lower demand.

Stone Energy Corp., based in Lafayette, La., is the only company in the sample of US operators to report an increase in its third-quarter profits from its year-earlier positive earnings. But for the first 9 months of 2009, the company incurred a loss largely due to a $340 million writedown in its oil and gas properties.

### Refiners

Weak product demand and relatively strong crude prices hurt the third-quarter results of US refiners via meager refining margins.

With revenues of $19.49 billion, Valero Energy Corp. posted a $629 million loss in the 2009 third quarter, compared with $1.15 billion in earnings a year earlier.

Holly Corp. reported that its net income for the third quarter of 2009 decreased to $31 million from $52 million in the same period of 2008, mostly due to industry-wide reduced refinery gross margins relative to the high levels in the 2008 third quarter.

While comparing the 2009 third quarter to the prior year's third quarter, Holly said the impact of the overall margin decreases was somewhat mitigated by substantial production gains. Overall refinery gross margins for the recent quarter were $8.27/bbl, compared to $15.17/bbl for the third quarter of 2008.

For the 3 months ended Sept. 30, 2009, Holly's refinery production levels increased 79% from a year earlier due to production from its newly acquired Tulsa refinery and production gains resulting from the recent Navajo and Woods Cross refinery capacity expansions. Scheduled downtime for major maintenance at the Navajo refinery in the first quarter of 2009 and at the Woods Cross refinery in the third quarter of 2008 also impacted production gains, the company reported.

### Canadian companies

A sample of 11 companies with headquarters in Canada combined for a 75% decrease in net income from the 2008 third quarter.

Most of these firms reported lower results for the quarter and for the first 9 months of the year, but Suncor Energy Inc. posted an increase in third-quarter earnings. And EnCana Corp. recorded increased profits for the quarter and the first 9 months.

Suncor's earnings reflect the first quarterly results since its merger with Petro-Canada. As a result of the merger, Suncor holds a 12% share in the Syncrude oil sands joint venture located near Suncor's existing oil sands operations in Fort McMurray, Alta.

EnCana reported that its financial performance was significantly enhanced by commodity-price hedges, which contributed $913 million in realized after-tax gains to cash flow in the third quarter.

Canadian Natural Resources Ltd. posted a 77% decline in third-quarter earnings from 2008 and a 65% drop in earnings for the first 9 months of 2009 as compared to a year earlier. The company reported that its total oil and natural gas liquids production for the recent quarter was up 17% from year-earlier volumes, reflecting production increases from Horizon oil sands mining and upgrading, as well as from Baobab and Olowi fields off West Africa, offset by the temporary curtailment of steaming and production at Primrose East and planned maintenance in the North Sea.

Canadian Natural Resources' gas production for the 2009 third quarter was down 13% from a year earlier as expected due to the company's realloca-

tion of capital towards higher-return oil projects.

### Service, supply firms

A sample of 22 oil field service and supply companies posted a collective 54% decline in third-quarter 2009 earnings on a 26% decline in revenues as a result of the worldwide slowdown in drilling activity.

The group recorded a collective 46% drop in earnings in the first 9 months of 2009 as compared with a year earlier, as revenues fell 17%. Five of the companies posted a loss in the recent quarter compared to just one in the third quarter of 2008.

Chad C. Deaton, Baker Hughes Inc. chairman, president, and chief executive officer, said the company's third-quarter North America operating margins rebounded from their second-quarter 2009 lows, and aggressive cost cutting in the first half of 2009 enabled it to absorb additional price decreases and improve profitability on modest activity increases. But Deaton added that international results were disappointing with revenue less than expected and price discounting greater than expected during the recent quarter.

Weatherford International Ltd. announced that its third-quarter revenues were $2.15 billion, or 15% lower than the same 2008 period, against a backdrop of a 39% decline in the global rig count.

North America was primarily responsible for Weatherford's earnings decline, the company said, with revenues decreasing 47% against a 52% decline in the rig count, while international revenues were up 12% against an 11% decrease in the international rig count. ✦

# Keep OCS sale on schedule, Va. governor-elect tells Salazar

**Nick Snow**
*Washington Editor*

Robert F. McDonnell, who will become Virginia's governor this month, has asked US Secretary of the Interior Ken Salazar "to do everything in your power" to ensure that a planned 2011 sale of federal oil and gas leases off the state's coast stays on schedule.

"Offshore energy exploration and production will be a priority in my administration," said the governor-elect in a Dec. 23 letter to Salazar. "I would like to work with you and [US President Barack Obama] to make Virginia an international leader in offshore energy exploration and production on the Atlantic coast. It is important for both our commonwealth and our country."

A spokeswoman for Salazar said on Dec. 29 that McDonnell's letter is being reviewed. "In regards to the specific question on timing, [the secretary] is reviewing the proposed Virginia lease and at this point he hasn't made any decisions," she said in an e-mailed response to an OGJ inquiry.

McDonnell, a Republican, is due to be inaugurated Virginia's governor on Jan. 16, 2010, succeeding Timothy M. Kaine, a Democrat, who asked Salazar on Feb. 19, 2009, to postpone the lease sale. Although he signed legislation creating a comprehensive Virginia energy strategy with offshore resource development into law, Kaine said, "Our policies do not support exploration for oil or production of gas or oil, which would be allowed under Lease Sale 220."

McDonnell, who included jobs and revenue from offshore resource development in his election campaign, noted in his letter to Salazar that more than 15 months have passed since Congress let offshore leasing moratoriums expire and then-US President George W. Bush rescinded his predecessors' presidential withdrawals. This cleared the way for Virginia to become the first East Coast state with offshore oil and gas activity in 2011, the governor-elect said.

"Virginia is eager to get started," he continued. "Nearly a year ago, the public comment period for the potential lease sale off Virginia

WATCHING GOVERNMENT

Nick Snow, Washington Editor

Blog at www.ogjonline.com

# 2009's reasons to chuckle

Before the season to be jolly completely slips away, let's look back at some of 2009's amusing moments in government and issue this column's annual "Watchy" awards. Many of us will return all too soon to tackling several very serious issues, but that doesn't mean we can't take time out for some chuckles now.

From the outset of 2009, it looked as if US Rep. Jim Costa (D-Calif.) would easily win the year's Apt Comparison Watchy with his frequent references to using "every tool in our energy toolbox" as he chaired actual fact-finding hearings of the House Natural Resources Committee's Energy and Mineral Resources Subcommittee.

But Costa was edged out of the Apt Comparison Watchy for 2009 on Nov. 10 when Margo Thorning, senior vice-president and chief economist at the American Council for Capital Formation, told the US Senate Finance Committee that having watched the cap-and-trade debate for 15 years, she was reminded of someone trying to lead a horse across a cattle guard.

## A vivid image

Thorning observed: "You have the rider pulling on the reins from the other side, and the business community and others digging in their heels to keep from being led across." The image was so vivid that one senator said he planned to start using it himself.

A Very-Well-Put Watchy goes to Colorado Gov. Bill Ritter Jr., who in a July 9 address in Denver disclosed that he asked US Rep. Diana DeGette (D-Colo.), the primary sponsor of legislation to federally regulate hydraulic fracturing, to seek a comprehensive study "instead of jumping directly to a new and potentially intrusive regulatory system."

A DeGette spokesman confirmed that the two spoke, that she agreed that a study was needed, and that she didn't plan to back off on her bill. We're betting that Ritter's name won't be on DeGette's dance card when Colorado's Democrats hold their next spring formal.

## 'Clunkers' complaint

Next is a Sauce-for-the-Gander Watchy for the Renewable Fuels Association after its president, Bob Dineen, complained on July 30 about the House's voting to transfer $2 billion from the US Department of Energy's renewable energy loan guarantee program to keep the "Cash for Clunkers" program going.

Conceding that there are benefits in the federal program paying people to trade in less fuel efficient cars for newer models, Dineen added: "These new cars should also be running on renewable fuels like ethanol in order to benefit both the changing climate and the domestic economy." We didn't need to be reminded, since we knew how far the US fuel ethanol industry would have gotten without government help.

Last but not least, the first-ever Belle of the Ball Watchy goes to natural gas, which became everyone's fuel-of-choice as the potential for abundant domestic supplies from shale formations became obvious. It's a big contrast to other fossil fuels, which some politicians treat like wallflowers. ✦

ended. Unfortunately, it appears that virtually no progress has been made at the federal level to get this process rolling."

## Took first step

The US Minerals Management Service took the first step toward holding Outer Continental Shelf Lease Sale 220 off Virginia on Nov. 13 when it published a call for information and interest/nominations and a notice of intent to prepare an environmental impact statement covering about 2.9 million acres some 50 miles off the state's coast.

The proposed leasing area may contain 130 million bbl of oil and 1.14 tcf of natural gas, MMS said. It is accepting comments on the call and the EIS notice through Jan. 13.

McDonnell asked that Virginia remain in the current 5-year federal OCS plan, and that the federal administrative process for the 2011 lease sale move forward immediately. "Any effort to remove or delay Virginia's participation in the lease sale would significantly hamper our efforts to create jobs, eliminate much-needed new revenue, and undermine support for President Obama's stated commitment to make the United States more energy secure," he warned.

The chief executives of two leading oil and gas industry associations separately applauded McDonnell's action on Dec. 29. "It is time for the Interior Department to take action to allow expeditious leasing of federal oil and gas resources off Virginia's coast. The [governor-elect], and the majority of Virginians, want such action," said American Petroleum Institute Pres. Jack N. Gerard.

Virginia could become the first area on the Atlantic OCS to be federally leased in nearly 30 years, noted National Ocean Industries Association Pres. Tom Fry. "America cannot have increased energy supply without increased access, and new areas of the OCS cannot be leased unless they are included in 5-year leasing plans and sales are scheduled," he said, adding, "None of this can happen unless the

necessary environmental reviews are conducted, and we urge [DOI] to begin this important work as soon as possible." ✦

# EIA 2010 forecast sees falling US oil imports

**Nick Snow**
*Washington Editor*

A significant increase in US biofuels production could make the nation less dependent on imported oil, the US Energy Information Administration said in an early release of its 2010 Annual Energy Outlook reference case.

The scenario, which EIA released on Dec. 14, did not include potential impacts of carbon dioxide emissions restrictions and other possible future policies. It also only included technologies that are commercially available or can reasonably be expected to become commercial in the next decade. EIA nevertheless forecast declining US reliance on imported liquid fuels.

"Our projections show that existing policies that stress energy efficiency and alternative fuels, together with higher energy prices, curb energy consumption growth and shift the energy mix toward renewable fuels," EIA Administrator Richard G. Newell said. "However, assuming no new policies, fossil fuels would still provide about 78% of all the energy used in 2035."

The reference case forecast a 16% increase in total US liquid fuels consumption, including both fossil liquids and biofuels, to an average 22 million b/d in 2035 from 19 million b/d in 2008. "Biofuels account for all of the growth, as consumption of petroleum-based liquids is essentially flat," EIA said, adding, "As a result, reliance on imported oil declines significantly over the next 25 years."

The scenario also envisioned US oil production climbing 20% from 5 million b/d in 2008 to more than 6 million b/d in 2027—where EIA expects it to remain through 2035. It cited more onshore production resulting from wider use of enhanced oil recovery and increased production offshore as primary causes.

It forecast that total US energy consumption would grow by 14% from 2008 to 2035 as fossil fuels' share declines from 84% to 78%. "Recent federal and state policies, and rising energy prices could moderate growth in energy consumption and shift it to renew-

able fuels," EIA indicated.

The forecast reflected changed assumptions at EIA about the domestic oil and gas resource base, including an updated characterization of natural gas shales to reflect evolving assessments and technology.

It predicted that shale gas and Alaska production would offset other US gas supply declines to meet growing demand and reduce import needs through 2035. The result under this reference case was that total US gas production would grow 13% from 20.6 tcf in 2008 to 23.2 tcf in 2035, including a 6 tcf shale gas contribution.

EIA also predicted that gas prices at the wellhead will begin to recover from their 2008-09 trough and gradually rise to around $8/Mcf by 2035. It expects oil costs to rise steadily and will include a wide range of prices when it releases its full 2010 Annual Energy Outlook early this year. ✦

# House move promised against EPA's GHG finding

**Nick Snow**
*Washington Editor*

A US House Republican energy leader said he plans to introduce a resolution expressing disapproval of the Environmental Protection Agency's greenhouse gas emission (GHG) endangerment finding.

"EPA's endangerment finding plainly was intended to make the president's policies look good in advance of his visit to the Copenhagen global warming conference, not to advance any public good in America," said Joe Barton (Tex.), the Energy and Commerce Committee's ranking minority member. "But it also has policy implications that

## NPRA suggests alternatives to EPA's proposed GHG regulations

**Nick Snow**
*Washington Editor*

The National Petrochemical & Refiners Association recommended three alternatives on Dec. 23 as it submitted comments to the US Environmental Protection Agency opposing EPA's proposed greenhouse gas regulations under the Clean Air Act.

"The path to [GHG regulation under the CAA] that EPA has chosen is difficult, uncertain, and unnecessarily risky in these troubling economic times. The Tailoring Rule that is the subject of these comments is doomed to failure," NPRA said.

"Fortunately, the timing, manner, and content of EPA's overall approach to regulating GHGs under the CAA [are] firmly with the agency's control," NPRA said, adding, "Our comments outline ways in which EPA could proceed down alternative pathways that provide more sensible regulation without [resorting] to extraordinary administrative law principles that cannot be applied in these circumstances."

EPA issued the proposed rulemaking, "Prevention of Significant Deterioration and Title V Greenhouse Gas Tailoring Rule," on Oct. 27. It would require facilities emitting more than 25,000 tons/year of GHGs to obtain permits demonstrating that they are using best practices and technologies to minimize GHG emissions, according to information at the agency's web site.

It also proposes new GHG emissions thresholds defining when CAA permits under the New Source Review and Title V operating permits programs would be required for new or existing industrial plants. The proposed thresholds would "tailor" the requirement so it would not apply to small farms, restaurants, and other small businesses while covering refineries, power plants, and other large installations that EPA said are responsible for nearly 70% of the nation's total GHG emissions from stationary sources.

### Endangerment finding

The proposed rulemaking's significance increased with EPA's Dec. 7 announcement that it had determined that six GHGs pose significant dangers to human health and are potentially subject to CAA regulation.

NPRA recommended that EPA interpret that the CAA's PSD provision be triggered only after a National Ambient Air Quality Standard is established for a pollutant. "Under this interpretation, which is fully consistent with the CAA and EPA's regulations, the [Section] 202 Rule would result in GHGs only being subject to Best Available Control Technology requirements if a source otherwise triggers PSD for a criteria pollutant," it said.

The agency also could delay issuing the 202 rule until it and the states are better prepared to address GHG permitting, NPRA continued. "EPA could use this time to pursue streamlining of PSD and Title V requirements on an aggressive time scale to avert the large economic impacts that the agency indicates Congress did not intend," it said.

NPRA said EPA also could specify that under the 202 rule, the date when GHGs are considered subject to "actual control" would be when vehicle manufacturers must comply with an attribute-based standard for the 2012 model year. "This would avoid an imminent PSD trigger for stationary sources and give states and EPA more time to address GHG permitting issues," the association said in its comments.

threaten serious damage to the economy for generations to come."

He said the finding "accurately reflects the thousands of candid, outrageous e-mails that EPA's allies in the global warming community sent to each other by demonstrating that public relations priorities, rather than straightforward science, are driving US policymaking on global warming, and nowhere did any demonstrate a whiff of concern for who pays the bill or how they earn their living."

House GOP leaders said three committees' ranking minority members, Darrell E. Issa (Calif.) of Oversight and Government Reform; F. James Sensenbrunner (Wis.) of Energy Independence and Global Warming; and LaMar S. Smith (Tex.) of Judiciary, back Barton's effort, as does Ralph M. Hall (Tex.), who also is on the Energy and Commerce Committee.

Barton's announcement came 3 days after Sen. Lisa Murkowski (R-Alas.), the Energy and Commerce Committee's ranking minority member, said she planned to file a disapproval resolution aimed at keeping EPA from regulating GHGs under the Clean Air Act as a consequence of its Dec. 7 endangerment finding (OGJ Online, Dec. 16, 2009).

## Boxer responds

Senate Environment and Public Works Committee Chairwoman Barbara Boxer (D-Calif.) expressed her own disapproval of the Republicans' plans.

"Debating over policy about unchecked global warming is fair, but repealing an endangerment finding based upon years of work by America's leading scientists and public health experts is radical in the extreme," she said, adding, "I am urging my colleagues to distance themselves from these dissenters and not to interfere with the independent work of scientists and public health experts from both the Bush and Obama administrations."

EPA issued its finding after conducting a study in response to a 2007 US Supreme Court ruling that GHGs fit within the Clean Air Act's definition of pollutants. The finding does not impose any emissions reduction requirements by itself but does allow the agency to finalize GHG standards for new light-duty vehicles as part of a joint rulemaking earlier this year with the US Department of Transportation.

Barton suggested the finding would do much more. "Everyone also understands that [it] is supposed to prod Congress into resuscitating cap-and-trade legislation that is dying from overexposure to public scrutiny," he said.

He said the policy envisioned by the Obama administration would take "money out of the pockets of those lucky to have jobs so that radical environmentalists can wage a war against nature."

## GOP leaders applaud

House GOP leaders applauded the four lawmakers' plans. "Republicans stand united against this EPA ruling because it is a job-killer," Minority Leader John Boehner (Ohio) said.

"The recent EPA decision to treat the air we exhale as a dangerous pollutant will hurt families and small businesses," added Republican Conference Leader Mike Pence (Ohio).

But Boxer said efforts to stop EPA are misguided. "Republicans are using scare tactics and false economic arguments to support this effort," she said. ✦

# House members ask DOI for care in polar bear action

**Nick Snow**
*Washington Editor*

Thirteen US House members asked Secretary of the Interior Ken Salazar to consider economic and energy security consequences of adopting a US Fish and Wildlife Service recommendation proposal to place critical habitat for polar bears under the Endangered Species Act (ESA).

"We urge the FWS to rely on the best available peer-reviewed science when determining the appropriate critical habitat for the polar bear, especially if such habitat designation could adversely impact activities essential to our nation's economy and severely impact US industry and consumers," Rep. Don Young (R-Alas.) and 12 other House members said in their Dec. 22 letter.

"As was the listing itself, the habitat designation is critical to Alaska, the nation, and the international community," the 12 Republicans and one Democrat, Dan Boren (Okla.), continued.

Their letter came as a 60-day comment period ended for the Interior agency's Oct. 22 proposal to put about 200,541 sq miles of barrier islands, sea ice, and terrestrial denning habitat under the ESA. The proposed critical habitat includes areas of oil and gas activity, FWS noted.

The polar bear was listed as a threatened species under the ESA in May 2008 due to loss of sea habitat from melting polar ice. FWS said other threats evaluated at that time included impacts from human activities such as oil and gas exploration and production, subsistence harvests, shipping, and tourism.

It said the ESA requires the US Interior secretary, to the maximum extent possible, to designate critical habitat at the time a species is listed. FWS determined, however, that more time would be needed to conduct a thorough evaluation and peer review of a potential critical habitat designation and consequently did not publish a proposed designation with the final listing rule.

## Mid-2010 deadline

As part of a subsequent legal settle-

## Alaska officials file objections to polar bear habitat proposal

Nick Snow
*Washington Editor*

The State of Alaska filed strong objections to the US Fish and Wildlife Service's proposal to designate 200,541 sq miles in the state and adjacent ocean as critical habitat for polar bears.

The area would be larger than California and cover nearly the entire US range of polar bears, they noted.

"By law, a critical habitat designation should balance the concern for the species with consideration for economic impacts," said Alaska Attorney General Dan Sullivan. "That has not been done here. Moreover, the designation should cover only those areas actually necessary for special protection. Instead, the service has included areas lacking any special features and has ignored the protections already in place for polar bears under the Marine Mammal Protection Act."

Denby Lloyd, commissioner of the Alaska Department of Fish and Game, said, "Proposing the entire range of a species as critical habitat is inconsistent with the facts and with the service's own previous decisions on Alaska species such as the Steller's eider and Northern sea otter."

Sullivan also emphasized the importance of the state's role in providing formal comments on the designation of critical habitat and urged the federal agency "to take into account the state's very legitimate concerns." Alaska's state government will continue to monitor how FWS implements critical habitat for polar bears, he indicated.

The proposed designation is overly broad and a job-killer for Alaskans and other Americans, Gov. Sean Parnell maintained.

"While [FWS] has yet to provide an economic study of the impacts from its proposed decision, major oil and gas exploration and development efforts will, at best, be delayed by this designation," he said. "The service's overly broad critical habitat designation simply means more projects must jump through more regulatory hoops. Neither Alaska nor our nation can afford these job-killing moves, nor can we remain so dependent on other nations for our energy supplies."

ment with several environmental organizations, DOI agreed to publish a final rule designating critical habitat for the polar bear no later than June 30, 2010, FWS said. The Oct. 22 proposal was a step toward fulfilling that agreement, it indicated.

"The FWS acknowledges that the sum of documented impacts from activities, such as oil and gas development and shipping, have been minimal on the polar bear population," the lawmakers said, adding, "Data provided by monitoring and reporting programs in the Beaufort and Chukchi Seas, as required under the more restrictive Marine Mammal Protection Act incidental take authorizations for oil and gas activities, have shown that oil and gas activities can coexist with polar bears through the use of appropriate mitigation measures."

They added they support FWS efforts to assure polar bears and other wildlife thrive and recognize the polar bear "has become iconic in the climate change debate, and as such, any policy affecting them quickly becomes one infused with emotion and attention from certain special interest groups."

They said, "We strongly urge the FWS to use sound science and incorporate any applicable technological and scientific advances when determining the most effective way to proceed forward with the polar bear proposed critical habitat. As climate modeling and scientific technology continue to develop, we trust that the FWS will reevaluate any determinations."

The letter produced an immediate response from Consumer Energy Alliance Pres. David Holt. "Balancing the safe, responsible development of America's abundant natural resources while ensuring its critical habitat is preserved is something we can do, must do, and in fact have done for many years," he said.

"Unfortunately, the [FWS] proposal, as currently written, seeks to lock up enormous resources of American energy [which] could create thousands of good-paying jobs and help stabilize energy prices for struggling consumers when they need it most," Holt observed. ✦

## IOGA of New York urges governor to remain committed to Marcellus shale

Eric Watkins
*Oil Diplomacy Editor*

The Independent Oil & Gas Association of New York has urged Gov. David Paterson to remain committed to his draft State Energy Plan, which supports the expansion of natural gas exploration in the Marcellus shale.

"We believe that New York cannot afford to turn away or postpone the tremendous opportunity for economic resurgence and a clean energy supply presented by the Marcellus shale," IOGA said, along with a coalition of business and economic development groups.

The letter was delivered as New

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WATCHING THE WORLD

Eric Watkins, Oil Diplomacy Editor

Blog at www.ogjonline.com

# Investors target Sudan

If India and China thought their oil and gas industries would have favored status around the world, they were mistaken. That was underlined when investment fund TIAA-CREF sold investments from Chinese and Indian companies operating in Sudan's upstream.

"Our decision to sell shares in these companies culminated a 3-year effort to encourage them to end their ties to Sudan or attempt to end suffering there," said Roger W. Ferguson Jr., TIAA-CREF chief executive.

"We have not divested from Petronas, which has acknowledged our concerns and engaged in dialogue about how it might address them," Ferguson said, giving executives in Kuala Lumpur a reprieve.

TIAA-CREF reminded investors of plans it announced last March to intensify pressure on five companies that maintain business relations with the government of Sudan to "cease those relations or attempt to ease suffering and end genocide in Darfur."

## Meetings sought

TIAA-CREF said it would seek meetings with target companies—PetroChina, CNPC Hong Kong, Oil & Natural Gas Corp., Sinopec, and Petronas—and would divest by yearend 2009 from those that refused to acknowledge the genocide and engage in a productive dialogue about how to confront it.

In particular, TIAA-CREF expressed the belief that members of society have a moral responsibility to confront genocide and crimes against humanity, and said it was "publicly asking companies operating in Sudan to help alleviate the suffering of its people."

With that in mind, TIAA-CREF said it would:

- Seek meetings between TIAA-CREF executives and executives of target companies to encourage them to take positive and meaningful humanitarian steps and attempt to end genocide.
- Publicly endorse the UN-sponsored Principles for Responsible Investment. Signatories include institutional investors with a combined $2.5 trillion in assets under management with whom "we will join to urge companies operating in Sudan to confront human rights abuses."
- Call upon other financial services companies to "follow our lead and increase pressure on target companies."

## Divestment threat

"We will evaluate progress within 9 months and, if we still hold positions in these companies at that time, we will divest their shares from all accounts if milestones showing significant progress are not achieved, and announce that decision publicly," TIAA-CREF said.

TIAA-CREF said, "If [the target companies] agree to engage in a productive dialogue, we will continue to hold their shares as long as progress continues and as long as portfolio management concerns warrant."

While TIAA-CREF met with each of the companies in the ensuing months, it said there was insufficient progress to warrant continued dialogue with PetroChina, CNPC Hong Kong, ONGC, and Sinopec.

The result? TIAA-CREF kept its word and sold its holdings in those companies across all funds and accounts as of Dec. 31, 2009. ✦

York's Department of Environmental Conservation nears the end of a 2-year process to develop a draft Supplemental Generic Environmental Impact Statement (SGEIS)—the set of regulatory standards that guide natural gas exploration and extraction in the state.

The draft SGEIS proposes stringent new regulatory standards to monitor gas exploration in the Marcellus shale.

"The extremely stringent requirements proposed by the SGEIS provide the public with the necessary oversight that natural gas exploration and extraction will be conducted in an environmentally safe manner," the letter said.

The letter followed earlier reports that New York City urged the state to ban natural gas drilling in its watershed, becoming the most powerful opponent to date of a process that critics say is poisoning drinking water.

Putting the city at odds with the gas industry, Steven Lawitts, the city's top environmental official, said hydraulic fracturing or fracing techniques used to produce the gas represented "unacceptable threats to the unfiltered fresh water supply of 9 million New Yorkers."

According to Marc LaVorgna, a spokesman for New York Mayor Michael Bloomberg, "Based on all the facts, the risks are too great and drilling simply cannot be permitted in the watershed."

At that time, Gov. Paterson, who will play a major role in deciding the future of drilling next year as he slashes state services to close a $3.2 billion budget deficit, said he was still listening to "all points of view."

Paterson told reporters, "We've actually extended the public comment period because of the grave concern that so many who we trust, like the mayor, are raising in this issue."

Earlier this year, New York proposed new rules that would allow drilling for natural gas in the Marcellus shale formation. New York City is asking the state to exclude the watershed from the areas that can be drilled.

## Spectra expansion

The IOGA letter coincided with

reports that Spectra Energy Corp. has signed binding precedent agreements with Chesapeake Energy Corp., Consolidated Edison, and Statoil Natural Gas.

The agreement calls for an expansion of Spectra's existing Texas Eastern Transmission and Algonquin Gas Transmission pipeline systems to deliver "new, critically needed" gas supplies to the New Jersey and New York area.

The proposed pipeline would be capable of transporting up to 800 MMcfd of gas supplies to the region and is targeted to be in service in fourth quarter 2013.

Aspects of the proposed expansion include:

- Construction of a new, 16-mile pipeline extension that connects Texas Eastern's existing pipeline in Staten Island, NY, to a new interconnect with ConEd in New York.
- Replacement of 5 miles of existing pipeline in New Jersey and New York with larger diameter pipeline.
- Additional facilities on Spectra Energy's existing Algonquin pipeline system.

Chesapeake Chief Executive Officer Aubrey K. McClendon said his firm's "industry-leading position in the Marcellus shale provides the perfect supply source to help energy consumers in the New York City area reduce their dependence on expensive imported oil and carbon-heavy coal." ✦

# Mexico's natural gas imports to soar by 133%

Mexico's demand for natural gas will continue to outstrip production, with imports to cover the country's requirements set to rise by 133% during 2009-24, according to government figures.

Mexico's El Financero newspaper, citing figures supplied by the Secretaria de Energia (Sener), said the country's imports of gas will grow to 3.02 bcfd from the current 1.293 bcfd.

According to the report entitled Outlook of the Natural Gas Market, Mexico's gas production grew 4.2% over the last decade, while the demand growth stood at 5.9%, representing a 1.7% shortfall to be filled by imports.

El Financero said this trend will be maintained until 2024, when the country's production will reach 8.668 bcfd, equivalent to an average growth rate of 2.3%/year. But it said that "demand will surpass 11 bcfd, which implies an annual growth rate of 2.8%."

The Sener report said Mexico's demand growth has been met partly with increasing gas imports, first from the US and then from other countries, with the establishment of LNG terminals in Altamira and Ensenada, in 2006 and 2008, respectively. It said the imports represented 3.7% of national demand in 1998, but 18.6% in 2008.

The Sener report explains increased demand for gas as coming from the launch of combined cycle plants to generate electricity, the moderate substitution of fuel oil in the electric and industrial sectors, greater requirements for the oil industry, and to a lesser degree, the use of gas that distributors have achieved in the residential and services sector.

The report states gas production will come from onshore and offshore fields.

It said production in Burgos is fundamental and will peak at 1.58 bcfd. However, its production will begin to decline in 2015, "registering volumes below 1 bcfd toward 2024."

Chicontepec field will reach its maximum production in 2023-24 when it will average 611 MMcfd. Its contribution to national gas production will surpass that of Burgos starting in 2020.

Regarding deepwater projects, gas production will begin with the Lakach project in 2013, with initial production of 23 MMcfd.

The report acknowledges deepwater production is important, but "given the environmental conditions where these projects are carried out, it is considered that only 50% of...production is usable and the other half is reinjected." ✦

# Umiat: a North Slope giant primed for oil development

*James S. Watt*
*Allen Huckabay*
*Mark R. Landt*
*Renaissance Alaska LLC*
*Houston*

Alaska's giant Umiat oil field, discovered in the late 1940s by the US Navy in search of new sources of oil after World War II, remains undeveloped to this day.

The field is untapped in spite of delineation by 12 legacy wells; the shallow depth of its consolidated, productive reservoirs; sweet, light 37° gravity oil; and over 1 billion bbl of original oil in place.

To this point, remoteness (92 miles from the Trans Alaska Pipeline System (TAPS)), permafrost, and low reservoir energy have been the main development challenges. All of these challenges have been addressed through modern technological advancements such as multilateral horizontal drilling, electric submersible pumps, and cold gas injection for pressure maintenance that bring Umiat development closer to fruition.

Remoteness and environment is still a key challenge; however, the State of Alaska announced in December 2009 an aggressive plan to build an all-season gravel road from TAPS to the Umiat area that would substantially reduce the threshold for commerciality.

Geologic mapping by the US Navy in 1944 first defined the Umiat anticline with its associated oil seeps.

The Navy and the US Geological Survey conducted an extensive mapping and drilling program in this remote part of northern Alaska from 1944 to 1953. In particular, between 1946 and 1952, a total of 11 wells were drilled on the Umiat anticline. Eight wells have an oil column and two wells had long-term tests.

Much of this early drilling was experimental utilizing a variety of types of drilling rigs as well as different types of drilling fluids. A deeper test, the Seabee-1, was drilled in 1978 and tested gas from a deeper horizon.

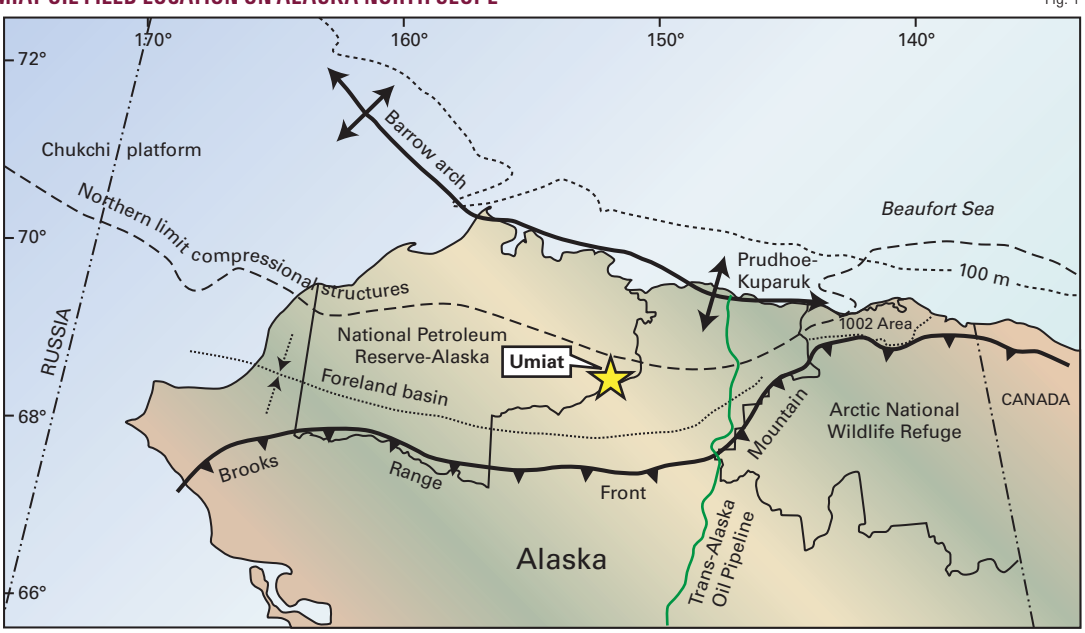
The Navy established an air base at Umiat and used the light oil for fuel. So unlike other Arctic pending developments, Umiat has an established footprint including an airstrip, lodging, warehouse storage, etc.

Renaissance Alaska LLC, through Renaissance Umiat LLC, controls 19,358 acres over the undeveloped Umiat oil field and a portion of the undeveloped Gubik gas field 12 miles east-northeast. Arctic Falcon Exploration LLC is a minority owner of Renaissance Umiat LLC.

Since acquiring the acreage in 2006 and 2007, Renaissance has derisked the project through extensive geoscience studies and an 86 sq mile 3D seismic survey shot in 2008. Re-

## UMIAT OIL FIELD LOCATION ON ALASKA NORTH SLOPE

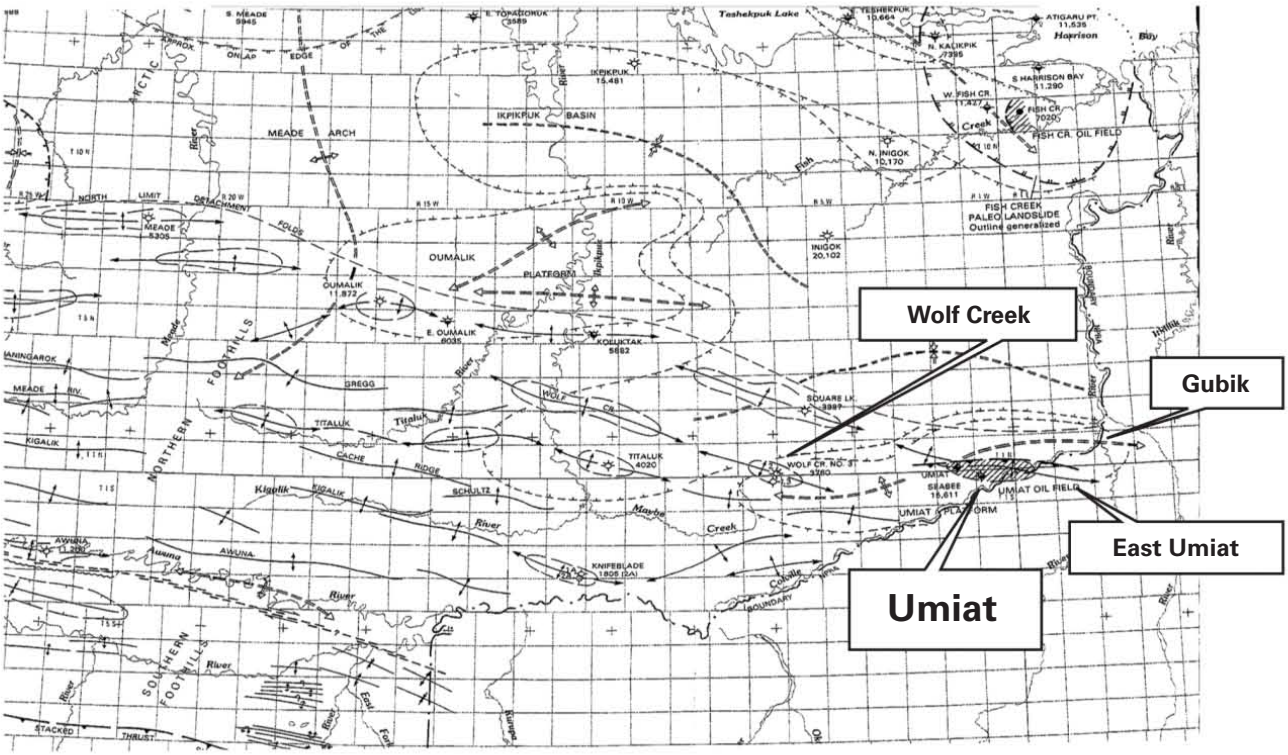
Fig. 1




Source: Alaska Geological Survey, modified from Bird and Molenaar, 1992

## Southern NPRA fold belt anticlines

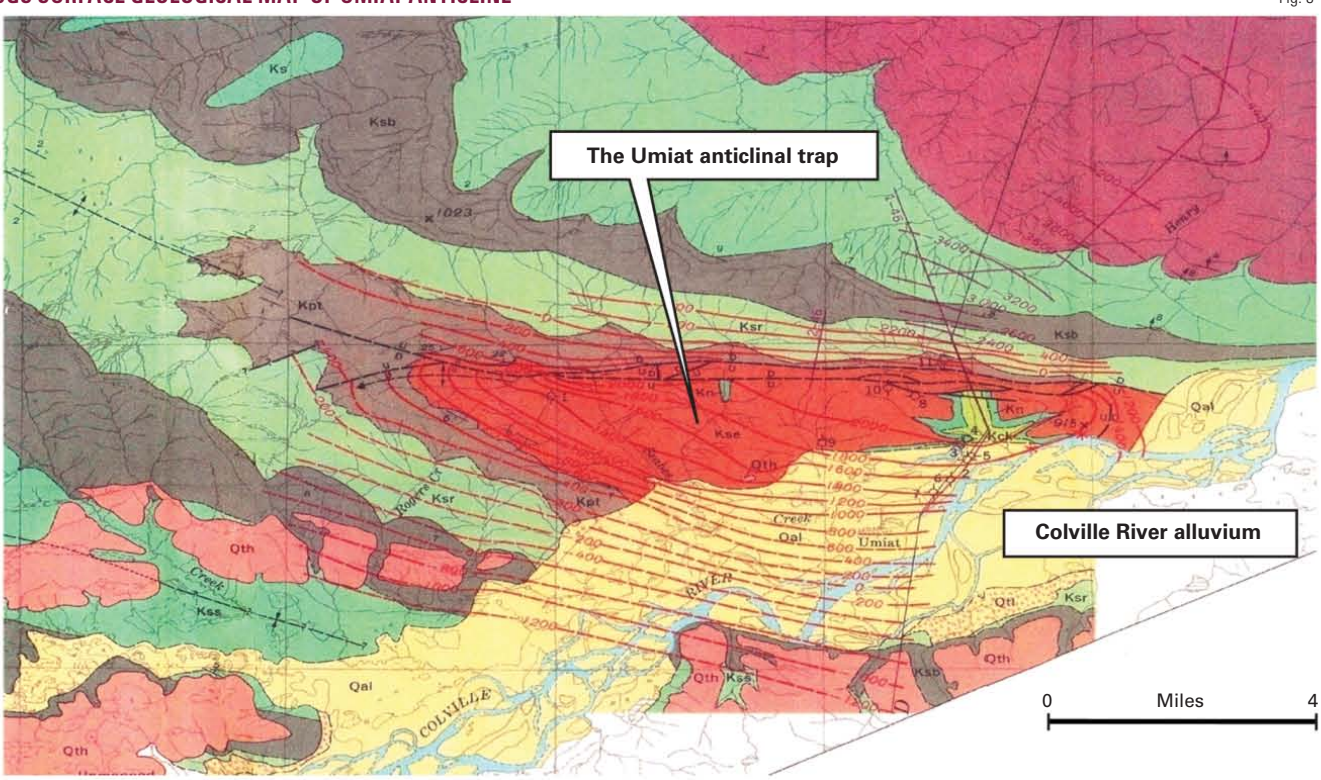
Fig. 2




Source: USGS Professional Paper 1399, 1988

## USGS surface geological map of Umiat anticline

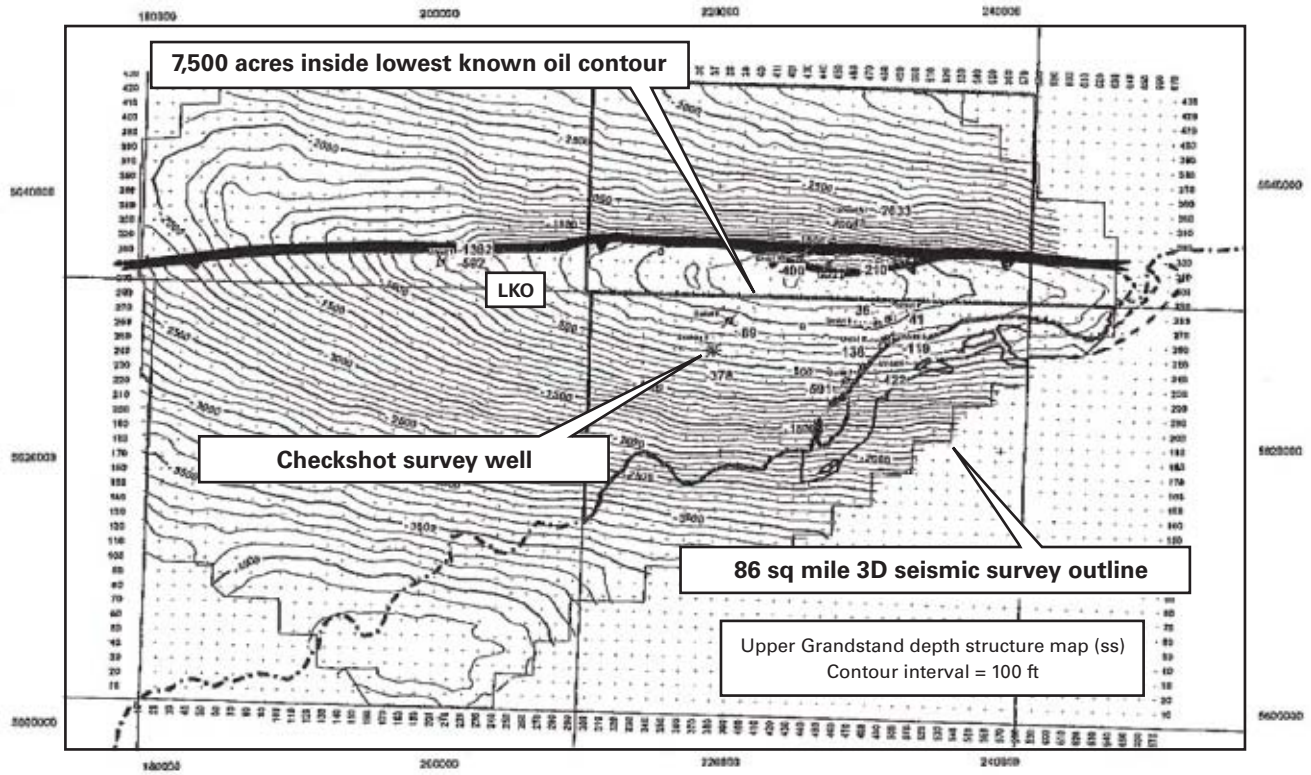
Fig. 3




Source: USGS Professional Paper 303-H, 1966

## UPPER GRANDSTAND STRUCTURE MAP

Fig. 4




naissance is currently formulating the plan of development.

### Umiat location

Umiat is in the central part of the North Slope at the northern edge of the Brooks Mountain Range thrust-fold belt (Fig. 1).

It is in the eastern part of the National Petroleum Reserve of Alaska (NPR-A) about 220 miles south of Prudhoe Bay oil field.

Umiat is in the leading edge of the fold belt surrounded by the Gubik, East Umiat, and Wolf Creek structures (Fig. 2) which have seen renewed appraisal drilling by Anadarko Petroleum Corp., Petro-Canada (now Suncor), and BG Group (British Gas) during 2008 and 2009 to assess gas reserve potential in preparation for nominating space in a proposed Alaska gas pipeline system.

## Geoscience discussion

### The Umiat structural trap

The map in Fig. 3 is a surface geological map of the Umiat anticlinal structure constructed by the USGS.

The southern part of the structure is masked by alluvium (yellow) from the Colville River, and a tributary of the river cuts into the structure and exposes the uppermost oil-bearing reservoirs.

Fig. 4 is a 3D seismic subsurface structure map at the top of the Upper Grandstand, one of the main productive horizons at Umiat. This map shows the outline of the 86 sq mile 3D seismic survey.

The Upper Grandstand two-way time values interpreted from the 3D seismic survey were converted to depth using the time/depth relationships derived from a check-shot survey from the Seabee-1 well shown by the arrow. The area inside the lowest known oil (LKO) in the Upper Grandstand reservoir is 7,500 acres.

### Reservoir section

The productive reservoirs at Umiat are in a Lower Cretaceous-aged sandstone interval known as the Nanushuk Group (Fig. 5).

The Nanushuk Group is made up of the Ninuluk, Chandler Tongue, Upper Grandstand, and Lower Grandstand formations. The Upper Grandstand mapped structural horizon in Fig. 4 is highlighted. The Nanushuk Group consists of shallow marine shoreface and

## GRANDSTAND SANDS PROPERTIES

Table 1

| | |
|---|---|
| Reservoir depth, ft | 500-1,400 |
| Productive area, acres | 7,500 |
| Reservoir temp., °F. | 26-36 |
| Avg. porosity, % | 14 |
| Avg. permeability, md | 55 (range 5-200) |
| Water saturation, % | 41 (Seabee well) |
| Gravity, degrees | 37 |
| Viscosity, cp | 2.9 measured @ 100° F.<br>7-9 (corrected to $T_{res}$) |
| Saturation pressure, psi | 330 |
| GOR, scf/stb | 71 |
| Sulfur, % | <0.1 |
| Pour point, °F. | < –5 |

deltaic sandstones and contains over 600 ft of net sandstone available for net pay at Umiat.

## Reservoir architecture

The block diagram in Fig. 6 shows the 12 legacy wells drilled at Umiat, the Upper and Lower Grandstand main productive horizons, and a possible deeper objective below the shallow oil field.

Umiat is a large ultrashallow (500 to 1,400 ft) oil accumulation. The solid green color represents proved, probable, and possible recoverable reserves of 250 million bbl of oil, and the stippled green pattern represents potential additional resource. Compared with the 7,500-acre Upper Grandstand oil accumulation, the Lower Grandstand oil accumulation has an areal extent of 5,600 acres.

## Well correlations and rates

Fig. 7 is a correlation cross section encompassing all the legacy wells drilled at Umiat.

The first well on the left is the Seabee well followed from left to right by wells 1 through 11. Note the erosion of the upper oil bearing reservoirs in wells 2 through 5. The lower oil bearing sandstones in the Chandler Tongue are not eroded, and the basal Chandler Tongue shale provides the top seal for the Upper Grandstand reservoir.

Across the top of the cross section are the oil pump rates for the wells. The Seabee well, on the far left, was drilled to evaluate deeper objectives and not tested in the shallow productive horizons.

Wells 1 through 3 were drilled with fresh water, and ice formed across the perforations in the zone of permafrost resulting in no flow. The low pump rates in the remainder of the wells were caused by inadequate pump capacities and formation damage from very high mud weights.

The two long term tests were at Well 5, which pumped at the rate of 400 b/d of oil for 93 days, and Well 9, which pumped 200-300 b/d of oil for 45 days. It was noted for Well 5 that the rate was limited to the capacity of the pump; the capacity of the well is not known.

## Reservoir-fluid properties

The Navy acquired conventional core in the productive horizons in almost every legacy well, particularly in the main Upper and Lower Grandstand reservoirs.

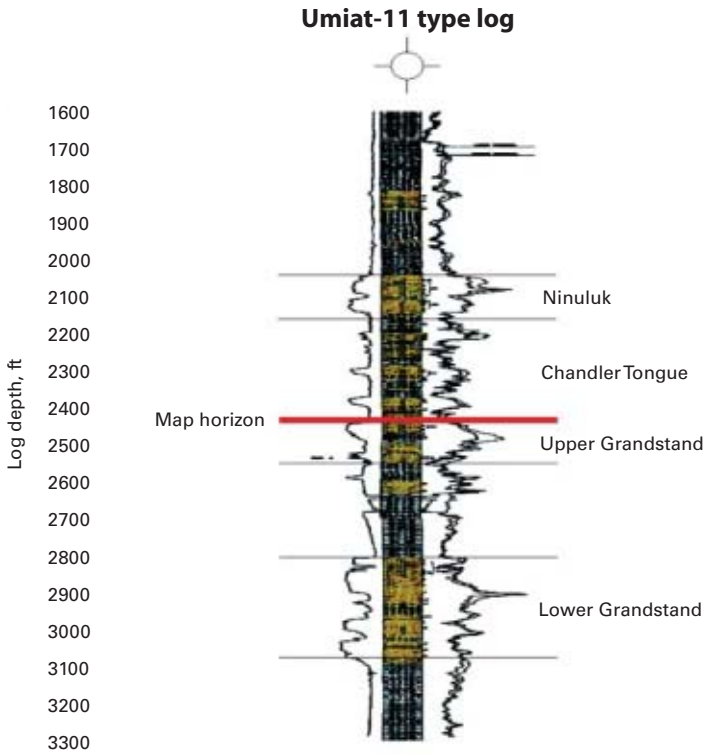
Fig. 8 is a cross-plot of Upper and Lower Grandstand porosities vs. permeabilities for most of the wells with an inset picture of the reservoir rock from core.

The Grandstand reservoirs are fine-grained, consolidated sandstones with an average porosity of 14% and an average permeability of 55 md.

Porosity and permeability for the Grandstand reservoirs are based on 200-plus core samples taken from 10 wells. The porosity of the productive reservoirs varies from 10% to 20% with an average of 14%, and the permeability varies from 1

## UMIAT NANUSHUK GROUP RESERVOIRS

Fig. 5




Source: USGS Professional Paper 305-B, 1958

md to 200 md with an average of 55 md (Table 1).

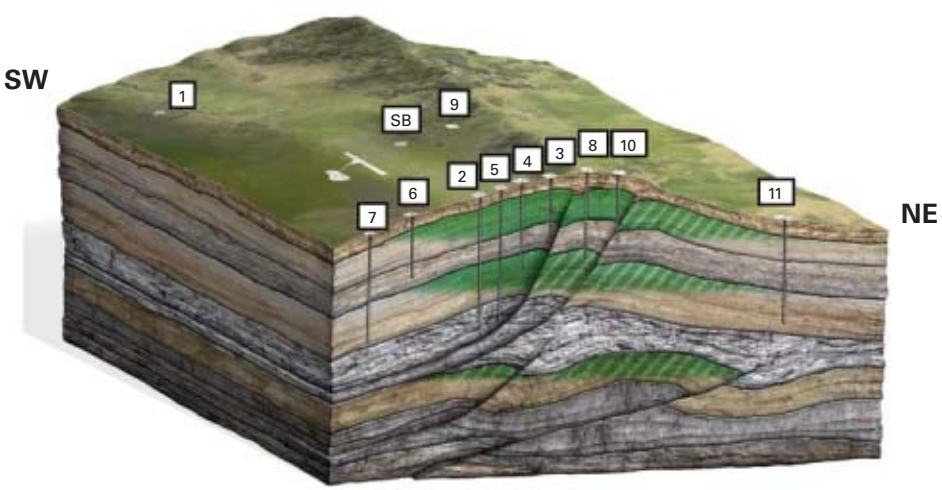
Relative uplift studies of the North Slope have shown that these reservoirs were originally buried to a depth of 6,000 to 7,000 ft, and apatite-fission dating techniques indicate they were uplifted to their present shallow elevation in Lower Tertiary time during the formation of the Brooks Range thrust-fold belt.

The fluid properties are also shown in Table 1. The Umiat crude is light sweet oil with 37° gravity. The viscosity measured on five oil samples is nearly 3 cp at 100° F. After applying correction for reservoir temperature it is estimated to be 7-9 cp.

The pour point of Umiat oil is less than –5° F., which indicates that the oil is mobile in the reservoir that is within permafrost, primarily the Upper Grandstand sands. This has been proven by the oil produced in several tests from the reservoirs in the permafrost.

## UMIAT: ONE OF THE WORLD'S MOST UNIQUE OIL FIELDS

Fig. 6




Solid green = proved.
Striped green = possible.

Field attributes:
1. Consolidated, good quality reservoir sandstones near surface.
2. Reservoirs contain light, 37° gravity sweet crude oil.
3. Original oil in place of more than 1 billion bbl.
4. More than half of the accumulation is in permafrost.
5. Surrounding structures tested gas.

Source: John Perez Graphics and Design

## Engineering discussion

### World class structure

As of 1960, Umiat was expected to be the largest oil field in Alaska.

The discovery of the supergiant fields on the northern coast in the late 1960s decreased the interest in developing what is still a large accumulation compared to the average size of an oil pool worldwide.

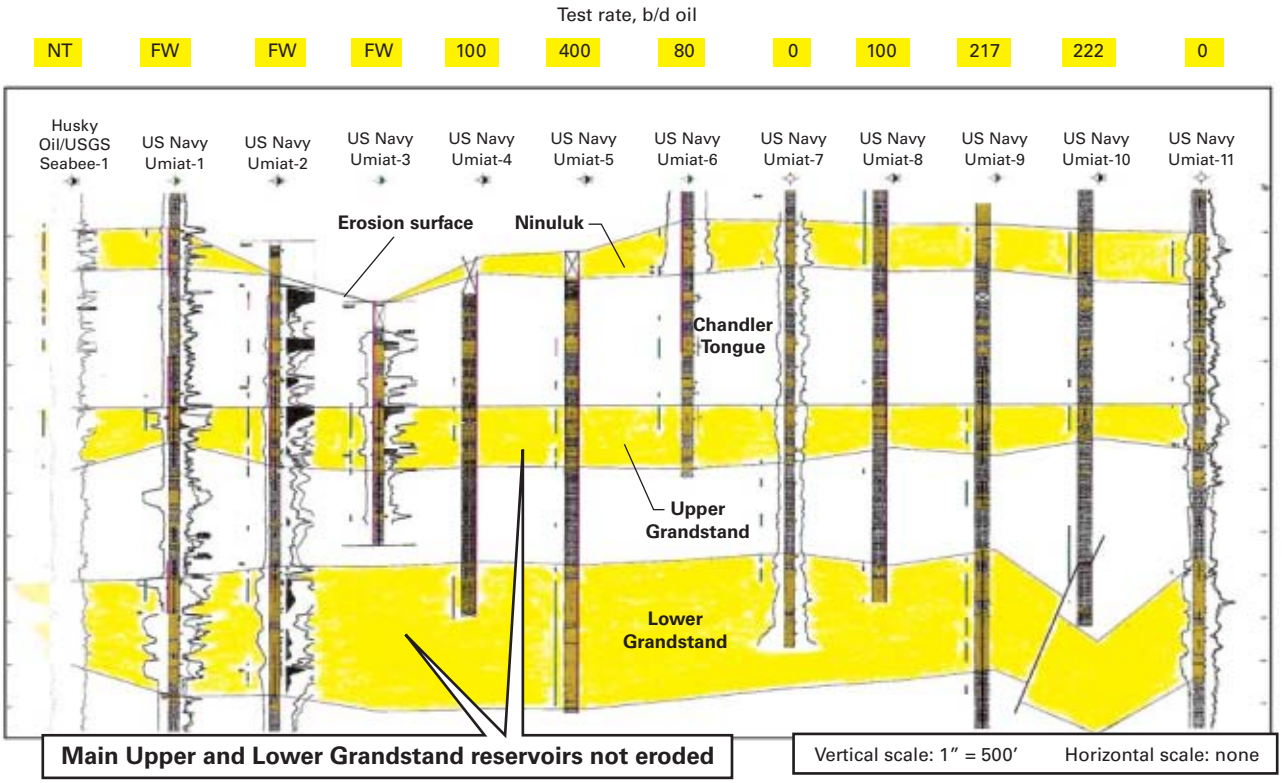
As economic parameters changed over the last 50 years, remote and complex reservoirs have become viable. Umiat continues to draw attention as one of the few remaining light oil reservoirs in Alaska, and in the US, that has not been developed.

### Field remoteness

The first challenge is the remoteness of the location.

## UMIAT OIL FIELD STRATIGRAPHIC CROSS-SECTION

Fig. 7




The nearest commercial traffic access road is the TAPS pipeline haul road (Dalton Highway) almost 92 miles to the east. Although the Prudhoe Bay area has significant oil and gas infrastructure, it is located 220 miles away even after an Umiat access road is built. However, there is an airstrip for year round access, and Umiat has lodging, warehouse storage, etc.

Umiat is planned to be developed using the proven methods that were employed for the Alpine development, which was roughly 70 miles west of Prudhoe Bay. At Alpine large sealifts and truckable modules were used to transport the facilities, including ones constructed in Alaska, Canada, and the Lower 48.

### *Pay opposite permafrost*

The Arctic environment presents the next most significant challenge. The year-round average surface temperature near 0° F. makes permanent habitation difficult and expensive.

One challenge particular to Umiat is the presence of at least part of the oil horizons within the permafrost zone. Although this should not immediately impact primary production rates when compared to other reservoirs with similar oil saturation and oil viscosity (at reservoir conditions), it represents unique challenges concerning secondary recovery or pressure maintenance operations.

A discussion of adverse sand-face plugging behavior in a 1960 US Bureau of Mines report[1] leads one to assume that keeping the formation cold and stable (steady state conditions) will result in higher oil permeability than allowing water to thaw then refreeze at thermal boundaries.

Any water injected into the reservoir would tend to freeze and block future injectivity. Any gas injected above reservoir temperature would tend to thaw, and then refreeze any interstitial water it came in contact with. Although the behavior has not been documented in the Umiat related literature, it is likely that sweep efficiency would be adversely affected by a moving water front preceding a hot injection gas front.

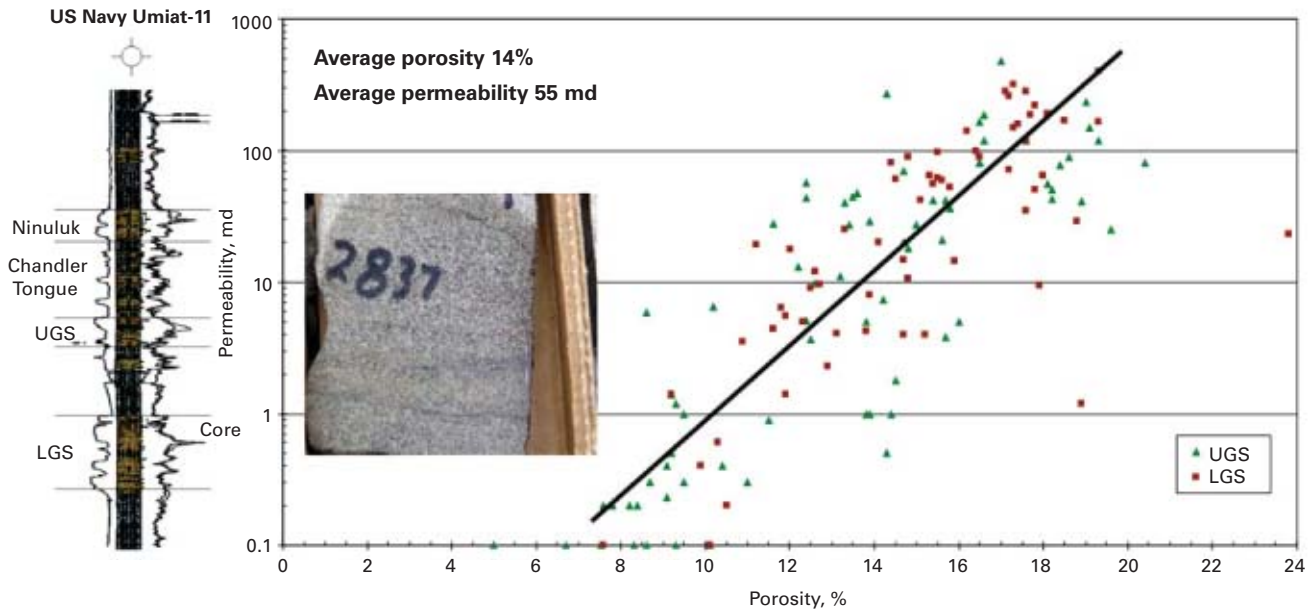
With this in mind, cold gas injection is proposed by Renaissance as the preferred pressure maintenance technique and was evaluated by both the Bureau of Mines and recent third party reservoir engineering studies.

Although the Bureau of Mines report stated that solution gas drive at low reservoir pressure results in reasonable recovery factors of 29% to 45% due to the significant expansion of a small amount of gas, makeup injection gas would be necessary to optimize recovery from the low pressure reservoirs. A recent third party reservoir engineering study estimates typical recovery factors of 22% for the UGS zones and 45% from the LGS reservoirs.

These recoveries are currently being researched further at the University of Alaska, Fairbanks. For the reserves

UMIAT GRANDSTAND SANDS POROSITY-PERMEABILITY CROSS-PLOT

Fig. 8




study, parameters were risked downward to account for reservoir heterogeneity and typical underperformance of horizontal wells compared to predevelopment simulation studies.

Renaissance has gas resources in the area for pressure maintenance.

## Horizontal drilling

Since 1960, horizontal drilling has provided viable rates in fields that were previously uneconomic.

On average, horizontal wells produce two to three times the rate of the similar vertical well.[2] Recent theoretical calculations predict rates could increase by 6:1.[3]

In reservoirs like the Bakken in Montana, the increase in productivity due to both horizontal drilling and multiple hydraulic fractures has provided the only means of economic production.

Horizontal drilling in Umiat field would provide several benefits.

The first benefit would be reduced well counts to access the entire structure and minimize additional footprint.

The second benefit would be to allow segregated access to large portions of the top and bottom of each of the target sand bodies.

The third benefit is simply that rates per wellbore of 1,000 b/d of oil or more can be expected from dual lateral wells.

*Umiat camp and airstrip lie along the Colville River in the Brooks Range foothills on Alaska's North Slope.*

## Artificial lift options

Given the complex wellbore geometry, artificial lift optimization will become an important driver for Umiat profitability.

If recovery from the development is to be maximized, withdrawals of all liquids at the lowest possible bottomhole pressure will be a goal of the artificial lift system. The use of electric submersible pumps (ESPs) is currently the preferred option. However, with gas injection for pressure maintenance, high gas-oil ratios may prevail with time.

Recent experience in high gas/low liquid horizontal producing environments has shown that fluids accumulating in low spots or "sumps" along the horizontal wellbore length create an oscillating gas surge that unloads fluids but also tends to vapor lock the ESP intake.

The ESP is planned to be placed in the deepest straight and horizontal section of the lower lateral of each well. This should cause all liquids to be removed from the wellbore at the lowest possible removal point, thus using gravity and fall-back to aid in gas separation.

Since the wells are shallow, the pump horsepower requirements are not extreme and a short pump can be pushed into the horizontal section if the wellbore size is large enough and doglegs are kept reasonable.

Gas lift is the other accepted technique for producing below a curved portion of a wellbore. With gas injection as the secondary recovery method, gas lift is a viable option and gas breakthrough will provide some additional lift capacity.

Lift gas delivered at 400-600 psia would be sufficient to lift significant volumes of Umiat oil. This option may be less capital intensive than ESPs but requires greater gas compression volumes.

## Development plan

Renaissance shot an 86 sq mile proprietary 3D seismic survey in the winter of 2008 to confirm the mapping of the 7,500-acre shallow structure and to assess the deeper potential.

The company has also focused on the plan of development and contracted third parties on pipeline route and cost, facility layout and costs, horizontal (lateral) development techniques, and obtained an independent reserve report. In addition, the University of Alaska at Fairbanks has a Department of Energy grant to, among other things, confirm cold gas injection as the preferred pressure maintenance mechanism.

The development plan includes a 115-well program split between Upper and Lower Grandstand using multilaterals on 80-acre spacing for 78 producers and 160-acre spacing for 37 gas injectors.

The pipeline from Umiat is expected to tie-in to TAPS at Pump Station 2. Peak field production should reach 50,000 b/d of oil. Total development cost is estimated to be $1.7 billion. Currently, further technical studies are underway to finalize the plan of development prior to obtaining funding for project sanction.

## Investment environment

Alaska is a stable domestic environment with significant fiscal incentives for investment, including fungible tax credits between 45% and 65% for drilling and development costs for small producers.

Majors have built the footprint, and there is ample infrastructure capacity. The late 2009 price environment rekindled activity on the North Slope of Alaska. Superindependents such as Pioneer Natural Resources at the Oooguruk project are applying proved technologies and leading this thrust.

Alaska receives almost 90% of its revenue from oil and gas production. Although the state has increased the overall severance taxes on production, the overall impact of the discounted value is minimal due to the up front tax credits. The tax credits lower the "at risk" investment; in other words, the state shares the risk dollars.

## Progressing the development

In closing, Umiat has world-class potential and is a low geological risk development project. Technological advances in drilling in permafrost,

horizontal drilling, artificial lift, and a real price increase in oil have brought Umiat to the development stage.

## Acknowledgments

We acknowledge the contributions of the entire Renaissance team: Vijay Bangia, David Doherty, Craig Moore, David Fulton, and Paula Hastreiter.

Credit should go ARC Financial Corp., whose investment has allowed Umiat to be derisked and progressed towards development, and to Arctic Falcon Exploration LLC who originally captured the key leasehold at Umiat and is one of the strongest advocates. Also, recognition is given to Ryder Scott & Associates for its contribution to the engineering discussion and the technical work in particular on artificial lift and analogs for horizontal wells. ✦

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OGJ FOCUS

# Rig-site equipment determines drilling fluid weight material sag

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A series of experiments determined the equipment needed for finding the degree of sedimentation or sag in various drilling fluids at a rig site.

The design makes use of equipment already specified in other API procedures.

Sedimentation of weighting materials in drilling fluids affects both safety and operational efficiency during drilling and completion. With barite sag, gas kicks can occur easily.

The experiments used a wide variety of suspensions and demonstrated the potential for use of a simple direct-weight measurement for suspension stability.

The tests included several model suspensions with several solvents (water and oil) and solutes (barite and sand).

The equipment designed provides testing under string rotation and varied temperatures.

The implications of sag are so severe that the drilling industry through an API committee has initiated task forces for determining better ways for controlling sag.

## Sag

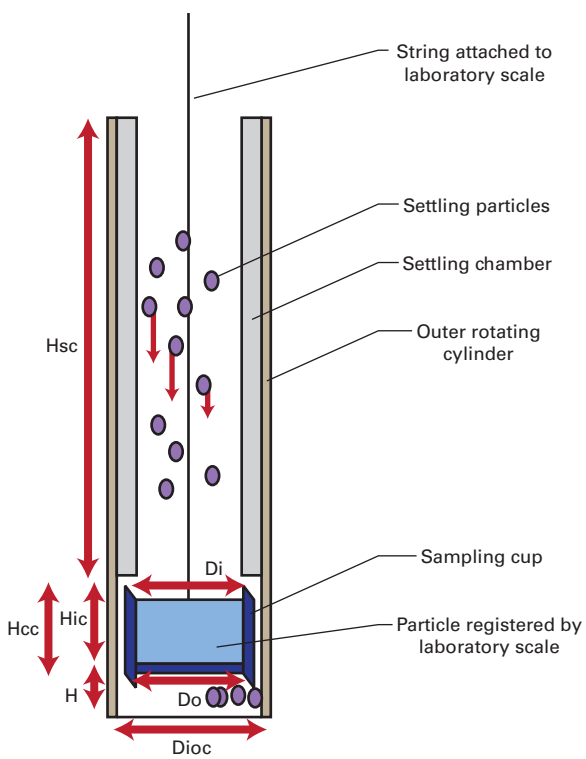
Two-phase dispersions occur in a wide range of products such as foods, paints, and pharmaceuticals as well as during drilling of wells. For all these applications, particle sedimentation affects processing efficiency, end product quality, and product shelf life. The stability of drilling fluids is of particular interest because unstable drilling fluids can be a safety hazard and also degrade drilling efficiency.[1]

Drilling fluids are polydisperse emulsions and dispersions consisting of widely different components that interfere with each other. Particle aggregation, hydrodynamic, and electrostatic interference and the fact that there are billions of particles, all of various shapes and sizes, make it difficult to numerically model the fluids despite recent advances in computational technology. This complexity forces us to describe the weight material settling phenomenon by empirical modeling based on reliable experimental data.

The weighting agents used in drilling fluids are dense minerals such as

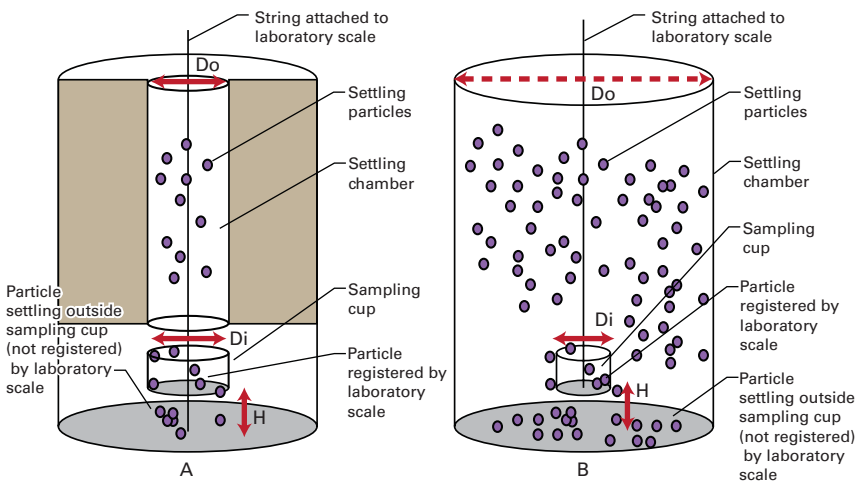
SETTLING MEASUREMENT PRINCIPLE

Fig. 1



## TWO SETTLING EQUIPMENT DESIGNS

Fig. 2




barite, ilmenite, hematite, or manganese tetraoxide. These additives provide the necessary density to maintain the hydrostatic head needed to prevent the wellbore from collapsing and to hinder influx of gas, oil, or water into the wellbore. Keeping this material in suspension is therefore of utmost importance.

For detecting the degree of weight-material settling, called sag, the petroleum industry has applied techniques ranging from large-scale flow loops to specially designed viscometers with various inserts to promote settling.

Various references have thoroughly described these methods,[2-4] and this article will not describe them further. It will, however, describe some less common alternative techniques that provide additional useful information about the sedimentation process that is not otherwise accessible.

A settling determination technique used within the food industry and in nuclear waste handling,[5] uses ultrasonic sensing. This technique is based on the principle that the speed of sound depends on the material transmitting and reflecting the sound signal. For a suspension such as a drilling fluid, change in signal response makes it possible to determine particle shape, size, and concentration at different positions in the sample, including the degree of settling.

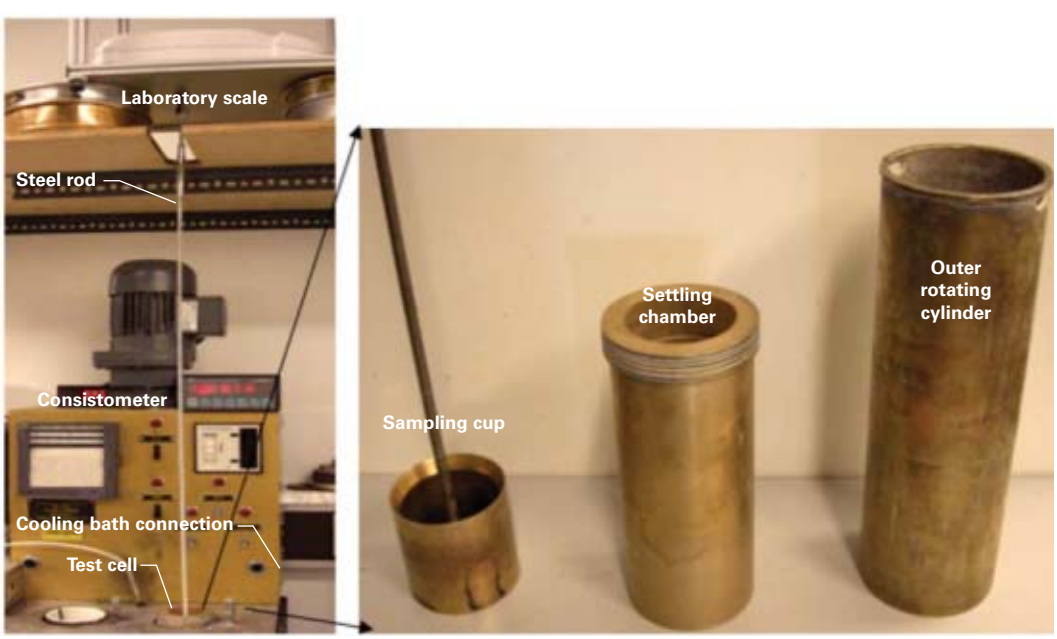
Because ultrasound may interfere with the gel structures in the drilling fluid and promote sag, it is, however, not clear to what degree this is useful as a general drilling fluid sag measurement tool.

The drilling industry has used nuclear magnetic resonance imaging for decades for formation logging. Rismanto and van der Zwaag[6] have used this technique for sag measurements.

NMR imaging measures the resonant absorption of radio waves by selected atomic nuclei in the sample. The technique makes it possible to determine the density of hydrogen atoms in a fluid and hence by inference the solids content of, for example, density stratification in the sample cell for solids not containing significant hydrogen.

## EQUIPMENT SETUP

Fig. 3




Saasen et al.[7] used a device for density measurement consisting of a 2-m long annulus that allowed inner string motion. The annulus had 25 sample collection ports for removing samples for density measurements.

Lewis and Rasmussen[8] used pressure sensors to determine particle concentrations and particle size distribution for soil sedimentation

processes.

Nguyen et al.[9] used a similar setup with pressure sensors at different positions in a flow-loop for studying barite sedimentation in oil-based drilling fluids and its dependence on drillstring rotation rate and wellbore inclination.

Not all of these techniques mentioned are suitable for field applications because of equipment size and complexity, while others show insufficient reproducibility or require specially trained staff to operate.

In the drilling industry, therefore, there is a need for an accurate device to determine a drilling fluid's settling potential.

The following describes the design of a simple device that uses direct weight measurement for sag determination.

## Equipment design

Our equipment consists of a settling chamber and a sampling cup that attaches to a laboratory scale with a steel rod (Fig. 1). The equipment registers solid material settling in the settling chamber only when the material hits the bottom of the sampling cup.

Using this simple principle and accounting for boundary conditions, we can determine some settling parameters that provide additional information of the settling process.

One of the boundary conditions needed is the area and volume of the sampling cup vs. the total volume of the settling chamber.

Design A (Fig. 2) has a sampling cup with a cross-sectional area equal to the area of the settling chamber ($D_i = D_o$). This implies the sampling cup collects most of the solid material in the settling chamber. Some material, however, will remain self-suspended due to Brownian motion and some may dissolve in the solvent (fluid). Because the laboratory scale will not register this material, there is some uncertainty in the weight reading.

Design B (Fig. 2) has a sampling cup with a much smaller base area than the settling chamber ($D_i << D_o$); the sampling cup therefore only collects a portion of the settling material. This design will be influenced insignificantly by wall effects and by material settling outside the sampling cup. The only elements needed in the evaluation is the area correction, sampling cup capacity, and buoyancy effects.

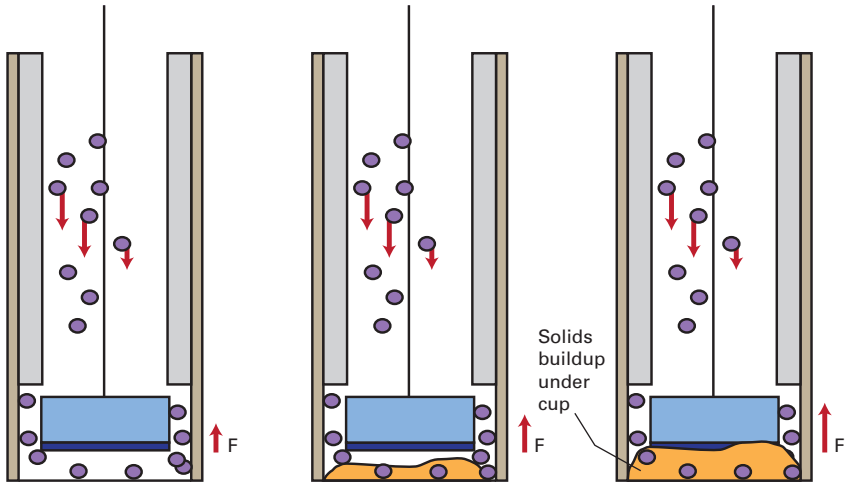
The equipment used in our experiments (Fig. 3) consists of the laboratory scale coupled with a modified atmospheric consistometer, as described in API's well-cementing testing standard.[10]

The consistometer is standard equipment for the preparation of well cement slurries before rheological measurements or for determining thickening time. Using a consistometer as base for our equipment design, we benefit from having the option of using the outer rotating cylinder to provide the possibility for running sag tests at dynamic conditions, for example, with a simulated drillstring rotation.

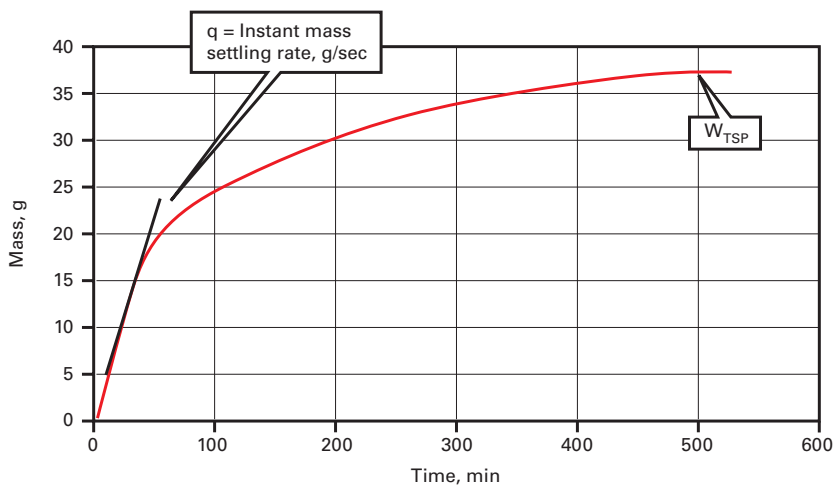
The equipment is coupled to a cooling bath that makes it possible to run tests at both high and low temperatures.

The sampling cup has an ID ($D_i$) of 50.2 mm and inner height ($H_{ic}$) of 49.6 mm, giving it a 98.2-ml volume. The first step inserts the cup into the consistometer before the mounting of the settling chamber. A small gap between the

**SOLIDS BUILDUP** Fig. 4

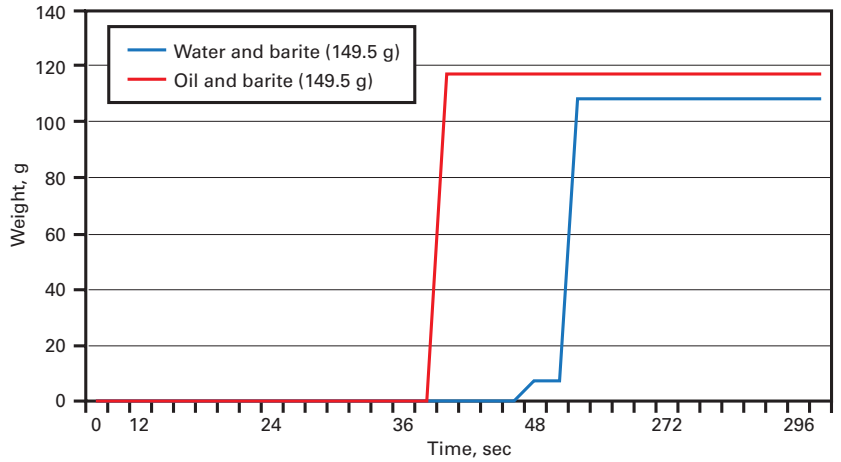



**PARTICLE SETTLING CURVE** Fig. 5



## FLUID SETTLING TESTS

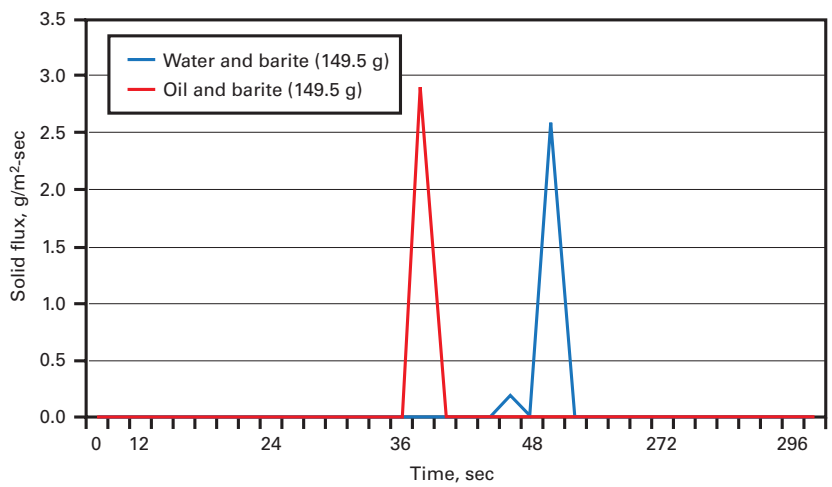
Fig. 6




Note: 149.5 g of barite ($\rho_p$=4.2 g/cc) added to two fluids: water ($p_w$ = 1.0 g/c) and oil ($p_o$ = 0.809 g/cc).

## SOLID FLUX MODEL

Fig. 7




settling chamber and the sampling cup allows the sampling cup to hang freely in the suspension to be tested.

The sampling cup has a 56-mm outer height ($H_{oc}$) and a 60-mm OD ($D_o$). It is attached to the laboratory scale with a 6-mm steel rod. There is a 4-6 mm gap (H) between the bottom of the sampling cup and the settling chamber. This allows for a specific amount of material to settle before solids buildup underneath the sampling cup affects the weight (Fig. 4).

The ID of the outer rotating cylinder ($D_{ioc}$) is 67 mm. This leaves a volume of about 34 ml in the annulus between the sampling cup and the outer rotating cylinder. In addition, the volume underneath the sampling cup is about 19 ml.

The bulk densities of loosely packed sand and barite used in our experiments were measured to be ~1.97 and ~2.37 g/cc, respectively.

From this it follows that for tests with sand, the maximum capacity of the sampling cup is ~194 g, while the sampling cup can collect 233 g of barite before being overfilled.

### Buoyancy effects

If one adds particles to the fluid after equipment assembly, as is the case for the experiments described in the article, we only need to account for the buoyancy effect from the fluid density. This assumes that the bulk volume of particles added is less than the sampling cup volume.

If one lowers the sampling cup into a particle-laden fluid, the particles present in the fluid surrounding the sampling cup affect the weight readings. This implies that, as settling occurs in the annulus between the sampling cup and underneath the sampling cup, buoyancy changes.

Fig. 4 describes this phenomenon. Particles settling underneath the sampling cup reduce the bulk density of this volume and thereby reduce buoyancy and increase registered weight.

Similarly, if the bulk volume of the settling material exceeds the sampling cup volume, some material will settle in the annulus between the sampling cup and settling chamber's wall. This leads to increased buoyancy from the suspension in the annulus and thereby a lower weight reading.

In addition, particles settling out of the suspension underneath the sampling cup will lead to a lower bulk density of the suspension surrounding it. This will in turn lead to less buoyancy and thereby higher weight readings.

For tests in which one adds solids-laden fluids after equipment assembly, one needs to consider these elements. For optimization studies in which the particle content is equal, the described design is still valid.

### Settling parameters

Several practical measures of sag in drilling fluids have been proposed. Swanson et al. describes one of the most commonly used measures that is based on the density difference between the top ($\rho_{top}$) and bottom layer ($\rho_{bottom}$) of a fluid column.[11] The difference defines a sag factor SF, Equation 1 in the equation box.

A sag factor of 0.5 thus corresponds to a nonsagging fluid, while values above some threshold identify potential

## Equations

$$SF = \left(\frac{\rho_{bottom}}{\rho_{bottom} + \rho_{top}}\right) \quad (1)$$

$$w_{TSP} = w_{dry} \times \left(\frac{\rho_p - \rho_f}{\rho_p}\right) \quad (2)$$

$$R_s = \frac{w_{SM}}{w_{TSP}} \quad (3)$$

$$A_{cor} = \frac{D_i^2}{D_0^2} \quad (4)$$

$$R_{SA} = \frac{w_{SM}}{w_{TSP} \times A_{cor}} \quad (5)$$

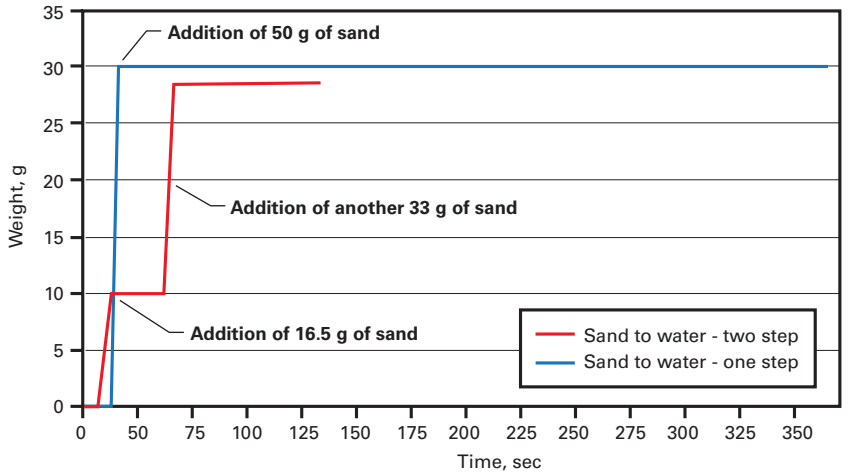
$$q_s = \frac{dm}{dt} \quad (6)$$

$$\Phi = \frac{1}{A}\frac{\partial m_p}{\partial t} \quad (7)$$

$$w_{TSP} = w_{dry} \cdot \left(\frac{\rho_p - \rho_f}{\rho_p}\right) \cdot \frac{1}{A} \int_{t=0}^{t=\Delta t_b} \Phi dt \quad (8)$$

## Modeled suspensions

Fig. 8




operational problems. Other measures of sag also use the density variation to identify a settling process as a significant sag incident.[12 13] The density differences alone, however, are not sufficient to predict sag incidents reliably.

For some operations one can still operate successfully with higher density differences than the set threshold value, while other operations require much smaller variations than specified. Furthermore, these measurements do not consider the dynamics in the system such as syneresis effects, for example, the displacement of free fluid to the top of the fluid column.

The equipment we developed allows for determining additional parameters that provide a more general and detailed description of the physics involved in the settling process. This includes the determination of parameters such as total settling potential, settling velocity or rate, and solid flux.

### Settling potential

For all types of settling testing, the mass of the total solid material content in a sample normally follows from the fluid composition. For particles settling in a fluid, Archimedes' principle applies: A body fully or partially submerged in a fluid is buoyed by a force equal to the weight of the fluid displaced.

With a known quantity of dry material, Equation 2 calculates the total settling potential ($w_{TSP}$), where $w_{dry}$ is the dry weight of the material, $\rho_p$ is the particle density, and $\rho_f$ is the density of the fluid suspending the solid material.

Equation 2 defines the settling potential, $R_S$, as a ratio the mass of settled material in the test ($w_{SM}$) to the total mass of material in the sample ($w_{TSP}$) given from the fluid composition.

For field applications, measurement of this parameter can be relevant if the well construction limitations are given and one can determine an acceptable settling potential, based on the available operational window.

The calculation requires a correction factor, $A_{cor}$ (Equation 4), when a sampling cup does not cover the entire bore (area) of the settling chamber (Design B in Fig. 1). $D_i$ is the sampling cup's diameter, and $D_o$ is the inner diameter of the settling chamber.

Equation 5 applies to a correction of the settling potential.

### Settling mass rate, flux

The time derivative of the settling curve provides directly the settling mass rate, $q_s$ (Equation 6). In the equation, m is the mass of settled material.

Fig. 5 shows a settling curve determined from a test that used our equipment. In this case, $D_i$ equals $D_o$ (Design A in Fig.1) and implies that the sampling cup collects almost all settled material and one can read the total settling potential, $w_{TSP}$, directly from the settling curve.

We define time of breakthrough ($t_b$) when $q_s = 0$, such as when the mass of material entering the sampling cup equals the mass of material leaving it. In addition, we now obtain $w_{TSP}$ and it should equal the calculated values given by Equation 2, provided that the sampling cup volume exceeds the bulk volume of particles in the suspension and hence that no material settles outside the sampling cup.

The term "solid flux" expresses the amount of material passing through a selected area during a specified time period (g/(m$^2$-sec)). This provides a more universal expression that also includes the area correction.

From Fig. 1, it is clear that the solid flux is inversely proportional to the base area of the inner cylinder and is then given by Equation 7, in which $m_p$ is the mass of settled material and A

is the cross-sectional area where the particles pass through.

A combination of Equations 2 and 7 gives the total settling potential (Equation 8).

In this manner, we have established a system independent of test device design that is more applicable than the currently used sag definitions previously described.

## Validation

To validate the performance of our equipment, we carried out numerous experiments with well defined model suspensions. The initial two tests used 149.5 g of barite at a 4.2 g/cc and an average 15-µm particle size ($D_{50}$).

The first test involved pouring 400 ml of oil ($\rho_f$ = 0.81 g/cc) into the test chamber and then adding barite. The second test was similar but used water ($\rho_f$ = 1.0 g/cc) in the settling chamber before the barite addition.

These additions of particles to two fluids should, according to Equation 1, give final readings of 121.0 g and 113.9 g, respectively.

Fig. 6 shows that the first test with barite added to oil gave a final reading of 117.4 g, while the test with barite added to water resulted in a 107.6-g reading. This resulted in an error of 2.9% and 5.5%, respectively.

The test with water in the settling chamber also obtained stable readings of ~7 g after 48-50 min before it increased to 107.6 g. This probably was caused by the high sensitivity of the laboratory scale that registers nearby movements.

At the end of the test period, the weight was increasing slightly, and we also observed some material settling outside the sampling cup, causing the discrepancy between the calculated and measured values. Furthermore, we observed some particles still to be dispersed in the fluid at the end of the test. These tests, however, show that the equipment will measure the sedimentation rate adequately with a reasonable accuracy.

Fig. 7 shows the solid flux for these tests (Equation 7) using a sampling cup with an ID $D_i$ = 50.2 mm. As observed from the figure, the solid flux is higher for particles settling in oil than in water.

Fig. 8 shows the results of similar experiments as in Figs. 6 and 7 but using sand (Bascarp 10 delivered by Askania AS) with a known particle size distribution added to 350 ml of water ($\rho_f$ = 1.0 g/cc). The density of the sand was 2.6 g/cc with an average particle size, $D_{50}$, of 114 µm.

Two tests were run during a short period, both having 400 ml of water in the settling chamber before particle additions. The first test added 50 g of sand to 400 ml of water. The second test had two steps: first 16.5 g added before an additional 33 g, which should, according to Equation 2 result in readings of 10.1 g and 30.4 g, respectively.

For these experiments, the first test showed an uncertainty of 0.9 %, while the two-step test ended up with uncertainties of 2.0% and 5.2% for each step of the test. In each test, we again observed that the fluid still suspened some material at the end of the test, explaining the discrepancy between calculated and measured values. ✦

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# Separations technology improves amine system's overall reliability

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Expansion and modifications at Marsulex Montreal Inc.'s sulfur-handling plant in Montreal have increased the plant's overall reliability through improved amine quality, improved the plant's operating costs as a result of a longer interval between cleaning, and yielded better hydrocarbon recovery.

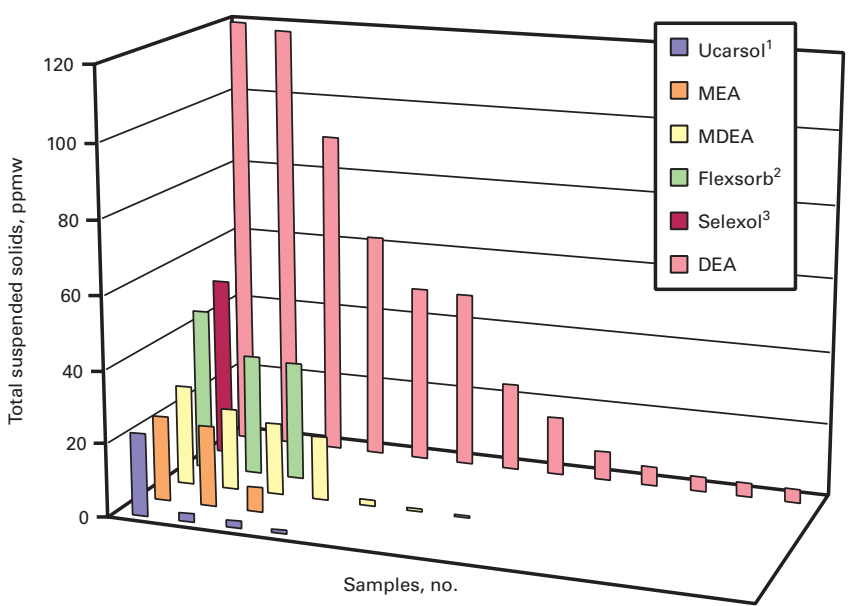
Amine systems in many refineries today are struggling to handle increased acid-gas loads resulting from low-sulfur gasoline and diesel production. Initiatives to increase amine and sulfur plants' reliability must ensure filtration and separation technology removes particulate and liquid contaminants in the amine circuits.

Marsulex Montreal's sulfur-handling plant sits near two refineries in Montreal. Hydrogen sulfide-rich amine arrives by pipeline at the Marsulex plant, which regenerates the amine and returns it to the refineries.

*Based on a presentation to Oil Sands and Heavy Oil Technologies Conference & Exhibition, July 14-16, 2009, Calgary.*

## AMINE CONTAMINATION

Fig. 1




[1]Dow Chemical Co. [2]ExxonMobil Corp. [3]UOP.

As part of a 50% expansion project completed in 2006, Marsulex installed the most current separations technology to reach the maximum design capacity by eliminating particulate and hydrocarbon ingression and contamination that were previously fouling plant equipment, reducing the amine solution's regeneration efficiency and thereby reducing reliability.

Deployment of rich-side filtration and high-performance liquid/liquid coalescers mitigated expensive equipment replacement and saved money.

## Amine contamination

Expansions to existing refineries, along with the shift in crude diets to heavier and more sour "opportunity crudes," have put refinery amine circuits and sulfur plants under more stress than ever before. With these increased sulfur loads, corrosion products, liquid hydrocarbons, and organic acids are making their way into the amine units.

That amine cleanliness plays a crucial role in overall amine and sulfur-plant performance and reliability is documented.[1,2] Contaminants must be reduced or eliminated to ensure reliable plant operation and environmental compliance.

Particulate matter found in amine solutions are, generally speaking, corrosion by-products. Solid contaminants are known to stabilize foams when foaming occurs.

A review of field test data from Pall's databases going back many years has shown consistently that particle-size distribution of suspended solids is generally finer than 20 µm, with the majority of particles smaller than 10 µm. This observation has been generally consistent even when total suspended solids have varied from site to site.

With mixed results, refiners (and

gas plants) have used different filtration and separation methods to combat the most common contaminants found in amine circuits. What is generally accepted as good practice is that total suspended solids in an amine circuit should be kept to less than 1 ppm by weight[2 3] and liquid hydrocarbons and organic acids must be reduced to levels as close to zero as possible.

Following is a summary of amine-circuit filtration data compiled from Pall's Scientific and Laboratory Services field tests. These data are a composite of results obtained in 10 countries from 17 refineries owned by 10 oil companies.

Fig. 1 shows diethanolamine as the most sampled amine and exhibiting the widest band of contamination, from a few ppmw to nearly 120 ppmw. What is telling is that in nearly all cases, the total suspended solid levels exceed recommended best practice of no more than 1 ppmw suspended solids, as advised in the expert literature.[3]

Fig. 2, showing particle-size distribution for several samplings of DEA and methyldiethanolamine, shows that most particles are smaller than 20 µm.

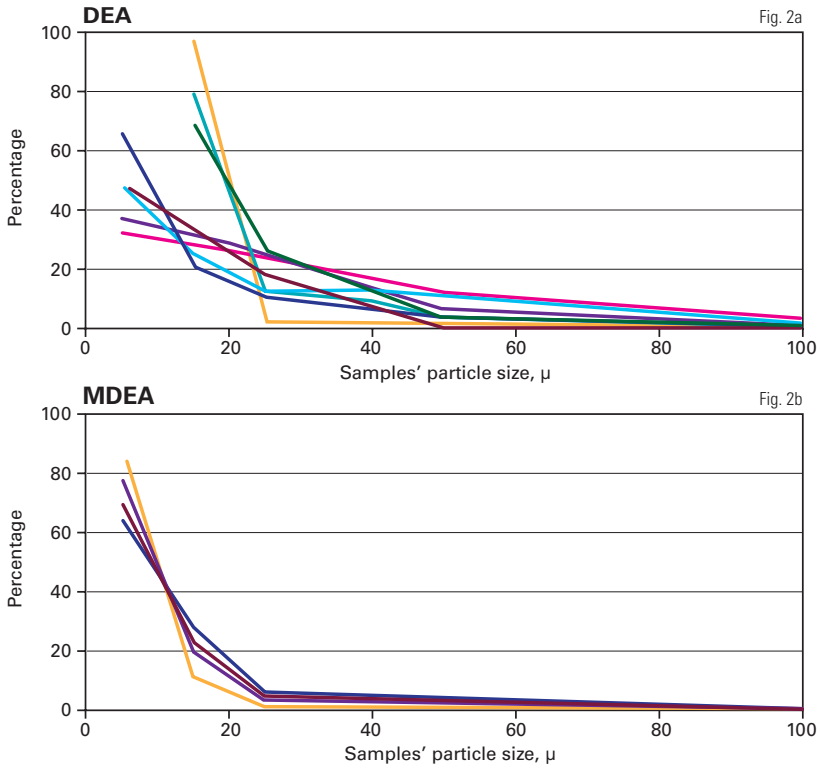
In complex refineries, liquid hydrocarbons can come from amine/LPG contactors or as condensibles in refinery fuel gas. Typically, the cause is poor liquid/liquid contactor outlet disengagement between LPG and amine or inadequate inlet separation of free liquids in refinery fuel gas entering vapor/liquid contactors.

In complex refineries, which have multiple contactors and in which it is difficult to pinpoint culprit streams, the best option is to deploy central filtration and separation to eliminate free liquid hydrocarbons from the amine.

High-performance liquid/liquid coalescers can break the stable, rich-

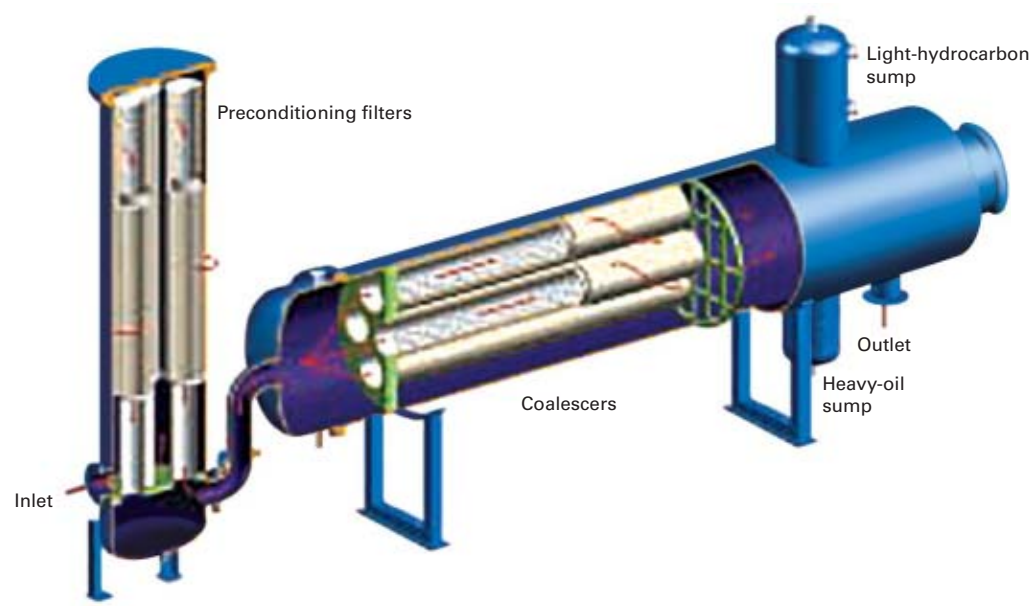
## Contamination: particle-size distribution

Fig. 2




## Filter, liquid/liquid coalescer*

Fig. 3



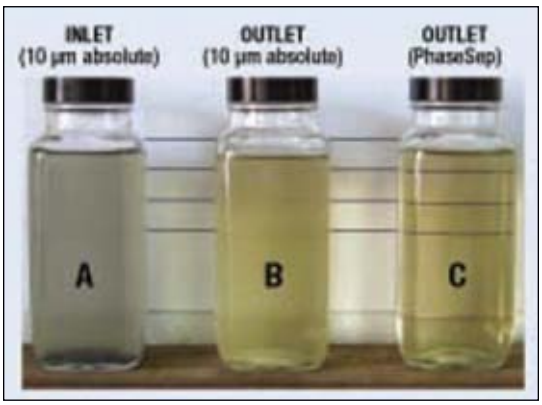

*Full flow, rich side.

amine/hydrocarbon emulsion that can damage the amine unit and sulfur-plant operations, which can in turn elevate overall refinery $SO_2$ emissions.

Within the amine circuit itself, the impact would be felt in the rich/lean heat exchangers, regenerator, reboiler tubes, and tower trays and packing, if left untreated. The consequences can range from heat-exchanger fouling, hydrocarbon entering the sour-water reflux discharge, increased corrosion, high amine losses due to foaming in contactors, formation of amine degradation products, or generation of heat-stable salts.

The efficiency of the sulfur-recovery unit and the life of the converter catalyst are degraded by carried-over hydrocarbons in the acid gas. In a serious hydrocarbon carryover, the consequences can be much more severe. These include soot deposition in the converters, runaway hydrocarbon combustion in the Claus unit, and high $SO_2$ emissions that result in regulatory penalties and possibly expensive capacity reductions.

In the worst cases, there might be the need to switch to sweeter crude slates as a mitigating strategy to reduce the sulfur load on the amine and Claus plants to curb emissions.




*Sample A is a rich amine at the outlet of the flash tank. The solution's color indicates finely divided corrosion particles, FeS. Sample B is a rich amine following 10-µm (Beta 5000) filtration. The haze indicates a stable emulsion; this sample remained hazy and unchanged for 3 weeks. Sample C, from the liquid/liquid coalescer outlet, is clear and bright after a single pass through the PhaseSep liquid/liquid coalescer. The emulsion was broken and liquid hydrocarbons separated (Fig. 4).*

## Hydrocarbon separation

In the rich-amine side of the process, a rich-side liquid/liquid coalescer, as proposed here, will perform a dual role:

- 100% rich-side filtration to remove solid particles, mainly FeS corrosion products.
- Elimination of free-hydrocarbons in the downstream process to near solubility level.

As an example, Pall's PhaseSep coalescer is a multiple-stage system starting with prefiltration (Fig. 3) that will remove particulate matter, provide protection, and pre-condition the feed to the coalescer. The coalescence stage that follows breaks the emulsion and allows the capture of dispersed hydrocarbon phase droplets, resulting in the separation of the two dissimilar streams.

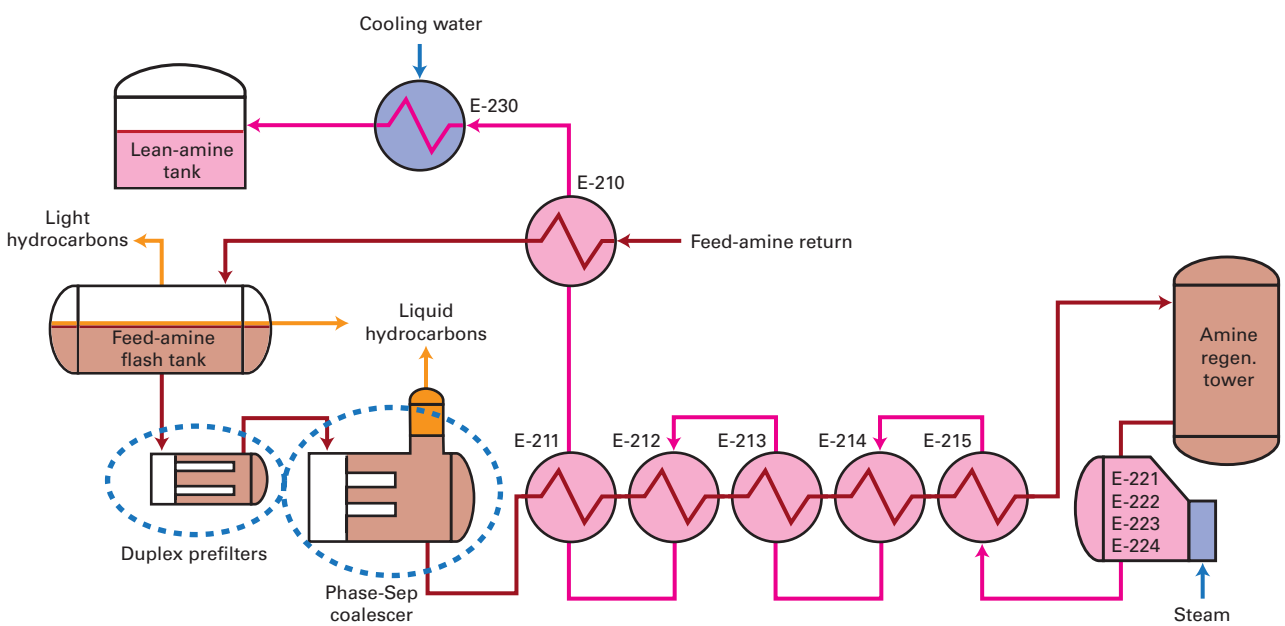
Phase separation liquid/liquid coalescers operate over a range of conditions, including where:

- The emulsion has an interfacial tension as low or lower than 5 dyne/cm. (PhaseSep coalescers have been applied in applications with an IFT as low as 0.5 dyne/cm.)
- The dispersed phase fluid is hydrocarbon, and continuous phase is aqueous (amine).

There are three essential steps to

## MARSULEX AMINE UNIT FLOW

Fig. 5



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achieving an efficient liquid/liquid separation:

*Stage 1: Prefiltration.* A rich-side full-flow prefilter is essential to protect and provide maximum operating life to the liquid/liquid coalescer. At the same time, and more importantly, 100% rich-side filtration prevents passage of suspended solids that may deposit in downstream equipment such as rich/lean heat exchangers, column packing or trays, and reboilers.

*Stage 2: Coalescence.* The two-phase liquid emulsion enters the coalescing element and flows inside-to-outside. This is where small, suspended droplets of the dissimilar fluid coalesce as the emulsion moves through a proprietary, specially formulated coalescer medium.

*Stage 3: Separation.* The coalesced dispersed phase separates in the settling zone of the coalescer housing. Due to the density difference on the two phases, these separated liquids exit through separate drain and outlet connections at the back end of the liquid/liquid coalescer housing.

*These are duplex Ultipleat high-flow, rich-amine filters (Fig. 6).*

## Marsulex experience

Up until 2004, the Marsulex amine unit was relatively reliable. Although it never had to be shut down for unplanned maintenance, its efficiency and maintenance costs were affected by amine contamination. The residence time of the flash drum was 22 min on average, with a design residence time of 19 min. This was sufficient to handle most hydrocarbon carryover conditions.

A simple particle filter assembly was installed on a 15-20% cleanup loop on the lean-amine side. It offered partial filtration of the lean amine before the refineries' contactors but no protection for the Marsulex amine unit and sulfur plant.

Following the planned 2006 expansion project, the maximum amine recirculation flow capacity would increase and therefore reduce the residence time in the flash drum. The operational residence time would be reduced to 13 min (at operating liquid level) or 9 min (at 50% liquid level). This was considered insufficient to separate liquid hydrocarbon from the amine adequately, raising concerns about the reliability of the plant under the new operating regime.

In preparation, Marsulex invited Pall to perform an on site demonstration of rich-side full-flow prefiltration and liquid/liquid coalescence. Testing performed during the fall of 2004 helped better define the contamination at the outlet of the existing flash drum. The site trials also validated the effectiveness of rich-side filtration and confirmed the efficiency of the liquid/liquid coalescer technology at separating hydrocarbons from rich-amine.

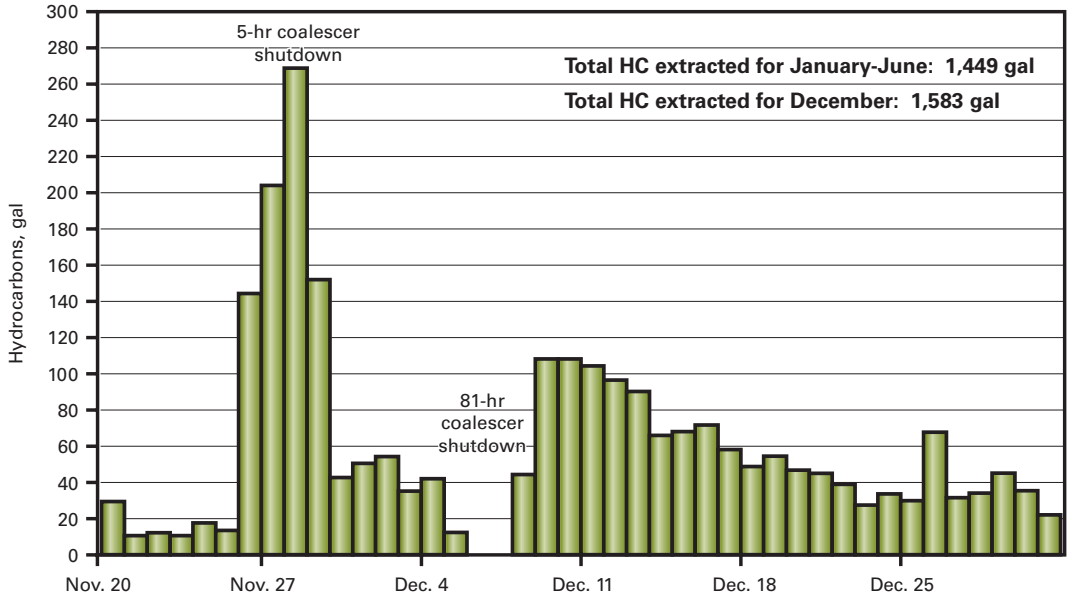
*This is a PhaseSep liquid/liquid coalescer unit (Fig. 7).*

During on site testing, the following were observed:

1. Even with adequate flash drum residence time, hydrocarbon/amine emulsion remained stable, as shown by rich-amine samples remaining hazy for longer than 3 weeks (Fig. 4, Sample B). Pall's high-efficiency PhaseSep liquid/liquid coalescer was capable of breaking and separating this emulsion in a single pass.

COALESCER F-212 EXTRACTION: 2007

Fig. 8




2. Rich-amine particulate concentrations vary substantially depending on the refinery's operating conditions at a given point in time. Using a 10-µm absolute-rated filter (Beta10 µm = 5,000) helped reduce suspended solids to concentrations near or less than 1 ppmw.

3. Hydrocarbon ($C_5$ to $C_{60}$) levels found upstream of the liquid/liquid coalescer pilot unit ranged 86-193 ppmw and included low levels of benzene, toluene, ethylbenzene, and xylene. Pall's PhaseSep liquid/liquid coalescer reduced overall hydrocarbon to near solubility in amine, based on a total extractable hydrocarbon analysis, using a Horuba Oil Content Analyzer (extractive infrared analyzer).

4. The average solids loading at the outlet of the flash tank (inlet of the rich-side filter) was 5 ppmw, with the lowest data point being 2 ppmw and the highest being 10 ppmw. The average solids loading at the outlet of the filter was <1 ppmw, having a range of values from nondetectable to 2 ppmw.

Based on the field trial results, Marsulex decided to install a full-flow, duplex filtration package followed by a full-flow high-performance PhaseSep liquid/liquid coalescer unit (Figs. 5-7).

## Operating data

The rich-side filter and coalescer units were installed early in 2006 and started up in June of that year. Before start-up of the equipment, the rich-amine was hazy and had a green-gray color at the outlet of the flash tank.

Since the unit has been in operation, amine samples at the outlet of the filtration and coalescing system are clear and bright, exhibiting the characteristic light straw color of a clean amine, as seen in Fig. 4, Sample C.

It was observed that, both in amine analysis and overall process stability, amine quality has improved. The most significant improvement has been in the consistently low concentration of suspended solids. Before the rich-side filtration coming on-line, total suspended solids in the circuit would reach 30 ppmw. Today, solids are found to be 1 ppmw on average, downstream of the rich-side filter.

With the liquid/liquid coalescer in place, the continuous low-level hydrocarbon ingression is being removed everyday. More critically, when episodic hydrocarbon spikes occur, the liquid/liquid coalescer responds immediately by separating the liquid hydrocarbon slugs, preventing circuit contamination, and maintaining circuit stability.

## Upset

Since start-up of the rich-side filters and liquid/liquid coalescers, there has only been one major hydrocarbon carryover to the sulfur-recovery unit and one major foaming incident at the refinery contactors.

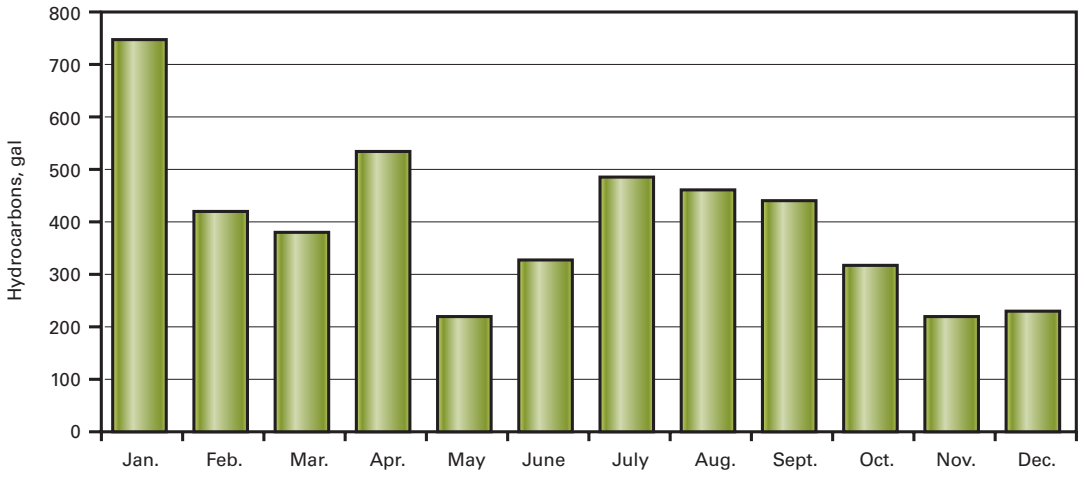
On the first occasion, an upset occurred at the time when the filters and liquid/liquid coalescer were bypassed for filter element changeout. This was during a period of very high solids, and filter life was short.

The event should have been a warning for the larger hydrocarbon spike that followed. Following the 5-hr shutdown to replace the filter elements, it took 3 days and eight filter replacements to clean the particles and hydrocarbon out of the amine loop and restore stability.

The second incident was most likely due to hydrocarbon contamination of

COALESCER F-212 EXTRACTION: 2008

Fig. 9




the amine during a coalescer shutdown. Given the system is a closed loop, however, it cleaned up and recovered once the coalescer was returned to service.

Employing the best practice of rich-side filtration and hydrocarbon coalescence proved the system can, and will, recover quickly. The alternative is unchecked contamination of the circuit that conventional separations techniques are inadequate at addressing (Figs. 8 and 9).

Since December 2007, the system has been operating without requiring coalescer shutdown. In February 2009, there was another major hydrocarbon carryover from one of the refineries. This time the coalescer extracted 840 gal (20 bbl) of hydrocarbon liquid over 2 days. High solids did not accompany this event, and the filter did not plug prematurely. With the separation train remaining online, there was no impact on the amine loop and the situation returned to normal as soon as the hydrocarbon contamination source was located and the cause for the discharge addressed.

To date, the amine heat exchanger train, reboilers, and regenerator tower have been performing without any need for shutdown. Unfortunately, we cannot compare performance before and after installation of the rich-side equipment because the entire circuit was significantly modified during the 2006 project. Marsulex can confirm, however, the general fouling tendency is greatly reduced compared with before the filtration unit start-up.

Today, Marsulex is projecting a 3-year or better turnaround schedule for the entire heat-exchanger train. The reboiler cleaning schedule will be based on the trends revealed from Marsulex's monitoring program.

## Process benefits

The most important benefit that the system provides is an increase in overall reliability of the amine system and sulfur plant. While the system's ability to allow for quick recovery after a particulate and-or hydrocarbon contamination event—which keeps the system performing at capacity—is the primary benefit, the operating costs are also greatly improved due to longer time between cleaning and better hydrocarbon recovery.

The lean/rich exchangers cleaning frequency has returned to a preventative maintenance schedule: five in 3 years vs. a required eight in 3 years due to significant fouling of the heat exchanger train.

Over time, Marsulex will reassess the schedule based on inspections. The frequency reduction is expected to save a minimum of $100,000 on maintenance costs. This is in addition to the energy savings realized with reduced steam consumption in the regenerator reboiler (not calculated here).

The liquid/liquid coalescer allowed greater liquid hydrocarbon recovery when compared to the flash drum alone. On average, the amount of liquid hydrocarbon recovered increased by 25%. For example, in 2008, this resulted in recovery of an

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additional 4,830 gal (115 bbl) of liquid hydrocarbon.

This offsets fuel costs because the recovered oil is now being fed to a boiler. Most importantly, removal of this volume of hydrocarbon ensures amine circuit stability, and protection of the downstream sulfur plant. ✦

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## NELSON-FARRAR COST INDEXES

**Refinery construction (1946 basis)**
*(Explained in OGJ, Dec. 30, 1985, p. 145)*

| | 1962 | 1980 | 2006 | 2007 | 2008 | Sept. 2008 | Aug. 2009 | Sept. 2009 |
|---|---|---|---|---|---|---|---|---|
| *Pumps, compressors, etc.* | 222.5 | 777.3 | 1,758.2 | 1,844.4 | 1,949.8 | 1,976.0 | 2,009.0 | 2,012.8 |
| *Electrical machinery* | 189.5 | 394.7 | 520.2 | 517.3 | 515.6 | 517.3 | 515.9 | 515.9 |
| *Internal-comb. engines* | 183.4 | 512.6 | 959.7 | 974.6 | 990.9 | 992.2 | 1,030.0 | 1,029.4 |
| *Instruments* | 214.8 | 587.3 | 1,166.0 | 1,267.9 | 1,342.1 | 1,364.0 | 1,390.5 | 1,396.4 |
| *Heat exchangers* | 183.6 | 618.7 | 1,162.7 | 1,342.2 | 1,354.6 | 1,374.7 | 1,253.8 | 1,253.8 |
| *Misc. equip. average* | 198.8 | 578.1 | 1,113.3 | 1,189.3 | 1,230.6 | 1,244.8 | 1,239.9 | 1,241.7 |
| *Materials component* | 205.9 | 629.2 | 1,273.5 | 1,364.8 | 1,572.0 | 1,689.9 | 1,345.0 | 1,368.9 |
| *Labor component* | 258.8 | 951.9 | 2,497.8 | 2,601.4 | 2,704.3 | 2,742.8 | 2,822.1 | 2,830.9 |
| *Refinery (Inflation) Index* | 237.6 | 822.8 | 2,008.1 | 2,106.7 | 2,251.4 | 2,321.7 | 2,231.2 | 2,246.1 |

**Refinery operating (1956 basis)**
*(Explained in OGJ, Dec. 30, 1985, p. 145)*

| | 1962 | 1980 | 2006 | 2007 | 2008 | Sept. 2008 | Aug. 2009 | Sept. 2009 |
|---|---|---|---|---|---|---|---|---|
| *Fuel cost* | 100.9 | 810.5 | 1,569.0 | 1,530.7 | 1,951.3 | 1,921.1 | 954.7 | 867.4 |
| *Labor cost* | 93.9 | 200.5 | 204.2 | 215.8 | 237.9 | 292.9 | 258.2 | 258.9 |
| *Wages* | 123.9 | 439.9 | 1,015.4 | 1,042.8 | 1,092.2 | 1,157.9 | 1,158.1 | 1,190.5 |
| *Productivity* | 131.8 | 226.3 | 497.5 | 483.4 | 460.8 | 395.3 | 448.5 | 459.8 |
| *Invest., maint., etc.* | 121.7 | 324.8 | 743.7 | 777.4 | 830.8 | 856.7 | 817.3 | 822.7 |
| *Chemical costs* | 96.7 | 229.2 | 365.4 | 385.9 | 472.5 | 534.8 | 403.9 | 422.1 |
| Operating indexes | | | | | | | | |
| *Refinery* | 103.7 | 312.7 | 579.0 | 596.5 | 674.1 | 709.3 | 580.0 | 576.4 |
| *Process units** | 103.6 | 457.5 | 870.7 | 872.6 | 1,045.1 | 1,060.1 | 697.6 | 669.2 |

**Add separate index(es) for chemicals, if any are used. See current Quarterly Costimating, first issue, months of January, April, July, and October.*

*These indexes are published in the first issue of each month. They are compiled by Gary Farrar, OGJ Contributing Editor.*

*Indexes of selected individual items of equipment and materials are also published on the Costimating page in the first issue of the months of January, April, July, and October.*

## INDEXES FOR SELECTED EQUIPMENT ITEMS

| Date | Materials component | Labor component | Misc. equipment | Nelson-Farrar inflation index | Date | Materials component | Labor component | Misc. equipment | Nelson-Farrar inflation index | Date | Materials component | Labor component | Misc. equipment | Nelson-Farrar inflation index |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1926 | 87.7 | 61.5 | 94.0 | 72.0 | 1955 | 176.1 | 189.6 | 161.5 | 184.2 | 1983 | 712.4 | 1,234.8 | 656.8 | 1,025.8 |
| 1928 | 93.2 | 64.5 | 89.0 | 71.0 | 1956 | 190.4 | 198.2 | 180.5 | 195.3 | 1984 | 735.3 | 1,278.1 | 665.6 | 1,061.0 |
| 1929 | 83.2 | 64.5 | 87.0 | 72.0 | 1957 | 201.9 | 208.6 | 192.1 | 205.9 | 1985 | 739.6 | 1,297.6 | 673.4 | 1,074.4 |
| 1930 | 76.0 | 66.5 | 84.0 | 70.3 | 1958 | 204.1 | 220.4 | 192.4 | 213.9 | 1986 | 730.0 | 1,330.0 | 684.4 | 1,089.9 |
| 1931 | 72.2 | 60.0 | 82.0 | 64.9 | 1959 | 207.8 | 231.6 | 196.1 | 222.1 | 1987 | 748.9 | 1,370.0 | 703.1 | 1,121.5 |
| 1932 | 68.0 | 49.0 | 79.0 | 56.6 | 1960 | 207.6 | 241.9 | 200.0 | 228.1 | 1988 | 802.8 | 1,405.6 | 732.5 | 1,164.5 |
| 1933 | 68.3 | 49.0 | 76.0 | 56.7 | 1961 | 207.7 | 249.4 | 199.5 | 232.7 | 1989 | 829.2 | 1,440.4 | 769.9 | 1,195.9 |
| 1934 | 73.5 | 55.5 | 74.0 | 62.7 | 1962 | 205.9 | 258.8 | 198.8 | 237.6 | 1990 | 832.8 | 1,487.7 | 797.5 | 1,225.7 |
| 1935 | 74.3 | 55.0 | 76.0 | 62.7 | 1963 | 206.3 | 268.4 | 201.4 | 243.6 | 1991 | 832.3 | 1,533.3 | 827.5 | 1,252.9 |
| 1936 | 78.2 | 60.0 | 77.0 | 67.3 | 1964 | 209.6 | 280.5 | 206.8 | 252.1 | 1992 | 824.6 | 1,579.2 | 837.6 | 1,277.3 |
| 1937 | 86.7 | 66.5 | 80.0 | 74.6 | 1965 | 212.0 | 294.4 | 211.6 | 261.4 | 1993 | 846.7 | 1,620.2 | 842.8 | 1,310.8 |
| 1938 | 84.7 | 71.5 | 81.0 | 76.8 | 1966 | 216.2 | 310.9 | 220.9 | 273.0 | 1994 | 877.2 | 1,664.7 | 851.1 | 1,349.7 |
| 1939 | 82.0 | 73.0 | 82.0 | 76.6 | 1967 | 219.7 | 331.3 | 226.1 | 266.7 | 1995 | 918.0 | 1,708.1 | 879.5 | 1,392.1 |
| 1940 | 82.2 | 74.5 | 83.0 | 77.6 | 1968 | 224.1 | 357.4 | 228.8 | 304.1 | 1996 | 917.1 | 1,753.5 | 903.5 | 1,418.9 |
| 1941 | 84.5 | 77.0 | 84.0 | 80.0 | 1969 | 234.9 | 391.8 | 239.3 | 329.0 | 1997 | 923.9 | 1,799.5 | 910.5 | 1,449.2 |
| 1942 | 86.2 | 82.0 | 85.0 | 83.7 | 1970 | 250.5 | 441.1 | 254.3 | 364.9 | 1998 | 917.5 | 1,851.0 | 933.2 | 1,477.6 |
| 1943 | 86.7 | 86.5 | 86.0 | 86.6 | 1971 | 265.2 | 499.9 | 268.7 | 406.0 | 1999 | 883.5 | 1,906.3 | 920.3 | 1,497.2 |
| 1944 | 87.6 | 88.5 | 88.0 | 88.1 | 1972 | 277.8 | 545.6 | 278.0 | 438.5 | 2000 | 896.1 | 1,973.7 | 917.8 | 1,542.7 |
| 1945 | 89.7 | 90.0 | 90.0 | 89.9 | 1973 | 292.3 | 585.2 | 291.4 | 468.0 | 2001 | 877.7 | 2,047.7 | 939.3 | 1,579.7 |
| 1946 | 100.0 | 100.0 | 100.0 | 100.0 | 1974 | 373.3 | 623.6 | 361.8 | 522.7 | 2002 | 899.7 | 2,137.2 | 951.3 | 1,642.2 |
| 1947 | 122.4 | 113.5 | 114.2 | 117.0 | 1975 | 421.0 | 678.5 | 415.9 | 575.5 | 2003 | 933.8 | 2,228.1 | 956.7 | 1,710.4 |
| 1948 | 139.5 | 128.0 | 122.1 | 132.5 | 1976 | 445.2 | 729.4 | 423.8 | 615.7 | 2004 | 1,112.7 | 2,314.2 | 993.8 | 1,833.6 |
| 1949 | 143.6 | 137.1 | 121.6 | 139.7 | 1977 | 471.3 | 774.1 | 438.2 | 653.0 | 2005 | 1,179.8 | 2,411.6 | 1,062.1 | 1,918.8 |
| 1950 | 149.5 | 144.0 | 126.2 | 146.2 | 1978 | 516.7 | 824.1 | 474.1 | 701.1 | 2006 | 1,273.5 | 2,497.8 | 1,113.3 | 2,008.1 |
| 1951 | 164.0 | 152.5 | 145.0 | 157.2 | 1979 | 573.1 | 879.0 | 515.4 | 756.6 | 2007 | 1,364.8 | 2,601.4 | 1,189.3 | 2,106.7 |
| 1952 | 164.3 | 163.1 | 153.1 | 163.6 | 1980 | 629.2 | 951.9 | 578.1 | 822.8 | 2008 | 1,572.0 | 2,704.3 | 1,230.6 | 2,251.4 |
| 1953 | 172.4 | 174.2 | 158.8 | 173.5 | 1981 | 693.2 | 1,044.2 | 647.9 | 903.8 | | | | | |
| 1954 | 174.6 | 183.3 | 160.7 | 179.8 | 1982 | 707.6 | 1,154.2 | 662.8 | 976.9 | | | | | |

# Yearly refinery construction indexes listed for 80+ years

*Gary Farrar*
*Contributing Editor*

Here are yearly values for the Nelson-Farrar refinery inflation cost index since 1926 (see tabulation above).

They are based on 1946 as 100, since that was the date of index inception. Values from 1926 to 1945 were back-calculated. ✦

## ITEMIZED REFINING COST INDEXES

The cost indexes may be used to convert prices at any date to prices at other dates by ratios to the cost indexes of the same date. Item indexes are published each quarter (first week issue of January, April, July, and October). In addition the Nelson Construction and Operating Cost Indexes are published in the first issue of each month of Oil & Gas Journal.

| Operating cost (based on 1956 = 100.0): | 1954 | 1972 | 2006 | 2007 | 2008 | Aug. 2009 | *References | Index for earlier year in Costimating and Questions on Technology issues |
|---|---|---|---|---|---|---|---|---|
| Power, industrial electrical | 98.5 | 131.2 | 850.2 | 8,97.3 | 939.2 | 964.4 | Code 0543 | No. 13, May 19, 1958, p. 181 |
| Fuel, refinery price | 85.5 | 152.0 | 1,523.6 | 1,497.0 | 1,821,7 | 908.5 | OGJ | No. 4, Mar. 17, 1958, p. 190 |
| Gulf cargoes | 85.0 | 130.4 | 2,023.9 | 1,968.0 | 2,755.5 | 1,974.4 | OGJ | No. 4, Mar. 17, 1958, p. 190 |
| NY barges | 82.6 | 169.6 | 1,837.5 | 2,066.9 | 2,829.7 | 2,427.2 | OGJ | No. 4, Mar. 17, 1958, p. 190 |
| Chicago low sulfur | — | — | 1,765.8 | 2,046.7 | 2,754.0 | 2,473.5 | OGJ | July 7, 1975, p. 72 |
| Western US | 84.3 | 168.1 | 2,358.1 | 2,704.2 | 3,642.4 | 3,161.7 | OGJ | No. 4, Mar. 17, 1958, p. 190 |
| Central US | 60.2 | 128.1 | 1,765.9 | 1,886.9 | 2,615.7 | 2,186.9 | OGJ | No. 4, Mar. 17, 1958, p. 190 |
| Natural gas at wellhead | 83.5 | 190.3 | 6,306.5 | 6,118.7 | 7,260.5 | 3,043.5 | Code 531-10-1 | No. 4, Mar. 17, 1958, p. 190 |
| Inorganic chemicals | 96.0 | 123.1 | 686.8 | 743.6 | 1,044.9 | 986.1 | Code 613 | Oct. 5, 1964, p. 149 |
| Acid, hydrofluoric | 95.5 | 144.4 | 414.9 | 414.9 | 414.9 | 414.9 | Code 613-0222 | Apr. 1, 1963, p. 119 |
| Acid, sulfuric | 100.0 | 140.7 | 397.4 | 397.4 | 397.4 | 439.1 | Code 613-0281 | No. 94, May 15, 1961, p. 138 |
| Platinum | 92.9 | 121.1 | 1,344.5 | 1,557.8 | 1,524.5 | 1,020.6 | Code 1022-02-73 | July 5, 1965, p. 117 |
| Sodium carbonate | 90.9 | 119.4 | 452.4 | 490.1 | 688.5 | 649.8 | Code 613-01-03 | No. 58, Oct. 12, 1959, p. 186 |
| Sodium hydroxide | 95.5 | 136.2 | 620.1 | 671.6 | 943.4 | 890.7 | Code 613-01-04 | No. 94, May 15, 1961, p. 138 |
| Sodium phosphate | 97.4 | 107.0 | 733.7 | 733.7 | 733.7 | 733.7 | Code 613-0267 | No. 58, Oct. 12, 1959, p. 186 |
| Organic chemicals | 100.0 | 87.4 | 764.5 | 799.9 | 958.1 | 797.5 | Code 614 | Oct. 5, 1964, p. 149 |
| Furfural | 94.5 | 137.5 | 1,103.1 | 1,174.1 | 1,382.7 | 1,150.8 | Chemical Marketing Reporter | No. 58, Oct. 12, 1959, p. 186 |
| MEK, tank-car lots | 82.6 | 87.5 | 625.0 | 625.0 | 625.0 | 625.0 | Reporter | |
| Phenol | 90.4 | 47.1 | 374.9 | 413.0 | 479.4 | 500.3 | Code 614-0241 | No. 58, Oct. 12, 1959, p. 186 |

## ITEMIZED REFINING COST INDEXES

| Operating cost (based on 1956 = 100.0): | 1954 | 1972 | 2006 | 2007 | 2008 | Aug. 2009 | *References | Index for earlier year in Costimating and Questions on Technology issues |
|---|---|---|---|---|---|---|---|---|
| *Operating labor cost (1956 = 100)* | | | | | | | | |
| Wages & benefits | 88.7 | 210.0 | 1,015.4 | 1,042.8 | 1,092.2 | 1,158.1 | Employ & Earn | No. 41, Feb. 16, 1969 |
| Productivity | 97.2 | 197.0 | 497.5 | 483.4 | 460.8 | 448.5 | Employ & Earn | No. 41, Feb. 16, 1969 |
| *Construction labor cost (1946 = 100)* | | | | | | | | |
| Skilled const. | 174.6 | 499.9 | 2,240.7 | 2,344.4 | 2,434.3 | 2,534.4 | Eng. News Record | No. 55, Nov. 3, 1949 |
| Common labor | 192.1 | 630.6 | 2,971.7 | 3,083.0 | 3,200.4 | 3,356.2 | Eng. News Record | No. 55, Nov. 3, 1949 |
| Refinery cost | 183.3 | 545.9 | 2,497.8 | 2,601.4 | 2,704.3 | 2,822.1 | OGJ | May 15, 1967, p. 97 |
| *Equipment or materials (1946 = 100):* | | | | | | | | |
| Bubble tray | 161.4 | 324.4 | 1,484.0 | 1,561.4 | 1,737.8 | 1,569.3 | Computed | July 8, 1962, p. 113 |
| Building materials (nonmetallic) | 143.6 | 212.4 | 969.6 | 1,003.2 | 1,065.3 | 1,084.6 | Code 13 | No. 61, Dec. 15, 1949 |
| Brick—building | 144.7 | 252.5 | 1,408.6 | 1,429.1 | 1,427.6 | 1,422.3 | Code 1342 | No. 20, Mar. 3, 1949 |
| Brick—fireclay | 193.1 | 322.8 | 1,540.5 | 1,616.2 | 1,742.9 | 1,892.5 | Code 135 | May 30, 1955, p. 104 |
| Castings, iron | 188.1 | 274.9 | 1,351.3 | 1,414.3 | 1,576.6 | 1,533.1 | Code 1015 | Apr. 1, 1963, p. 119 |
| Clay products (structural, etc.) | 159.1 | 342.0 | 951.6 | 963.2 | 972.9 | 965.8 | Code 134 | No. 20, Mar. 3, 1949 |
| Concrete ingredients | 141.1 | 218.4 | 1,092.0 | 1,172.2 | 1,231.3 | 1,259.8 | Code 132 | No. 22, Mar. 17, 1949 |
| Concrete products | 138.5 | 199.6 | 921.1 | 961.6 | 997.3 | 1,005.8 | Code 133 | Oct. 2, 1967, p. 112 |
| Electrical machinery | 159.9 | 216.3 | 520.2 | 517.3 | 515.6 | 515.9 | Code 117 | May 2, 1955, p. 104 |
| Motors and generators | 157.7 | 211.0 | 880.3 | 917.1 | 964.2 | 995.6 | Code 1173 | May 2, 1955, p. 104 |
| Switchgear | 171.2 | 271.0 | 1,147.3 | 1,212.2 | 1,254.4 | 1,295.0 | Code 1175 | May 2, 1955, p. 104 |
| Transformers | 161.9 | 149.3 | 612.5 | 696.9 | 766.4 | 743.3 | Code 1174 | No. 31, May 19, 1949 |
| Engines (combustion) | 150.5 | 233.3 | 959.7 | 974.6 | 990.9 | 1,030.0 | Code 1194 | No. 36, June 23, 1949 |
| Exchangers (composite) | 171.7 | 274.3 | 1,162.7 | 1,342.2 | 1,354.6 | 1,253.8 | Manufacturer | Mar. 16, 1964, p. 154 |
| Copper base | 190.7 | 266.7 | 1,059.4 | 1,201.8 | 1,221.6 | 1,161.0 | Manufacturer | Mar. 16, 1964, p. 154 |
| Carbon steel | 156.8 | 281.9 | 1,162.1 | 1,344.7 | 1,369.2 | 1,287.3 | Manufacturer | Mar. 16, 1964, p. 154 |
| Stainless steel (304) | — | — | 1,174.8 | 1,322.1 | 1,319.5 | 1,183.0 | Manufacturer | July 1, 1991, p. 58 |
| Fractionating towers | 151.0 | 278.5 | 1,207.2 | 1,274.3 | 1,379.5 | 1,333.0 | Computed | June 8, 1963, p. 133 |
| Hand tools | 173.8 | 346.5 | 1,792.5 | 1,830.6 | 1,918.2 | 1,991.8 | Code 1042 | June 27, 1955 |
| Instruments (composite) | 154.6 | 328.4 | 1,166.0 | 1,267.9 | 1,342.1 | 1,390.5 | Computed | No. 34, June 9, 1949 |
| Insulation (composite) | 198.5 | 272.4 | 2,257.4 | 2,258.6 | 2,213.1 | 2,183.0 | Manufacturer | July 4, 1988, p. 193 |
| Lumber (composite): | 197.8 | 353.4 | 1,309.8 | 1,204.1 | 1,134.5 | 1,064.4 | Code 81 | No. 7, Dec. 2, 1948 |
| Southern pine | 181.2 | 303.9 | 984.3 | 846.4 | 780.3 | 741.1 | Code 81102 | No. 7, Dec. 2, 1948 |
| Redwood, all heart | 238.0 | 310.6 | 1,948.1 | 1,744.3 | 1,607.9 | 1,526.7 | Code 811-0332 | July 5, 1965, p. 117 |
| Machinery | | | | | | | | |
| General purpose | 159.9 | 278.5 | 1,213.7 | 1,271.8 | 1,338.9 | 1,375.6 | Code 114 | Feb. 17, 1949 |
| Construction | 165.9 | 324.4 | 1,559.7 | 1,594.4 | 1,645.6 | 1,693.5 | Code 112 | Apr. 1, 1968, p. 184 |
| Oil field | 161.9 | 269.1 | 1,599.1 | 1,715.8 | 1,858.8 | 1,866.2 | Code 1191 | Oct. 10, 1955, p. 267 |
| Paints—prepared | 159.0 | 231.8 | 1,040.8 | 1,078.5 | 1,150.1 | 1,221.7 | Code 621 | May 16, 1955, p. 117 |
| Pipe | | | | | | | | |
| Gray iron pressure | 195.0 | 346.9 | 2,687.9 | 2,730.8 | 2,865.0 | 2,983.8 | Code 1015-0239 | Jan. 3, 1983, p. 76 |
| Standard carbon | 182.7 | 319.9 | 2,306.9 | 2,299.2 | 2,904.9 | 2,377.0 | Code 1017-0611 | Jan. 3, 1983, p. 76 |
| Pumps, compressors, etc. | 166.5 | 337.5 | 1,758.2 | 1,758.4 | 1,949.8 | 2,009.0 | Code 1141 | No. 29, May 5, 1949 |
| Steel-mill products | 187.1 | 330.6 | 1,527.5 | 1,620.0 | 1,973.5 | 1,454.7 | Code 1017 | Jan. 3, 1983, p. 73 |
| Alloy bars | 198.7 | 349.4 | 1,311.8 | 1,239.7 | 1,469.8 | 1,137.5 | Code 1017-0831 | Apr. 1, 1963, p. 119 |
| Cold-rolled sheets | 187.0 | 365.5 | 1,658.4 | 1,916.6 | 1,935.6 | 1,475.3 | Code 1017-0711 | Jan. 3, 1983, p. 73 |
| Alloy sheets | 177.0 | 225.9 | 862.4 | 996.7 | 1,006.6 | 766.9 | Code 1017-0733 | Jan. 3, 1983, p. 73 |
| Stainless strip | 169.0 | 221.2 | 920.7 | 1,064.2 | 1,074.7 | 819.0 | Code 1017-0755 | Jan. 3, 1983, p. 73 |
| Structural carbon, plates | 193.4 | 386.7 | 1,766.6 | 1,945.3 | 2,383.6 | 1,788.1 | Code 1017-0400 | Jan. 3, 1983, p. 73 |
| Welded carbon tubing | 180.0 | 265.5 | 2,337.3 | 2,329.6 | 2,943.2 | 2,408.4 | Code 1017-0622 | Jan. 3, 1983, p. 73 |
| Tanks and pressure vessels | 147.3 | 246.4 | 1,014.3 | 1,076.4 | 1,160.7 | 1,142.2 | Code 1072 | No. 5, Nov. 18, 1949 |
| Tube stills | 123.0 | 125.3 | 579.9 | 612.0 | 714.1 | 582.8 | Computed | Oct. 1, 1962, p. 85 |
| Valves and fittings | 197.0 | 350.9 | 1,839.6 | 1,943.9 | 2,048.8 | 2,125.3 | Code 1149 | No. 46, Sept. 1, 1940 |
| *Nelson-Farrar Refinery (Inflation Index)* | | | | | | | | |
| (1946) | 179.8 | 438.5 | 2,008.1 | 2,106.7 | 2,251.4 | 2,231.2 | OGJ | May 15, 1969 |
| *Nelson-Farrar Refinery Operation* | | | | | | | | |
| (1956) | 88.7 | 118.5 | 579.0 | 596.5 | 674.2 | 580.0 | OGJ | No. 2, Mar. 3, 1958, p. 167 |
| *Nelson-Farrar Refinery Process* | | | | | | | | |
| (1956) | 88.4 | 147.0 | 870.7 | 872.6 | 1,045.1 | 697.6 | OGJ | No. 2, Mar. 3, 1958, p. 167 |

*Code refers to the index number of the Bureau of Statistics, US Department of Labor, "Wholesale Prices" Itemized Cost Indexes, Oil & Gas Journal.

Excavating pipe without damaging it requires purpose-built tools such as this half-moon shoe cut to fit the pipe's OD (Fig. 1).

# Pipeline operators underusing potential pipeline rehabilitation

**David Howell**
*Pipeline Equities*
*Houston*


By selling recovered line pipe into the structural market instead of rehabilitating it for its own use, the pipeline industry is underusing a potentially valuable asset.

The cost of new 8.625-in. OD steel pipe runs as high as $25/ft. The same size and grade can be excavated for less than one-third the cost. This article examines the factors affecting potential recovery and rehabilitation of retired line pipe.

## Background

An 8.625-in OD pipeline was laid in 1920 near Tulsa to transport crude oil from a new field to a tank farm 40 miles away. The field depleted within a few years, but in the late 1920s, the pipeline was recovered from Oklahoma and transported to the Permian basin in Texas to transport new crude oil to a tank farm.

Originally, pipelayers spread the line out in 20-ft sections kicked off of wagons pulled by teams of mules into a man-made ditch. Five-ft chain tongs and 48-in. pipe wrenches sufficiently tightened joints, individually screwed together at 20-ft intervals, to hold back up. This practice led to a pipe collar visible on the outside of the pipe showing a connection every 20 ft. The pipe often disconnected during attempts to recover it from the ditch in Oklahoma.

Oxyacetylene welds were strong enough by the late 1920s to keep the needed pressure on the pipeline for low-pressure crude transportation, though they were not as strong as the pipe wall. Such weld strength eliminated the need for two or three men with large pipe wrenches and chain tongs. Removal of the old collars and threads and beveling the surfaces facilitated the new oxyacetylene-weld jointing technique when the pipeline moved in 1928 from Oklahoma to Crane, Ward, and Winkler counties in Texas.

This pipeline went through three owners over time and was purchased for salvage in 2007. The fields and wells the pipe was intended to service had been depleted, and it was no longer viable as a pipeline where it was. A pipeline-recovery team removed the line and the operating company's marketing department found, despite a little wear, the pipeline retained the qualities of good Grade B steel. WT was intact and had little corrosion, making it suitable for transport of slurry from a copper mine in northern Mexico to the disposal site nearby. The owner plans to use it for as long as the mine is in operation

An additional 30-mile section was shipped to Vietnam as a water transportation pipeline near what is now Ho Chi Minh City. It will probably be in use there for another 40 years.

## Reuse rewards

Pipeline Equities in 2008 took up a 6.625-in. OD line in Central Louisiana in gas service for 9 years. The field was depleted and the landowner, using the land for timber, wanted the pipeline removed so he could use the right of way

to plant more trees. PE took up the line and transported it to Certified Pipe Service Inc.'s Houston yard where workers cleaned out paraffin from the interior, straightened the joints where needed, and removed the fusion-bonded epoxy coating from their exteriors.

PE then beveled the ends and sent the pipe to a recoating yard. It is now in service as a gas transmission line in Oklahoma, saving the customers 30% off the cost of new pipe.

An 8.625-in. OD pipeline relaid in the 1950s near Amarillo, Tex., used one of the first electric-weld constructions. In service until 5 years ago, the pipe's coating remained well bonded and the pipe itself in excellent condition. A customer wants the pipe taken up with minimal or no damage to the coating. PE estimates 15% damage to coating, an amount economically replaceable in the field with patches, taking up the pipe in 60-ft sections to decrease the number of welds and limit trucking expenses. The customer plans to relay the line for low-pressure natural gas service in the Permian basin.

Another Texas gas producer and pipeline company has a policy in place to purchase idled or abandoned lines for takeup and removal to its own system. On four occasions in the past 3 years, the company has excavated, 8, 6, and 12-in. OD line pipe from dormant systems, rehabilitated the pipe, and relaid it.

## Cost savings

A compelling reason to rehabilitate a pipeline is to get rid of the costs of keeping it in the ground. Miles of permanently idled pipeline are regularly patrolled by employees dedicated to the task. Other companies contract agents at even greater sums to answer "One Calls" or DOT calls flagging lines for construction or other identification purposes.

*Proper recycling requires proper removal and careful measurement of the pipe. These men are measuring from weld to weld to ensure correct cuts (Fig. 2).*

If the company maintains rights-of-way via mowing and general signage upkeep, the costs can be extraordinary. Judicial districts in many states assign ad valorem taxes, school taxes, county taxes, and state taxes to these properties. Theses taxes often go unquestioned and are paid accordingly. Incidental pipeline relocation expenses due to highway and subdivision expansion also seem to be simply passed off as a necessary cost of doing business.

## Regulatory incentives

Pipeline operators have long abandoned retired equipment in place, seeking to reduce maintenance and care, taxes, and upkeep while maintaining ownership of idled pipelines. Federal and state lawmakers and regulators, however, wish to end this practice and clearly define requirements for abandoning or idling out-of-use pipelines. Idled pipelines pose potential hazards to landowners and land users. New real estate developments in congested areas

*This machine at Certified Pipe Services' yard in Houston straightens recovered bowed or bent pipe (Fig. 3).*

*A beveling machine finishes the cut ends of a rehabilitated joint of pipe, required if the pipe is to be reused as pipeline (Fig. 4).*

often face pipeline relocation and identification issues, and landowners might be unaware of rights-of-way.

Pipeline companies will be required to remove pipelines if they are termed abandoned or if they are idled with demonstrated "intent to abandon" by lack of maintenance, removal of signage, failure to pay taxes due, etc. Regulators will require companies at least to identify dormant pipeline inventory and obtain permission from landowners before abandonment procedures of any sort.

Federal regulation remains pending, but at least one Texas legislator from Houston and another from the Fort Worth (Barnett shale) area will introduce a bill in an upcoming session of the state legislature requiring pipeline operators to notify landowners before abandonment and obtain permission from affected landowners.

## Removal procedures

Reusing pipelines relies on good maintenance of the line while in the ground and care during removal. Excavation should be performed by competent and experienced pipeline-recovery personnel.

Taking up a pipeline uses many of the same procedures as laying it. A specially equipped track hoe with a custom half-moon shoe attached excavates the pipe (Fig. 1). The shoe generally fits the diameter of the pipe without sharp edges that could damage the exterior of the pipe. A good hoe operator with the right shoe can unearth good pipe, while a poor or inexperienced pipeline excavator can turn the pipe into junk.

A side boom can occasionally lift the pipe out of the ditch, but more often the pipe is cut in 100 to 200 ft sections and dragged out of the ditch by a bulldozer. Dragging out too long a length will cause the pipe to bow or bend. After removal, a bulldozer backfills the excavation ditch and dresses the right-of-way.

A cutter cuts the pipe at connections in 20, 30, 40, or 60 ft intervals, depending on where the welds lie (Fig. 2). Most truck trailers can carry 40-45 ft pipe sections . Either torch or saw can cut the pipe, depending on preferences of the supervisor and potential fire hazards.

A front-end loader can load the pipe on trucks for transport. A track hoe with special forks can also perform this task. Tracks work better on the right-of-way than tires. Two or three pieces of equipment per crew, proper supervision, and competent personnel can remove most pipelines.

## Pipe rehabilitation

Most pipelines have some sort of coating. Removing it can occur either on site or at a cleaning yard. Responsible recovery crews have environmental certification and are educated to handle potentially hazardous coating waste. Checking the pipe for bends, bows, dents, and dings follows coating removal, as does confirmation of roundness and straightness.

Pipe separation separates the better pipe for shipment to customers or reuse from pipe that might need additional attention. Damages will occur no matter how competent an operator. The track hoe forks or shoe cant dent of ding the pipe during the removal process.

Intentionally bowed pipe needs to be straightened (Fig. 3). Customers want round, straight pipe, that is also more economical to load and transport. Reusing the pipe as line pipe requires

beveling each end where the pipe was cut during removal (Fig. 4). Recovery crews may be able to rehabilitate excavated pipelines at the removal site with portable dedenters, pipe straighteners, and beveling machines.

Performing pipe rehabilitation on site reduces the expense of pipe handling to a minimum. If necessary, however, pipe service yards in various parts of the country have the expertise and equipment to handle most jobs. If pipe coating has not been damaged beyond repair, pipe can go directly to a coating facility or threading facility, depending on its intended use.

*This 8-in. OD steel pipe used as bridge guards was reclaimed from a recovered pipeline installed in 1923 (Fig. 5).*

## Landowner relations

Care and handling of the landowner whose property will be crossed while retrieving the pipe is even more important than care and handling of the pipe itself. A landowner can either help greatly or impede recovery. Most right-of-way contracts grant the pipeline owner rights of removal, repair, ingress, egress, and so forth. But no landowner actually wants you on his or her property, raising the importance of having a skilled, experienced right-of-way agent on the job.

The best method when the operator owns the easement is to return the right-of-way to the landowner at the operator's expense. The landowner would like to have clear unencumbered title to his property; granting him that will help move the process along. Once the exchange of dollars comes into the picture, it becomes the basis for everything, and it is only a question of how much the operator is going to pay.

## Marketing

Tubular steel has many uses. Hundreds of thousands of tons/year enter the piling markets to shore up anything needing to be strengthened. Anything needing additional support along shorelines, piers for buildings, and bridge supports all use tubular steel derived from rehabilitated pipeline. Millions of tons went to China in the 1980-90s for use in the foundations of its extensive highway network.

More than 150 companies resell secondary and rehabilitated line pipe, each specializing in a particular area. One group of companies sells 25,000 ft/month of 16, 18, or 20-in. OD pipe as casing to oil and gas drilling contractors. Another 150,000 ft/month of 8.625 and 10.75-in. OD line enters the surface casing market for oil and gas operators.

Companies sell product to piling contractors and for use as culvert for roads and bridges. Still more retired pipe enters farm and ranch operations for use in corrals and cattle guards at gates.

Other users need center posts and columns for fences, barns, and other buildings. Flag poles, bridge, and guardrail applications consume thousands of tons/year (Fig. 5). But unless scrap prices rise dramatically, this market should be the last resort for pipeline-recovery applications. ✦

**The author**

*David Howell (davidhowell@pipelineequities.com) is principal of Pipeline Equities, conducting pipeline salvage and recovery as well as brokering and appraising pipelines. Howell is a designated senior right-of-way agent through the International Right of Way Association, holding environmental and acquisition-negotiation certifications. He earned a BA in political science at Texas A&M-Kingsville.*

## New pump jack uses magnet electric rotary motor

The new Mitey Titan pump jack uses a permanent magnet electric rotary motor that features large torque, low rotation speed, low noise, and high power.

The pump jack was developed and designed by Guizhou Aerospace Linquan Motor Co. Ltd., Guizhou, China, in conjunction with Zhejiang University, Hangzhou, China. Authorized distributors include MTech Industries, Edmonton, and Shanghai Grandway Telecom Tech Co. Ltd., Shanghai.

Features of the unit include high efficiency, long life span, simplicity in structure, ease of operation, light weight, and small area needed for installation and operation. The pump jack experiences what the firms say are power savings upwards of 50% due to motor and frequency conversion technology.

Additional components of the pumping unit are the frame and frequency conversion control devices. Mechanical transmission parts have been eliminated with the exception of the motor. The pump jack has direct drive, eliminating the need for a gearbox.

The motor is a three dimensional permanently magnetic electric type compounded by a novel double-plate electric motor and an external rotor electric motor. Utilizing know-how such as pole conversion, frequency conversion, new permanent magnetic materials, plate-panel electric motor, and the external-rotor electric motor in addition to improvements in structure, material, manufacturing technology, and the intelligent control system, this motor offers higher torque vs. existing low speed and high torque motors, the firms say.

The permanent magnet electric rotary motor works within the pumping unit's tower type structure and is supported by a cylindrical steel post. The motor directly drives the polished rod through the belt system. The stroke and stroke frequency of the rod are adjusted within a given range through a frequency conversion unit. A suspended weight is used as the balancing weight, and the base flange of the post is fixed to the foundation by bolts.

Source: **MTech Industries,** 6329 – 76 Ave., Edmonton, Alta. T6K 2T9.

## Trip coil monitor helps improve power system reliability

The newly released SEL-2652 trip coil monitor checks on the connections and circuit continuity of the circuit breaker trip coil and lockout relay to give power system operators confidence that the breaker is ready when needed.

The self-powered SEL-2652 indicates circuit breaker status with a clearly visible external LED and a contact output for alarms or SCADA.

The unit provides constant monitoring of the health of trip circuits and lockout relays with an easy-to-use, reliable device, the firm says.

Source: **Schweitzer Engineering Laboratories Inc.,** 2350 N.E. Hopkins Court, Pullman, WA 99163.

## M-I Swaco,

Houston, has acquired Cyclotech, a Basingstoke, UK-based water treatment and produced sand management company. The deal, terms of which aren't disclosed, is intended to enhance M-I Swaco's production technologies line and is complementary to its EPCON business.

Cyclotech, formed in 1994, specializes in produced water treatment and produced sand management products and process debottlenecking of oil and gas production.

M-I Swaco, jointly owned 60% by Smith International Inc. and 40% by Schlumberger Ltd., is a leading provider of a wide range of products and engineering services designed to deliver drilling and environmental solutions and wellbore productivity and production technologies.

## Schlumberger,

Paris, has announced an agreement with Rock Deformation Research Ltd. (RDR) to provide the RDR structural analysis module within the Petrel seismic-to-simulation workflow. It is the first Ocean partner plug-in to be released as a module with Petrel. The new RDR module enables comprehensive analysis of seal and trap. In addition to enhancing fault seal and structural analysis, the new module includes fault juxtaposition and property mapping capabilities, such as permeability prediction, clay mixing, and smearing algorithms. This module will be available for Petrel 2010 and will be exclusively sold and supported by Schlumberger Information Solutions.

RDR is a global leader in structural geology consultancy and research associated with deformation and fluid flow in the subsurface.

Schlumberger is the world's leading supplier of technology, integrated project management, and information solutions to the oil and gas industry worldwide.

## Helmerich & Payne Inc.,

Tulsa, has announced that Juan Pablo Tardio will be promoted to vice-president and CFO effective April 30, 2010, upon the retirement of current Executive Vice-Pres. and CFO Douglas E. Fears. Tardio began his H&P career in 2001 and took responsibility for investor relations in 2005. He was promoted to director of investor relations in January 2008. Tardio has a BS in industrial engineering and an MBA from the University of Houston. Fears served nearly 24 years with H&P, starting with the company in 1986 as an internal auditor. In 1988, he was elected vice-president and CFO and was promoted to executive vice-president in 2008.

H&P is primarily a contract drilling company, with a fleet of 247 land rigs and 9 offshore platform rigs.

## Transocean Ltd.,

Zug, Switzerland, has appointed Rob Saltiel executive vice-president and COO; he currently is executive vice-president, performance. Steven Newman, currently president and COO, will remain president until he takes over as CEO upon the retirement in early 2010 of current CEO Bob Long.

Transocean is the world's largest offshore drilling contractor and a leading provider of drilling management services worldwide.

## IMPORTS OF CRUDE AND PRODUCTS

| | Districts 1-4 12-11 2009 | Districts 1-4 12-4 2009 | District 5 12-11 2009 | District 5 12-4 2009 | Total US 12-11 2009 | Total US 12-4 2009 | Total US *12-12 2008 |
|---|---|---|---|---|---|---|---|
| | 1,000 b/d | | | | | | |
| Total motor gasoline | 930 | 700 | 37 | 50 | 967 | 750 | 802 |
| Mo. gas. blending comp. | 679 | 596 | 37 | 50 | 716 | 646 | 666 |
| Distillate | 229 | 185 | 0 | 0 | 229 | 185 | 175 |
| Residual | 302 | 188 | 28 | 39 | 330 | 227 | 276 |
| Jet fuel-kerosine | 28 | 37 | 29 | 59 | 57 | 96 | 45 |
| Propane-propylene | 179 | 135 | 8 | 8 | 187 | 143 | 291 |
| Other | 131 | 453 | 16 | 10 | 147 | 463 | 683 |
| **Total products** | **2,478** | **2,294** | **155** | **216** | **2,633** | **2,510** | **2,938** |
| **Total crude** | **6,940** | **7,139** | **832** | **998** | **7,772** | **8,137** | **9,673** |
| **Total imports** | **9,418** | **9,433** | **987** | **1,214** | **10,405** | **10,647** | **12,611** |

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

## PURVIN & GERTZ LNG NETBACKS—DEC. 18, 2009

| Receiving terminal | Liquefaction plant: Algeria | Malaysia | Nigeria | Austr. NW Shelf | Qatar | Trinidad |
|---|---|---|---|---|---|---|
| | $/MMbtu | | | | | |
| Barcelona | 6.65 | 4.55 | 5.82 | 4.44 | 5.13 | 5.74 |
| Everett | 4.85 | 2.76 | 4.48 | 2.85 | 3.29 | 5.14 |
| Isle of Grain | 3.73 | 1.74 | 3.12 | 1.66 | 2.20 | 3.14 |
| Lake Charles | 2.96 | 1.11 | 2.74 | 1.27 | 1.49 | 3.58 |
| Sodegaura | 5.21 | 7.48 | 5.47 | 7.17 | 6.44 | 4.72 |
| Zeebrugge | 6.25 | 4.29 | 5.58 | 4.22 | 4.66 | 5.64 |

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

## CRUDE AND PRODUCT STOCKS

| District | Crude oil | Motor gasoline: Total | Motor gasoline: Blending comp.[1] | Jet fuel, kerosine | Fuel oils: Distillate | Fuel oils: Residual | Propane–propylene |
|---|---|---|---|---|---|---|---|
| | 1,000 bbl | | | | | | |
| PADD 1 | 14,447 | 59,626 | 42,226 | 10,203 | 74,628 | 13,563 | 5,480 |
| PADD 2 | 88,513 | 50,896 | 23,892 | 8,219 | 29,356 | 1,082 | 22,402 |
| PADD 3 | 159,709 | 70,595 | 40,347 | 12,744 | 45,144 | 17,994 | 28,070 |
| PADD 4 | 15,918 | 6,530 | 2,092 | 625 | 3,337 | 229 | [1]1,797 |
| PADD 5 | 53,800 | 29,566 | 25,642 | 9,222 | 11,898 | 3,606 | — |
| **Dec. 11, 2009** | **332,387** | **217,213** | **134,199** | **41,013** | **164,363** | **36,474** | **57,749** |
| **Dec. 4, 2009** | **336,076** | **216,334** | **134,837** | **42,546** | **167,317** | **36,222** | **61,422** |
| **Dec. 12, 2008[2]** | **321,289** | **203,959** | **110,320** | **37,916** | **133,523** | **35,930** | **58,787** |

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

## REFINERY REPORT—DEC. 11, 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 | 1,089 | 1,084 | 2,464 | 76 | 349 | 87 | 50 |
| PADD 2 | 3,198 | 3,183 | 2,279 | 249 | 900 | 49 | 219 |
| PADD 3 | 7,003 | 6,813 | 2,525 | 673 | 1,907 | 308 | 656 |
| PADD 4 | 482 | 478 | 306 | 20 | 145 | 7 | [1]52 |
| PADD 5 | 2,364 | 2,246 | 1,523 | 427 | 425 | 121 | — |
| **Dec. 11, 2009** | **14,136** | **13,804** | **9,097** | **1,445** | **3,726** | **572** | **977** |
| **Dec. 4, 2009** | **14,330** | **13,921** | **9,163** | **1,388** | **3,994** | **574** | **1,145** |
| **Dec. 12, 2008[2]** | **14,814** | **14,552** | **9,199** | **1,315** | **4,617** | **534** | **993** |
| | **17,681 Operable capacity** | | **80.0% 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

| | *12-18-09 | *12-19-08 | Change | Change, % |
|---|---|---|---|---|
| | $/bbl | | | |
| **SPOT PRICES** | | | | |
| Product value | 78.53 | 48.43 | 30.10 | 62.2 |
| Brent crude | 71.89 | 42.81 | 29.08 | 67.9 |
| Crack spread | 6.64 | 5.61 | 1.02 | 18.3 |
| **FUTURES MARKET PRICES** | | | | |
| **One month** | | | | |
| Product value | 79.40 | 49.22 | 30.17 | 61.3 |
| Light sweet crude | 71.77 | 39.65 | 32.12 | 81.0 |
| Crack spread | 7.62 | 9.57 | –1.95 | –20.3 |
| **Six month** | | | | |
| Product value | 85.37 | 57.94 | 27.43 | 47.3 |
| Light sweet crude | 76.70 | 51.67 | 25.03 | 48.4 |
| Crack spread | 8.67 | 6.27 | 2.40 | 38.3 |

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

## OGJ GASOLINE PRICES

| | Price ex tax 12-16-09 | Pump price* 12-16-09 | Pump price 12-17-08 |
|---|---|---|---|
| | ¢/gal | | |
| (Approx. prices for self-service unleaded gasoline) | | | |
| Atlanta | 225.5 | 256.9 | 172.5 |
| Baltimore | 217.5 | 259.4 | 162.5 |
| Boston | 217.5 | 259.4 | 167.5 |
| Buffalo | 207.7 | 270.9 | 168.3 |
| Miami | 223.0 | 275.9 | 171.5 |
| Newark | 218.5 | 251.4 | 173.3 |
| New York | 207.7 | 270.9 | 178.4 |
| Norfolk | 211.7 | 249.4 | 168.3 |
| Philadelphia | 216.2 | 266.9 | 177.4 |
| Pittsburgh | 214.7 | 265.4 | 182.4 |
| Wash., DC | 227.0 | 268.9 | 187.4 |
| PAD I avg | 217.0 | 263.2 | 173.6 |
| Chicago | 228.2 | 283.3 | 175.6 |
| Cleveland | 225.7 | 272.1 | 155.1 |
| Des Moines | 207.7 | 248.1 | 160.5 |
| Detroit | 223.5 | 275.1 | 166.9 |
| Indianapolis | 220.0 | 270.1 | 165.6 |
| Kansas City | 198.5 | 234.2 | 155.2 |
| Louisville | 217.3 | 258.2 | 161.6 |
| Memphis | 200.3 | 240.1 | 154.9 |
| Milwaukee | 214.2 | 265.5 | 160.7 |
| Minn.-St. Paul | 213.0 | 258.6 | 159.6 |
| Oklahoma City | 185.8 | 221.2 | 150.9 |
| Omaha | 199.4 | 245.1 | 152.8 |
| St. Louis | 198.4 | 234.1 | 166.3 |
| Tulsa | 183.7 | 219.1 | 154.6 |
| Wichita | 192.3 | 235.7 | 155.0 |
| PAD II avg | 207.2 | 250.7 | 159.7 |
| Albuquerque | 212.2 | 249.4 | 169.9 |
| Birmingham | 214.6 | 253.9 | 165.5 |
| Dallas-Fort Worth | 208.0 | 246.4 | 162.1 |
| Houston | 210.0 | 248.4 | 151.9 |
| Little Rock | 203.2 | 243.4 | 160.5 |
| New Orleans | 216.0 | 254.4 | 167.3 |
| San Antonio | 212.5 | 250.9 | 170.9 |
| PAD III avg | 210.9 | 249.6 | 164.0 |
| Cheyenne | 222.0 | 254.4 | 156.9 |
| Denver | 219.0 | 259.4 | 166.0 |
| Salt Lake City | 211.0 | 253.9 | 160.9 |
| PAD IV avg | 217.3 | 255.9 | 161.2 |
| Los Angeles | 230.8 | 296.6 | 177.9 |
| Phoenix | 219.6 | 257.0 | 168.8 |
| Portland | 235.3 | 278.7 | 183.8 |
| San Diego | 230.9 | 296.7 | 188.8 |
| San Francisco | 236.9 | 302.7 | 184.7 |
| Seattle | 237.2 | 293.1 | 178.8 |
| PAD V avg | 231.8 | 287.5 | 180.4 |
| **Week's avg.** | **214.6** | **259.4** | **167.1** |
| **Nov. avg.** | **218.8** | **263.6** | **215.5** |
| **Oct. avg.** | **208.4** | **253.6** | **317.6** |
| **2009 to date** | **182.5** | **232.0** | — |
| **2008 to date** | **285.0** | **329.3** | — |

*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

| | 12-11-09 ¢/gal | | 12-11-09 ¢/gal |
|---|---|---|---|
| **Spot market product prices** | | | |
| Motor gasoline (Conventional-regular) | | Heating oil No. 2 | |
| New York Harbor | 181.95 | New York Harbor | 187.85 |
| Gulf Coast | 179.70 | Gulf Coast | 186.73 |
| Los Angeles | 187.20 | Gas oil | |
| Amsterdam-Rotterdam-Antwerp (ARA) | 184.84 | ARA | 182.65 |
| Singapore | 185.36 | Singapore | 186.07 |
| Motor gasoline (Reformulated-regular) | | Residual fuel oil | |
| New York Harbor | 180.20 | New York Harbor | 161.83 |
| Gulf Coast | 178.95 | Gulf Coast | 164.36 |
| Los Angeles | 193.45 | Los Angeles | 192.23 |
| | | ARA | 157.86 |
| | | Singapore | 171.63 |

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

## BAKER HUGHES RIG COUNT

| | 12-18-09 | 12-19-08 |
|---|---|---|
| Alabama | 5 | 4 |
| Alaska | 9 | 12 |
| Arkansas | 37 | 55 |
| California | 26 | 38 |
| Land | 25 | 38 |
| Offshore | 1 | 0 |
| Colorado | 44 | 101 |
| Florida | 0 | 1 |
| Illinois | 0 | 0 |
| Indiana | 3 | 2 |
| Kansas | 19 | 18 |
| Kentucky | 12 | 9 |
| Louisiana | 177 | 172 |
| N. Land | 120 | 87 |
| S. Inland waters | 13 | 9 |
| S. Land | 13 | 23 |
| Offshore | 31 | 53 |
| Maryland | 0 | 0 |
| Michigan | 0 | 0 |
| Mississippi | 7 | 21 |
| Montana | 8 | 11 |
| Nebraska | 1 | 0 |
| New Mexico | 50 | 63 |
| New York | 2 | 4 |
| North Dakota | 62 | 81 |
| Ohio | 8 | 12 |
| Oklahoma | 93 | 165 |
| Pennsylvania | 62 | 24 |
| South Dakota | 0 | 1 |
| Texas | 478 | 824 |
| Offshore | 2 | 8 |
| Inland waters | 0 | 0 |
| Dist. 1 | 22 | 20 |
| Dist. 2 | 16 | 35 |
| Dist. 3 | 33 | 59 |
| Dist. 4 | 28 | 80 |
| Dist. 5 | 68 | 163 |
| Dist. 6 | 59 | 132 |
| Dist. 7B | 15 | 27 |
| Dist. 7C | 44 | 57 |
| Dist. 8 | 93 | 105 |
| Dist. 8A | 20 | 31 |
| Dist. 9 | 36 | 43 |
| Dist. 10 | 42 | 64 |
| Utah | 17 | 33 |
| West Virginia | 22 | 30 |
| Wyoming | 41 | 71 |
| Others—HI-1; NV-4; OR-1; TN-1; VA-3 | 10 | 12 |
| **Total US** | **1,193** | **1,764** |
| **Total Canada** | **368** | **369** |
| **Grand total** | **1,561** | **2,133** |
| US Oil rigs | 409 | 387 |
| US Gas rigs | 773 | 1,366 |
| Total US offshore | 34 | 67 |
| **Total US cum. avg. YTD** | **1,087** | **1,882** |

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 | 12-18-09 Percent footage* | Rig count | 12-19-08 Percent footage* |
|---|---|---|---|---|
| 0-2,500 | 84 | 1.1 | 93 | 4.3 |
| 2,501-5,000 | 60 | 70.0 | 110 | 53.6 |
| 5,001-7,500 | 130 | 26.9 | 248 | 16.1 |
| 7,501-10,000 | 232 | 6.4 | 405 | 2.9 |
| 10,001-12,500 | 256 | 12.5 | 385 | 2.0 |
| 12,501-15,000 | 162 | 1.8 | 349 | 0.2 |
| 15,001-17,500 | 165 | -- | 156 | -- |
| 17,501-20,000 | 65 | -- | 78 | -- |
| 20,001-over | 31 | -- | 35 | -- |
| **Total** | **1,185** | **10.8** | **1,859** | **6.6** |
| INLAND | 17 | | 22 | |
| LAND | 1,131 | | 1,785 | |
| OFFSHORE | 37 | | 52 | |

*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]12-18-09 | [2]12-19-08 |
|---|---|---|
| | 1,000 b/d | |
| (Crude oil and lease condensate) | | |
| Alabama | 21 | 21 |
| Alaska | 716 | 709 |
| California | 640 | 647 |
| Colorado | 69 | 67 |
| Florida | 6 | 4 |
| Illinois | 25 | 25 |
| Kansas | 114 | 109 |
| Louisiana | 1,430 | 1,136 |
| Michigan | 18 | 18 |
| Mississippi | 64 | 62 |
| Montana | 86 | 83 |
| New Mexico | 170 | 158 |
| North Dakota | 219 | 207 |
| Oklahoma | 184 | 179 |
| Texas | 1,406 | 1,346 |
| Utah | 67 | 62 |
| Wyoming | 152 | 144 |
| All others | 67 | 73 |
| **Total** | **5,454** | **5,050** |

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

## US CRUDE PRICES

| | 12-18-09 $/bbl* |
|---|---|
| Alaska-North Slope 27° | 64.51 |
| South Louisiana Sweet | 73.75 |
| California-Midway Sunset 13° | 64.40 |
| Lost Hills 30° | 72.75 |
| Wyoming Sweet | 63.86 |
| East Texas Sweet | 69.25 |
| West Texas Sour 34° | 64.75 |
| West Texas Intermediate | 69.75 |
| Oklahoma Sweet | 69.75 |
| Texas Upper Gulf Coast | 62.75 |
| Michigan Sour | 61.75 |
| Kansas Common | 68.75 |
| North Dakota Sweet | 52.50 |

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

## WORLD CRUDE PRICES

| $/bbl[1] | 12-11-09 |
|---|---|
| United Kingdom-Brent 38° | 74.70 |
| Russia-Urals 32° | 73.61 |
| Saudi Light 34° | 73.71 |
| Dubai Fateh 32° | 76.80 |
| Algeria Saharan 44° | 75.46 |
| Nigeria-Bonny Light 37° | 76.31 |
| Indonesia-Minas 34° | 79.73 |
| Venezuela-Tia Juana Light 31° | 72.56 |
| Mexico-Isthmus 33° | 72.45 |
| OPEC basket | 74.97 |
| Total OPEC[2] | 74.63 |
| Total non-OPEC[2] | 72.89 |
| Total world[2] | 73.89 |
| US imports[3] | 71.78 |

[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]

| | 12-11-09 | 12-4-09 | 12-11-08 | Change, % |
|---|---|---|---|---|
| | bcf | | | |
| Producing region | 1,120 | 1,195 | 909 | **23.2** |
| Consuming region east | 1,968 | 2,061 | 1,689 | **16.5** |
| Consuming region west | 478 | 517 | 422 | **13.3** |
| **Total US** | **3,566** | **3,773** | **3,020** | **18.1** |
| | **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

## World oil balance

| | 2009 2nd qtr. | 2009 1st qtr. | 2008 4th qtr. | 2008 3rd qtr. | 2008 2nd qtr. | 2008 1st qtr. |
|---|---|---|---|---|---|---|
| | Million b/d | | | | | |
| **DEMAND** | | | | | | |
| **OECD** | | | | | | |
| US & Territories | 18.75 | 19.07 | 19.53 | 19.20 | 20.05 | 20.31 |
| Canada | 2.08 | 2.20 | 2.26 | 2.28 | 2.19 | 2.31 |
| Mexico | 2.01 | 2.05 | 2.07 | 2.14 | 2.19 | 2.12 |
| Japan | 4.03 | 4.72 | 4.71 | 4.34 | 4.63 | 5.45 |
| South Korea | 2.17 | 2.34 | 2.14 | 2.10 | 2.11 | 2.35 |
| France | 1.81 | 2.02 | 2.04 | 1.95 | 1.95 | 2.01 |
| Italy | 1.52 | 1.55 | 1.62 | 1.64 | 1.64 | 1.66 |
| United Kingdom | 1.67 | 1.73 | 1.73 | 1.65 | 1.73 | 1.73 |
| Germany | 2.39 | 2.57 | 2.65 | 2.71 | 2.43 | 2.49 |
| Other OECD Europe | 6.84 | 7.05 | 7.40 | 7.60 | 7.33 | 7.45 |
| Australia & New Zealand | 1.10 | 1.08 | 1.12 | 1.10 | 1.11 | 1.10 |
| **Total OECD** | **44.37** | **46.38** | **47.27** | **46.71** | **47.36** | **48.98** |
| NON-OECD | | | | | | |
| China | 8.44 | 7.62 | 7.54 | 7.78 | 8.07 | 7.94 |
| FSU | 4.19 | 4.10 | 4.48 | 4.47 | 4.22 | 4.23 |
| Non-OECD Europe | 0.77 | 0.77 | 0.80 | 0.80 | 0.80 | 0.79 |
| Other Asia | 9.53 | 9.30 | 8.83 | 9.06 | 9.74 | 9.64 |
| Other non-OECD | 16.32 | 15.33 | 15.68 | 16.53 | 16.12 | 15.29 |
| **Total non-OECD** | **39.25** | **37.12** | **37.33** | **38.64** | **38.95** | **37.89** |
| **TOTAL DEMAND** | **83.62** | **83.50** | **84.60** | **85.35** | **86.31** | **86.87** |
| **SUPPLY** | | | | | | |
| **OECD** | | | | | | |
| US | 8.97 | 8.78 | 8.46 | 8.18 | 8.75 | 8.67 |
| Canada | 3.20 | 3.38 | 3.40 | 3.40 | 3.22 | 3.38 |
| Mexico | 2.99 | 3.06 | 3.12 | 3.15 | 3.19 | 3.29 |
| North Sea | 4.00 | 4.40 | 4.37 | 4.06 | 4.31 | 4.44 |
| Other OECD | 1.53 | 1.54 | 1.59 | 1.59 | 1.57 | 1.52 |
| **Total OECD** | **20.69** | **21.16** | **20.94** | **20.38** | **21.04** | **21.30** |
| **NON-OECD** | | | | | | |
| FSU | 12.87 | 12.60 | 12.46 | 12.42 | 12.60 | 12.59 |
| China | 3.98 | 3.92 | 3.99 | 3.97 | 4.00 | 3.94 |
| Other non-OECD | 12.44 | 12.43 | 12.35 | 12.29 | 12.12 | 12.20 |
| **Total non-OECD, non-OPEC** | **29.29** | **28.95** | **28.80** | **28.68** | **28.72** | **28.73** |
| **OPEC*** | **33.68** | **33.41** | **35.16** | **36.18** | **35.84** | **35.72** |
| **TOTAL SUPPLY** | **83.66** | **83.52** | **84.90** | **85.24** | **85.60** | **85.75** |
| **Stock change** | **0.04** | **0.02** | **0.30** | **–0.11** | **–0.71** | **–1.12** |

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

## OECD total net oil imports

| | Aug. 2009 | July 2009 | June 2009 | Aug. 2008 | Chg. vs. previous year Volume | Chg. vs. previous year % |
|---|---|---|---|---|---|---|
| | Million b/d | | | | | |
| Canada | –1,591 | –1,426 | –1,483 | –1,449 | –142 | 9.8 |
| US | 9,124 | 9,704 | 9,939 | 11,064 | –1,940 | –17.5 |
| Mexico | –856 | –1,001 | –989 | –1,183 | 327 | –27.6 |
| France | 1,790 | 1,710 | 1,687 | 1,721 | 69 | 4.0 |
| Germany | 2,113 | 2,071 | 2,105 | 2,443 | –330 | –13.5 |
| Italy | 1,292 | 1,451 | 1,297 | 1,214 | 78 | 6.4 |
| Netherlands | 848 | 621 | 1,103 | 931 | –83 | –8.9 |
| Spain | 1,429 | 1,417 | 1,487 | 1,483 | –54 | –3.6 |
| Other importers | 3,656 | 3,869 | 3,722 | 4,120 | –464 | –11.3 |
| Norway | –1,896 | –2,156 | –1,779 | –2,102 | 206 | –9.8 |
| United Kingdom | 491 | 278 | 58 | 389 | 102 | 26.2 |
| **Total OECD Europe** | **9,723** | **9,261** | **9,680** | **10,199** | **–476** | **–4.7** |
| Japan | 4,273 | 3,886 | 4,157 | 4,868 | –595 | –12.2 |
| South Korea | 2,124 | 2,263 | 2,070 | 1,976 | 148 | 7.5 |
| Other OECD | 785 | 969 | 919 | 851 | –66 | –7.8 |
| **Total OECD** | **23,582** | **23,656** | **24,293** | **26,326** | **–2,744** | **–10.4** |

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

## OECD* total gross imports from OPEC

| | Aug. 2008 | July 2008 | June 2008 | Aug. 2007 | Chg. vs. previous year Volume | Chg. vs. previous year % |
|---|---|---|---|---|---|---|
| | Million b/d | | | | | |
| Canada | 337 | 343 | 447 | 261 | 76 | 29.1 |
| US | 4,567 | 4,623 | 4,814 | 6,344 | –1,777 | –28.0 |
| Mexico | 21 | 18 | 21 | 21 | — | — |
| France | 641 | 831 | 808 | 891 | –250 | –28.1 |
| Germany | 395 | 390 | 365 | 442 | –47 | –10.6 |
| Italy | 846 | 982 | 969 | 1,235 | –389 | –31.5 |
| Netherlands | 643 | 516 | 533 | 664 | –21 | –3.2 |
| Spain | 650 | 577 | 756 | 777 | –127 | –16.3 |
| Other importers | 1,024 | 1,288 | 1,189 | 1,445 | –421 | –29.1 |
| United Kingdom | 259 | 257 | 348 | 379 | –120 | –31.7 |
| **Total OECD Europe** | **4,458** | **4,841** | **4,968** | **5,833** | **–1,375** | **–23.6** |
| Japan | 3,637 | 3,597 | 3,309 | 4,052 | –415 | –10.2 |
| South Korea | 2,324 | 2,468 | 2,384 | 2,283 | 41 | 1.8 |
| Other OECD | 521 | 553 | 547 | 568 | –47 | –8.3 |
| **Total OECD** | **15,865** | **16,443** | **16,490** | **19,362** | **–3,497** | **–18.1** |

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

## US petroleum imports from source country

| | Sept. 2009 | Aug. 2009 | Average YTD 2009 | Average YTD 2008 | Chg. vs. previous year Volume | Chg. vs. previous year % |
|---|---|---|---|---|---|---|
| | 1,000 b/d | | | | | |
| Algeria | 641 | 551 | 491 | 540 | –49 | –9.1 |
| Angola | 414 | 364 | 486 | 512 | –26 | –5.1 |
| Kuwait | 246 | 148 | 189 | 197 | –8 | –4.1 |
| Nigeria | 894 | 917 | 752 | 1,014 | –262 | –25.8 |
| Saudi Arabia | 1,045 | 766 | 1,052 | 1,542 | –490 | –31.8 |
| Venezuela | 1,146 | 1,070 | 1,139 | 1,190 | –51 | –4.3 |
| Other OPEC | 635 | 751 | 791 | 1,017 | –226 | –22.2 |
| **Total OPEC** | **5,021** | **4,567** | **4,900** | **6,012** | **–1,112** | **–18.5** |
| Canada | 2,356 | 2,524 | 2,448 | 2,465 | –17 | –0.7 |
| Mexico | 1,271 | 1,159 | 1,266 | 1,284 | –18 | –1.4 |
| Norway | 59 | 52 | 116 | 107 | 9 | 8.4 |
| United Kingdom | 295 | 225 | 253 | 225 | 28 | 12.4 |
| Virgin Islands | 280 | 223 | 290 | 328 | –38 | –11.6 |
| Other non-OPEC | 2,439 | 2,493 | 2,764 | 2,501 | 263 | 10.5 |
| **Total non-OPEC** | **6,700** | **6,676** | **7,137** | **6,910** | **227** | **3.3** |
| **TOTAL IMPORTS** | **11,721** | **11,243** | **12,037** | **12,922** | **–885** | **–6.8** |

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

## Oil stocks in OECD countries*

| | Aug. 2009 | July 2009 | June 2009 | Aug. 2008 | Chg. vs. previous year Volume | Chg. vs. previous year % |
|---|---|---|---|---|---|---|
| | Million bbl | | | | | |
| France | 178 | 174 | 173 | 176 | 2 | 1.1 |
| Germany | 284 | 277 | 280 | 276 | 8 | 2.9 |
| Italy | 130 | 127 | 129 | 131 | –1 | –0.8 |
| United Kingdom | 96 | 97 | 92 | 96 | 0 | 0.0 |
| Other OECD Europe | 727 | 717 | 729 | 705 | 22 | 3.1 |
| **Total OECD Europe** | **1,415** | **1,392** | **1,403** | **1,384** | **31** | **2.2** |
| Canada | 199 | 203 | 198 | 197 | 2 | 1.0 |
| US | 1,828 | 1,842 | 1,839 | 1,711 | 117 | 6.8 |
| Japan | 610 | 607 | 611 | 643 | –33 | –5.1 |
| South Korea | 160 | 157 | 149 | 150 | 10 | 6.7 |
| Other OECD | 111 | 108 | 110 | 106 | 5 | 4.7 |
| **Total OECD** | **4,323** | **4,309** | **4,310** | **4,191** | **132** | **3.1** |

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

## IMPORTS OF CRUDE AND PRODUCTS

| | Districts 1-4 | | District 5 | | Total US | | |
|---|---|---|---|---|---|---|---|
| | 12-18 2009 | 12-11 2009 | 12-18 2009 | 12-11 2009 | 12-18 2009 | 12-11 2009 | *12-19 2008 |
| | 1,000 b/d | | | | | | |
| Total motor gasoline | 830 | 930 | 18 | 37 | 848 | 967 | 1,254 |
| Mo. gas. blending comp. | 618 | 679 | 18 | 37 | 636 | 716 | 1,064 |
| Distillate | 313 | 229 | 22 | 0 | 335 | 229 | 240 |
| Residual | 316 | 302 | 50 | 28 | 366 | 330 | 622 |
| Jet fuel-kerosine | 33 | 28 | 44 | 29 | 77 | 57 | 111 |
| Propane-propylene | 179 | 179 | 11 | 8 | 190 | 187 | 229 |
| Other | (63) | 131 | 33 | 16 | (30) | 147 | 142 |
| **Total products** | **2,226** | **2,478** | **196** | **155** | **2,422** | **2,633** | **3,662** |
| **Total crude** | **6,902** | **6,940** | **805** | **832** | **7,707** | **7,772** | **9,118** |
| **Total imports** | **9,128** | **9,418** | **1,001** | **987** | **10,129** | **10,405** | **12,780** |

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

## PURVIN & GERTZ LNG NETBACKS—DEC. 25, 2009

| Receiving terminal | Liquefaction plant | | | | | |
|---|---|---|---|---|---|---|
| | Algeria | Malaysia | Nigeria | Austr. NW Shelf | Qatar | Trinidad |
| | $/MMbtu | | | | | |
| Barcelona | 6.65 | 4.55 | 5.82 | 4.44 | 5.14 | 5.74 |
| Everett | 4.85 | 2.79 | 4.48 | 2.87 | 3.33 | 5.14 |
| Isle of Grain | 4.24 | 2.29 | 3.62 | 2.18 | 2.78 | 3.65 |
| Lake Charles | 2.98 | 1.11 | 2.76 | 1.28 | 1.51 | 3.58 |
| Sodegaura | 5.56 | 7.48 | 5.81 | 7.17 | 6.44 | 4.87 |
| Zeebrugge | 6.25 | 4.56 | 5.63 | 4.45 | 4.97 | 5.66 |

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 | 13,678 | 58,855 | 41,556 | 10,400 | 71,876 | 13,727 | 5,172 |
| PADD 2 | 89,713 | 50,189 | 24,191 | 7,904 | 29,461 | 1,153 | 21,230 |
| PADD 3 | 155,769 | 71,824 | 40,640 | 12,833 | 45,285 | 17,960 | 25,952 |
| PADD 4 | 15,612 | 6,257 | 1,921 | 551 | 3,134 | 213 | [1]1,940 |
| PADD 5 | 52,774 | 29,205 | 25,275 | 9,303 | 11,580 | 3,988 | — |
| **Dec. 18, 2009** | **327,546** | **216,330** | **133,583** | **40,991** | **161,336** | **37,041** | **54,294** |
| **Dec. 11, 2009** | **332,387** | **217,213** | **134,199** | **41,013** | **164,363** | **36,474** | **57,441** |
| **Dec. 19, 2008[2]** | **318,188** | **207,295** | **111,738** | **37,347** | **135,337** | **35,993** | **58,199** |

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

## REFINERY REPORT—DEC. 18, 2009

| District | REFINERY OPERATIONS | | REFINERY OUTPUT | | | | |
|---|---|---|---|---|---|---|---|
| | Gross inputs | Crude oil inputs | Total motor gasoline | Jet fuel, kerosine | Fuel oils | | Propane-propylene |
| | | | | | Distillate | Residual | |
| | 1,000 b/d | | | | | | |
| PADD 1 | 1,135 | 1,127 | 2,473 | 80 | 347 | 75 | 51 |
| PADD 2 | 3,164 | 3,146 | 2,242 | 203 | 968 | 37 | 247 |
| PADD 3 | 6,909 | 6,669 | 2,457 | 698 | 1,839 | 324 | 645 |
| PADD 4 | 496 | 494 | 312 | 20 | 168 | 7 | [1]51 |
| PADD 5 | 2,447 | 2,341 | 1,479 | 438 | 484 | 119 | — |
| **Dec. 18, 2009** | **14,151** | **13,777** | **8,963** | **1,439** | **3,806** | **562** | **994** |
| **Dec. 11, 2009** | **14,136** | **13,804** | **9,097** | **1,445** | **3,726** | **572** | **977** |
| **Dec. 19, 2008[2]** | **14,912** | **14,511** | **9,090** | **1,390** | **4,404** | **628** | **993** |
| | **17,681 Operable capacity** | | **80.0% 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

| | *12-25-09 | *12-26-08 | Change | Change, % |
|---|---|---|---|---|
| | $/bbl | | | |
| **SPOT PRICES** | | | | |
| Product value | 81.97 | 43.14 | 38.83 | 90.0 |
| Brent crude | 73.10 | 36.31 | 36.79 | 101.3 |
| Crack spread | 8.88 | 6.83 | 2.04 | 29.9 |
| **FUTURES MARKET PRICES** | | | | |
| **One month** | | | | |
| Product value | 81.95 | 42.76 | 39.19 | 91.7 |
| Light sweet crude | 75.40 | 37.99 | 37.41 | 98.5 |
| Crack spread | 6.55 | 4.77 | 1.79 | 37.4 |
| **Six month** | | | | |
| Product value | 87.19 | 51.70 | 35.49 | 68.6 |
| Light sweet crude | 78.63 | 46.59 | 32.04 | 68.8 |
| Crack spread | 8.56 | 5.12 | 3.44 | 67.3 |

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

## OGJ GASOLINE PRICES

| | Price ex tax 12-23-09 | Pump price* 12-23-09 | Pump price 12-24-08 |
|---|---|---|---|
| | ¢/gal | | |
| (Approx. prices for self-service unleaded gasoline) | | | |
| Atlanta | 224.8 | 256.2 | 170.8 |
| Baltimore | 216.5 | 258.4 | 160.8 |
| Boston | 215.8 | 257.7 | 165.8 |
| Buffalo | 206.4 | 269.6 | 166.7 |
| Miami | 221.7 | 274.6 | 198.8 |
| Newark | 217.5 | 250.4 | 171.7 |
| New York | 207.0 | 270.2 | 176.7 |
| Norfolk | 210.7 | 248.4 | 166.7 |
| Philadelphia | 214.9 | 265.6 | 175.7 |
| Pittsburgh | 213.0 | 263.7 | 180.7 |
| Wash., DC | 225.7 | 267.6 | 185.7 |
| PAD I avg | 215.8 | 262.0 | 171.9 |
| Chicago | 225.9 | 281.0 | 174.5 |
| Cleveland | 224.9 | 271.3 | 153.6 |
| Des Moines | 206.9 | 247.3 | 159.4 |
| Detroit | 222.7 | 274.3 | 165.6 |
| Indianapolis | 219.2 | 269.3 | 164.5 |
| Kansas City | 197.0 | 232.7 | 154.3 |
| Louisville | 215.8 | 256.7 | 160.5 |
| Memphis | 199.5 | 239.3 | 153.6 |
| Milwaukee | 213.8 | 265.1 | 159.5 |
| Minn.-St. Paul | 211.9 | 257.5 | 158.5 |
| Oklahoma City | 184.3 | 219.7 | 149.6 |
| Omaha | 198.6 | 244.3 | 151.5 |
| St. Louis | 197.6 | 233.3 | 165.4 |
| Tulsa | 182.9 | 218.3 | 153.5 |
| Wichita | 190.4 | 233.8 | 153.6 |
| PAD II avg | 206.1 | 249.6 | 158.5 |
| Albuquerque | 211.2 | 248.4 | 168.6 |
| Birmingham | 212.6 | 251.9 | 164.4 |
| Dallas-Fort Worth | 207.0 | 245.4 | 161.3 |
| Houston | 208.3 | 246.7 | 150.6 |
| Little Rock | 202.2 | 242.4 | 158.8 |
| New Orleans | 214.3 | 252.7 | 165.7 |
| San Antonio | 211.2 | 249.6 | 169.6 |
| PAD III avg | 209.6 | 248.2 | 162.7 |
| Cheyenne | 219.0 | 251.4 | 155.6 |
| Denver | 213.3 | 253.7 | 163.9 |
| Salt Lake City | 205.0 | 247.9 | 159.6 |
| PAD IV avg | 212.4 | 251.0 | 159.7 |
| Los Angeles | 229.7 | 295.5 | 175.2 |
| Phoenix | 218.9 | 256.3 | 166.2 |
| Portland | 233.4 | 276.8 | 181.2 |
| San Diego | 229.0 | 294.8 | 186.2 |
| San Francisco | 235.0 | 300.8 | 182.2 |
| Seattle | 235.7 | 291.6 | 176.2 |
| PAD V avg | 230.3 | 286.0 | 177.9 |
| **Week's avg.** | **213.1** | **257.9** | **165.6** |
| **Nov. avg.** | **218.8** | **263.6** | **215.5** |
| **Oct. avg.** | **208.4** | **253.6** | **317.6** |
| **2009 to date** | **187.0** | **232.5** | — |
| **2008 to date** | **281.9** | **326.2** | — |

*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

| | 12-18-09 ¢/gal | | 12-18-09 ¢/gal |
|---|---|---|---|
| **Spot market product prices** | | | |
| Motor gasoline (Conventional-regular) | | Heating oil No. 2 | |
| New York Harbor | 187.76 | New York Harbor | 192.95 |
| Gulf Coast | 185.39 | Gulf Coast | 191.45 |
| Los Angeles | 196.76 | Gas oil | |
| Amsterdam-Rotterdam-Antwerp (ARA) | 177.05 | ARA | 190.01 |
| Singapore | 189.81 | Singapore | 188.81 |
| Motor gasoline (Reformulated-regular) | | Residual fuel oil | |
| New York Harbor | 186.01 | New York Harbor | 163.76 |
| Gulf Coast | 185.26 | Gulf Coast | 165.40 |
| Los Angeles | 202.76 | Los Angeles | 192.23 |
| | | ARA | 162.73 |
| | | Singapore | 174.87 |

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

## BAKER HUGHES RIG COUNT

| | 12-25-09 | 12-26-08 |
|---|---|---|
| Alabama | 5 | 4 |
| Alaska | 8 | 12 |
| Arkansas | 35 | 53 |
| California | 25 | 37 |
| Land | 24 | 36 |
| Offshore | 1 | 1 |
| Colorado | 42 | 98 |
| Florida | 0 | 1 |
| Illinois | 0 | 0 |
| Indiana | 3 | 2 |
| Kansas | 20 | 20 |
| Kentucky | 3 | 8 |
| Louisiana | 179 | 173 |
| N. Land | 123 | 90 |
| S. Inland waters | 11 | 8 |
| S. Land | 13 | 22 |
| Offshore | 32 | 53 |
| Maryland | 0 | 0 |
| Michigan | 0 | 0 |
| Mississippi | 6 | 17 |
| Montana | 6 | 7 |
| Nebraska | 1 | 0 |
| New Mexico | 49 | 65 |
| New York | 2 | 4 |
| North Dakota | 64 | 80 |
| Ohio | 8 | 12 |
| Oklahoma | 95 | 159 |
| Pennsylvania | 63 | 24 |
| South Dakota | 0 | 1 |
| Texas | 478 | 801 |
| Offshore | 3 | 8 |
| Inland waters | 0 | 0 |
| Dist. 1 | 20 | 16 |
| Dist. 2 | 18 | 34 |
| Dist. 3 | 33 | 56 |
| Dist. 4 | 27 | 79 |
| Dist. 5 | 72 | 152 |
| Dist. 6 | 58 | 135 |
| Dist. 7B | 11 | 28 |
| Dist. 7C | 45 | 56 |
| Dist. 8 | 97 | 101 |
| Dist. 8A | 19 | 29 |
| Dist. 9 | 35 | 43 |
| Dist. 10 | 40 | 64 |
| Utah | 17 | 29 |
| West Virginia | 22 | 30 |
| Wyoming | 40 | 72 |
| Others—HI-1; NV-4; OR-1; TN-1 | 7 | 12 |
| **Total US** | **1,178** | **1,721** |
| **Total Canada** | **268** | **279** |
| **Grand total** | **1,446** | **2,000** |
| US Oil rigs | 416 | 364 |
| US Gas rigs | 751 | 1,347 |
| Total US offshore | 36 | 68 |
| **Total US cum. avg. YTD** | **1,087** | **1,879** |

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 | 12-25-09 Percent footage* | Rig count | 12-26-08 Percent footage* |
|---|---|---|---|---|
| 0-2,500 | 83 | 1.2 | 91 | 4.3 |
| 2,501-5,000 | 59 | 71.1 | 108 | 56.4 |
| 5,001-7,500 | 130 | 26.9 | 244 | 16.3 |
| 7,501-10,000 | 225 | 5.3 | 412 | 2.9 |
| 10,001-12,500 | 261 | 13.0 | 370 | 2.1 |
| 12,501-15,000 | 161 | 1.8 | 360 | 0.2 |
| 15,001-17,500 | 164 | — | 152 | — |
| 17,501-20,000 | 69 | — | 75 | — |
| 20,001-over | 33 | — | 36 | — |
| **Total** | **1,185** | **10.7** | **1,848** | **6.8** |
| INLAND | 17 | | 23 | |
| LAND | 1,131 | | 1,775 | |
| OFFSHORE | 37 | | 50 | |

*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]12-25-09 | [2]12-26-08 |
|---|---|---|
| | 1,000 b/d | |
| (Crude oil and lease condensate) | | |
| Alabama | 22 | 20 |
| Alaska | 723 | 702 |
| California | 644 | 645 |
| Colorado | 70 | 67 |
| Florida | 7 | 4 |
| Illinois | 25 | 25 |
| Kansas | 116 | 109 |
| Louisiana | 1,441 | 1,159 |
| Michigan | 18 | 19 |
| Mississippi | 64 | 63 |
| Montana | 88 | 83 |
| New Mexico | 168 | 155 |
| North Dakota | 234 | 202 |
| Oklahoma | 184 | 178 |
| Texas | 1,414 | 1,349 |
| Utah | 68 | 61 |
| Wyoming | 152 | 142 |
| All others | 68 | 73 |
| **Total** | **5,506** | **5,056** |

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

## US CRUDE PRICES

| | 12-25-09 $/bbl* |
|---|---|
| Alaska-North Slope 27° | 64.51 |
| South Louisiana Sweet | 78.50 |
| California-Midway Sunset 13° | 69.15 |
| Lost Hills 30° | 77.70 |
| Southwest Wyoming Sweet | 68.55 |
| East Texas Sweet | 74.00 |
| West Texas Sour 34° | 69.50 |
| West Texas Intermediate | 74.50 |
| Oklahoma Sweet | 74.50 |
| Texas Upper Gulf Coast | 67.50 |
| Michigan Sour | 66.50 |
| Kansas Common | 73.25 |
| North Dakota Sweet | 57.25 |

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

## WORLD CRUDE PRICES

| $/bbl[1] | 12-18-09 |
|---|---|
| United Kingdom-Brent 38° | 71.48 |
| Russia-Urals 32° | 70.61 |
| Saudi Light 34° | 70.70 |
| Dubai Fateh 32° | 72.74 |
| Algeria Saharan 44° | 72.52 |
| Nigeria-Bonny Light 37° | 73.31 |
| Indonesia-Minas 34° | 75.87 |
| Venezuela-Tia Juana Light 31° | 70.13 |
| Mexico-Isthmus 33° | 70.02 |
| OPEC basket | 71.88 |
| Total OPEC[2] | 71.40 |
| Total non-OPEC[2] | 69.52 |
| Total world[2] | 70.60 |
| US imports[3] | 68.51 |

[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]

| | 12-18-09 | 12-11-09 | 12-18-08 | Change, % |
|---|---|---|---|---|
| | bcf | | | |
| Producing region | 1,067 | 1,120 | 912 | **17.0** |
| Consuming region east | 1,869 | 1,968 | 1,702 | **9.8** |
| Consuming region west | 464 | 478 | 427 | **8.7** |
| **Total US** | **3,400** | **3,566** | **3,041** | **11.8** |
| | **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.

## PACE REFINING MARGINS

| | Oct. 2009 | Nov. 2009 | Dec. 2009 | Dec. 2008 | 2009 vs. 2008 Change | 2009 vs. 2008 Change, % |
|---|---|---|---|---|---|---|
| | | | $/bbl | | | |
| US Gulf Coast | | | | | | |
| West Texas Sour | 2.99 | 1.64 | 3.49 | 5.58 | –2.09 | –37.4 |
| Composite US Gulf Refinery | 4.51 | 3.11 | 4.07 | 6.50 | –2.43 | –37.4 |
| Arabian Light | 1.40 | 2.38 | 4.02 | 7.19 | –3.17 | –44.0 |
| Bonny Light | 1.75 | –0.98 | –0.91 | (1.08) | 0.17 | –16.2 |
| US PADD II | | | | | | |
| Chicago (WTI) | 3.66 | 0.35 | 1.94 | 6.18 | –4.24 | –68.6 |
| US East Coast | | | | | | |
| NY Harbor (Arab Med) | 0.22 | 2.41 | 4.32 | 6.70 | –2.38 | –35.5 |
| East Coast Comp-RFG | 3.27 | 1.96 | 2.34 | 3.50 | –1.16 | –33.2 |
| US West Coast | | | | | | |
| Los Angeles (ANS) | 9.94 | 7.80 | 9.35 | 9.30 | 0.05 | 0.6 |
| NW Europe | | | | | | |
| Rotterdam (Brent) | 1.30 | 0.66 | 0.95 | 3.34 | –2.40 | –71.7 |
| Mediterranean | | | | | | |
| Italy (Urals) | –1.69 | –2.82 | –2.04 | 3.95 | –5.99 | –151.7 |
| Far East | | | | | | |
| Singapore (Dubai) | –0.41 | –1.11 | –0.73 | (0.29) | –0.44 | 152.7 |

Source: Jacobs Consultancy Inc.
Data available in OGJ Online Research Center.

## US NATURAL GAS BALANCE DEMAND/SUPPLY SCOREBOARD

| | Oct. 2009 | Sept. 2008 | Oct. 2008 | Oct. 2009-2008 change | Total YTD 2009 | Total YTD 2008 | YTD 2009-2008 change |
|---|---|---|---|---|---|---|---|
| | | | | bcf | | | |
| **DEMAND** | | | | | | | |
| Consumption | 1,658 | 1,567 | 1,632 | 26 | 18,552 | 18,948 | –396 |
| Addition to storage | 258 | 346 | 334 | –76 | 3,066 | 3,032 | 34 |
| Exports | 76 | 84 | 69 | 7 | 858 | 801 | 57 |
| Canada | 41 | 47 | 37 | 4 | 548 | 447 | 101 |
| Mexico | 33 | 33 | 28 | 5 | 285 | 312 | –27 |
| LNG | 2 | 4 | 4 | –2 | 25 | 42 | –17 |
| **Total demand** | **1,992** | **1,997** | **2,035** | **–43** | **22,476** | **22,781** | **–305** |
| **SUPPLY** | | | | | | | |
| Production (dry gas) | 1,785 | 1,697 | 1,702 | 83 | 17,565 | 16,903 | 662 |
| Supplemental gas | 5 | 4 | 5 | 0 | 51 | 44 | 7 |
| Storage withdrawal | 97 | 57 | 91 | 6 | 2,085 | 3,178 | –1,093 |
| Imports | 307 | 306 | 321 | –14 | 3,134 | 3,299 | –165 |
| Canada | 278 | 274 | 288 | –10 | 2,729 | 2,971 | –242 |
| Mexico | 2 | 0 | 6 | –4 | 25 | 30 | –5 |
| LNG | 27 | 32 | 27 | 0 | 380 | 298 | 82 |
| **Total supply** | **2,194** | **2,064** | **2,119** | **75** | **22,835** | **23,424** | **–589** |

**NATURAL GAS IN UNDERGROUND STORAGE**

| | Oct. 2009 | Sept. 2008 | Aug. 2008 | Oct. 2008 | Change |
|---|---|---|---|---|---|
| | | | bcf | | |
| Base gas | 4,279 | 4,278 | 4,268 | 4,235 | 44 |
| Working gas | 3,807 | 3,643 | 3,352 | 3,399 | 408 |
| **Total gas** | **8,086** | **7,921** | **7,620** | **7,634** | **452** |

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

## WORLDWIDE NGL PRODUCTION

| | Sept. 2009 | Aug. 2009 | 9 month average production 2009 | 9 month average production 2008 | Change vs. previous year Volume | Change vs. previous year % |
|---|---|---|---|---|---|---|
| | | | 1,000 b/d | | | |
| Brazil | 77 | 76 | 78 | 87 | –9 | –10.4 |
| Canada | 569 | 586 | 570 | 641 | –71 | –11.0 |
| Mexico | 364 | 373 | 370 | 368 | 3 | 0.7 |
| United States | 1,941 | 1,896 | 1,863 | 1,810 | 53 | 2.9 |
| Venezuela | 200 | 200 | 200 | 200 | — | — |
| Other Western Hemisphere | 203 | 200 | 202 | 196 | 6 | 3.0 |
| **Western Hemisphere** | **3,355** | **3,331** | **3,283** | **3,301** | **–18** | **–0.5** |
| Norway | 249 | 273 | 274 | 274 | — | — |
| United Kingdom | 105 | 71 | 128 | 161 | –33 | –20.5 |
| Other Western Europe | 9 | 10 | 10 | 10 | — | 1.6 |
| **Western Europe** | **363** | **354** | **412** | **445** | **–33** | **–7.4** |
| Russia | 436 | 432 | 418 | 422 | –4 | –0.8 |
| Other FSU | 150 | 150 | 150 | 150 | — | — |
| Other Eastern Europe | 11 | 14 | 14 | 15 | –1 | –5.8 |
| **Eastern Europe** | **597** | **596** | **583** | **587** | **–4** | **–0.8** |
| Algeria | 350 | 350 | 343 | 356 | –13 | –3.6 |
| Egypt | 70 | 70 | 70 | 70 | — | — |
| Libya | 80 | 80 | 80 | 80 | — | — |
| Other Africa | 131 | 131 | 131 | 129 | 2 | 1.6 |
| **Africa** | **631** | **631** | **625** | **635** | **–11** | **–1.7** |
| Saudi Arabia | 1,597 | 1,572 | 1,439 | 1,440 | –1 | –0.1 |
| United Arab Emirates | 250 | 250 | 250 | 250 | — | — |
| Other Middle East | 835 | 835 | 835 | 880 | –45 | –5.1 |
| **Middle East** | **2,682** | **2,657** | **2,524** | **2,570** | **–46** | **–1.8** |
| Australia | 73 | 77 | 70 | 66 | 4 | 5.5 |
| China | 650 | 650 | 650 | 630 | 20 | 3.2 |
| India | — | — | — | — | — | — |
| Other Asia-Pacific | 169 | 169 | 169 | 179 | –10 | –5.7 |
| **Asia-Pacific** | **892** | **896** | **889** | **875** | **13** | **1.5** |
| **TOTAL WORLD** | **8,521** | **8,466** | **8,315** | **8,413** | **–99** | **–1.2** |

Totals may not add due to rounding.
Source: Oil & Gas Journal.
Data available in OGJ Online Research Center.

## OXYGENATES

| | Oct. 2009 | Sept. 2008 | Change | YTD 2009 | YTD 2008 | Change |
|---|---|---|---|---|---|---|
| | | | 1,000 bbl | | | |
| Fuel ethanol | | | | | | |
| Production | 22,956 | 21,752 | 1,204 | 208,133 | 179,531 | 28,602 |
| Stocks | 15,080 | 15,688 | (608) | 15,080 | 15,192 | (112) |
| MTBE | | | | | | |
| Production | 938 | 1,386 | (448) | 14,407 | 14,820 | (413) |
| Stocks | 985 | 543 | 442 | 985 | 762 | 223 |

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

## US HEATING DEGREE-DAYS

| | Nov. 2009 | Nov. 2008 | Normal | 2009 % change from normal | Total degree-days July 1 through Nov. 30 2009 | Total degree-days July 1 through Nov. 30 2008 | Total degree-days July 1 through Nov. 30 Normal | % change from normal |
|---|---|---|---|---|---|---|---|---|
| New England | 619 | 759 | 727 | –14.9 | 1,381 | 1,432 | 1,384 | –0.2 |
| Middle Atlantic | 546 | 698 | 667 | –18.1 | 1,078 | 1,198 | 1,193 | –9.6 |
| East North Central | 609 | 787 | 757 | –19.6 | 1,314 | 1,355 | 1,337 | –1.7 |
| West North Central | 588 | 806 | 840 | –30.0 | 1,376 | 1,393 | 1,447 | –4.9 |
| South Atlantic | 294 | 417 | 339 | –13.3 | 479 | 625 | 528 | –9.3 |
| East South Central | 408 | 535 | 449 | –9.1 | 676 | 778 | 695 | –2.7 |
| West South Central | 220 | 273 | 293 | –24.9 | 364 | 389 | 385 | –5.5 |
| Mountain | 552 | 540 | 676 | –18.3 | 1,106 | 981 | 1,219 | –9.3 |
| Pacific | 354 | 275 | 396 | –10.6 | 606 | 469 | 690 | –12.2 |
| **US average*** | **442** | **538** | **539** | **–18.0** | **865** | **899** | **922** | –6.2 |

*Excludes Alaska and Hawaii.
Source: DOE Monthly Energy Review.
Data available in OGJ Online Research Center.

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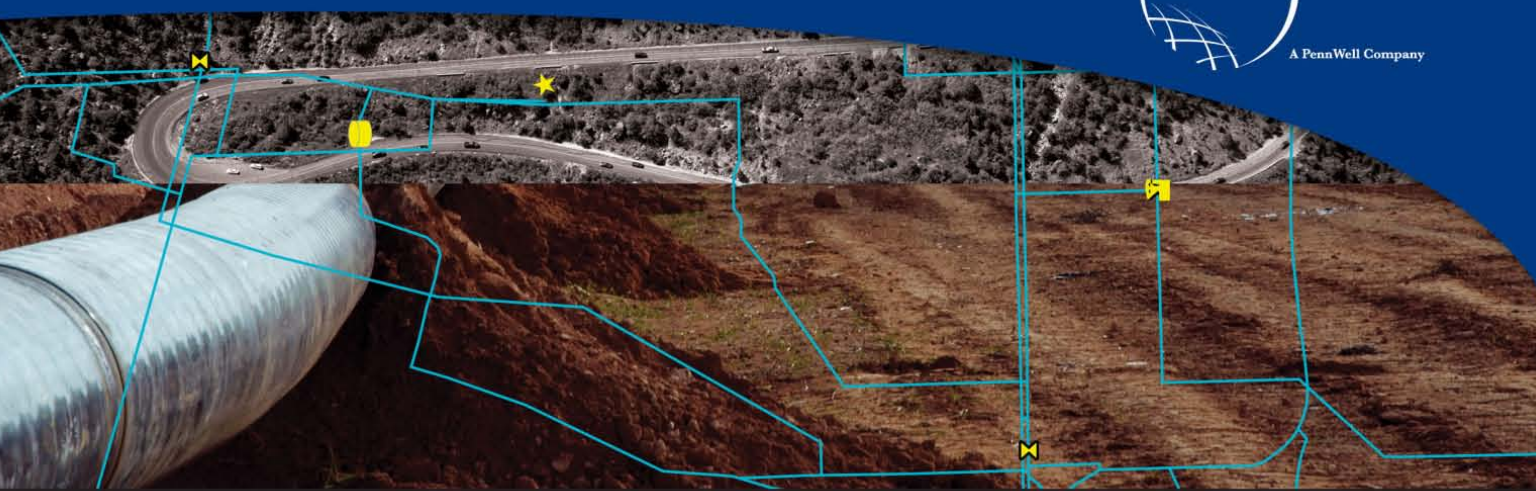


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## Europol: Emission trading fraud costs Europe €5 billion

*By the time it ended, the Copenhagen climate summit had become farcical enough to obscure an instructive disclosure that emerged in the confab's early days. At this writing, quarrelling summiteers were straining to assemble some token agreement that would keep their effort from looking like more than an international contest for other people's money.*

*Not even Nobel Laureate Barack Obama, who took time off from his healthcare fiasco in the US to prod international leaders into valiant combat against climate variation, could rescue the moment.*

*Glaciers, therefore, seem destined to continue melting, which they were going to do no matter what happened in Copenhagen. A greater hazard to human well-being lurks in the US Congress, where Obama's political party is fragmenting over a thunderously unpopular campaign to overhaul health care.*

*The danger is that Democratic social engineers will channel their frustration over an inevitable health-care retreat into a reinvigorated push for greenhouse gas emission control via cap-and-trade.*

*It's on that threat to prosperity that a report by Europol, the European law-enforcement cooperative, has much to teach.*

*On Dec. 9, 2009,Europol said the European Union's Emission Trading System, a cap-and-trade scheme, had been fleeced for €5 billion in the preceding 18 months by fraudulent trades.*

*"It is estimated that in some countries up to 90% of the whole market volume was caused by fraudulent activities," it said.*

*Criminals apparently had been buying emission allowances in countries where they didn't have to pay Europe's value-added tax (VAT) and reselling in VAT countries, collecting the tax from buyers and disappearing without passing the money on to authorities.*

*Suspicion arose in response to unprecedented increases in emission trading in late 2008. After France, the Netherlands, the UK, and Spain changed tax rules to prevent exploitation, market volume dropped by as much as 90%.*

*The ever-present threat of trading fraud is a powerful reason for the US to spurn cap-and-trade. Congressional supporters of the approach insist they can fashion controls that will keep emissions trading within honest bounds. But they're largely the same people who, behind closed doors, are turning health care into political hash.*

*(Online Dec. 18, 2009; author's e-mail: bobt@ogjonline.com)*

The Editor's Perspective

*by Bob Tippee, Editor*

Market Journal

*by Sam Fletcher, Senior Writer*

## A 'virtual' oil price gain

The front-month contract for benchmark US light, sweet crudes traded as high as $80/bbl before closing at $79.36/bbl Dec. 31 in what many described as a 78% price jump during 2009 and its biggest surge since 1999 on the New York Mercantile Exchange. But Olivier Jakob at Petromatrix, Zug, Switzerland, charged the alleged 78% gain is "purely a virtual number that will look good only on a misleading investment brochure."

Had a leveraged trader bought a NYMEX crude contract at the end of 2008 and rolled his position on "the penultimate day of expiry" at the end of 2009, his earnings would have totaled $19.44/bbl for the year, a 43.6% gain, Jakob said. A trader who rolled his front West Texas Intermediate position on the first day of the month would have made $16.18/bbl or 36.3%, while one who bought the February 2010 contract at the end of 2008 in order to avoid the contango roll would have made $19.12/bbl "but on a higher flat-price basis, hence a return of 31.74%," said Jakob.

"The real tradable returns of WTI in 2009 depend on the timing of the roll of the position, but if we average the roll on the first day of the month, on penultimate day, and the unrolled February 2010 returns, then we come to a WTI increase of $18.25/bbl or 40.9% during 2009, which is about half the virtual gains printed on the continuous charts and reported by the mass media." Jakob said. "If we are to compare the 2009 WTI returns based on the February contract (i.e. unrolled position) then the returns for 2009 were only the fourth best of the last 10 years, and that is only because there were 3 negative years. In other words, over the last 10 years for those years that had positive returns on WTI, 2009 was the worse year in terms of percent returns."

Jakob said, "The largest loser of the year would have been the investor...buying commodity exchange traded funds or commodity indices under the belief that he was buying a futures-look-alike contract while he was buying a net-asset-value instrument based on futures. In a contango structure any net-asset-value instrument on commodity futures will mathematically underperform the direct purchase of a commodity futures. This being said there are many asset managers [who] are happy to pay a higher commission for an underperforming investment vehicle to cover for their lack of understanding of the markets they are investing in."

In money markets, Jakob said, "The euro made strong gains during the year but came back under pressure during December to bring it closer to the start-of-the-year value, and large speculators have been getting overly bullish on the dollar index." Crude prices continued increasing in December while the dollar index also rebounded. Jakob observed, "There is nothing sacred in a dollar-to-oil correlation but with crude oil prices rising in tandem with the dollar index, it means that Brent on a euro price basis is at the highest level of 2009, and that could start to hit the European demand price elasticity."

**Price forecasts**

Analysts in the Houston office of Raymond James & Associates Inc. claim their 2009 oil price forecast was "unusually" accurate. "For the first time in 7 years," they said, "our forecast...did not prove overly conservative. At $60/bbl, our oil forecast was near consensus and ended almost dead-on with the full-year average of $58/bbl—despite the panicky meltdown in oil prices that reached its trough in February."

Raymond James analysts' 2010 forecast is for $80/bbl, "which assumes modestly higher demand and falling non-OPEC supply." They expect bullish supply and demand trends to continue for several years and set their initial 2011 forecast at $95/bbl.

On the other hand, they admitted, "Our bearish 2009 US gas price forecast was directionally accurate but still 20% too high." Their gas price forecast of $5/Mcf at the start of the year was well below Wall Street's $7.31/Mcf consensus. Gas prices slid steadily through the third quarter as they expected but further than predicted, averaging $4/Mcf for the year. This year they are lowering their gas price prediction to an average $5/Mcf from $5.50/Mcf previously; their initial 2011 gas price prediction also is $5/Mcf.

Raymond James analysts expect US gas prices to hover around $5/Mcf for several years because that is the price level at which US gas supply rises, LNG imports increase, and gas-to-coal demand switching takes place.

(Online Jan. 5, 2010; author's e-mail: samf@ogjonline.com)

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