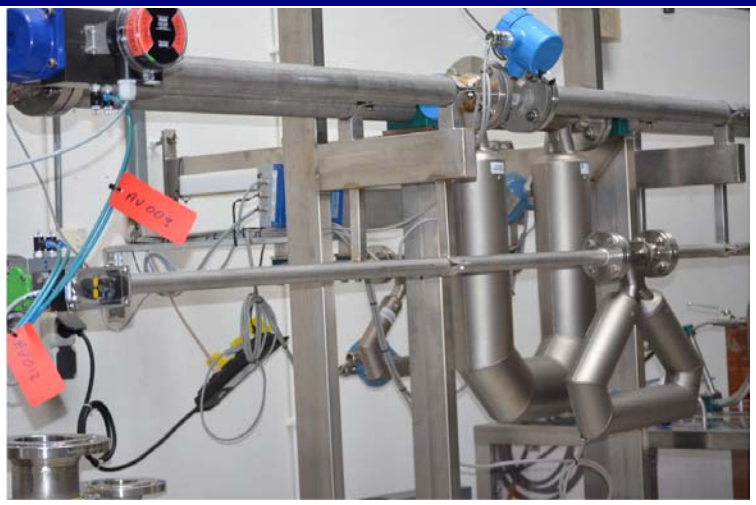
*We create change in flow*

# *energy monitor*



**Q2 2015**

*Test stand at VSL, the Netherlands' National Metrology Institute (NMI) photo by Flow Research*

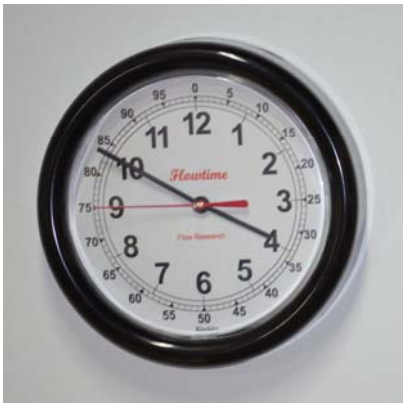
*Daniel Bernoulli*

## Oil & Gas and Refining
## Power & Renewables

**Issues & Perspectives:**
**Flow Calibration**

**Global Spotlight:**
**International Energy Agency (IEA)**

**Company Korner:**
**Schlumberger acquiring Cameron**



*Flowtime Wall Clock*

**Flow Research, Inc.**

***A Worldflow publication***

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| ___ The World Market for Liquefied Natural Gas (LNG) | *www.flowlng.com* |
| ___ The World Market for Oil and Oil Flow Measurement | *www.oilflows.com* |
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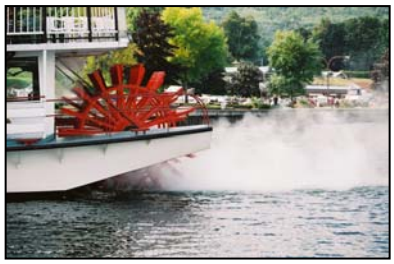

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# Energy Monitor

# Q2 2015

**Flow Research, Inc.**

**Energy Monitor**

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# Energy Monitor
# Q2 2015

*Publisher and Executive Editor: Jesse Yoder, PhD (jesse@flowresearch.com)*
*Associate Editors: Vicki Tuck, Leslie Buchanan, and Norm Weeks*

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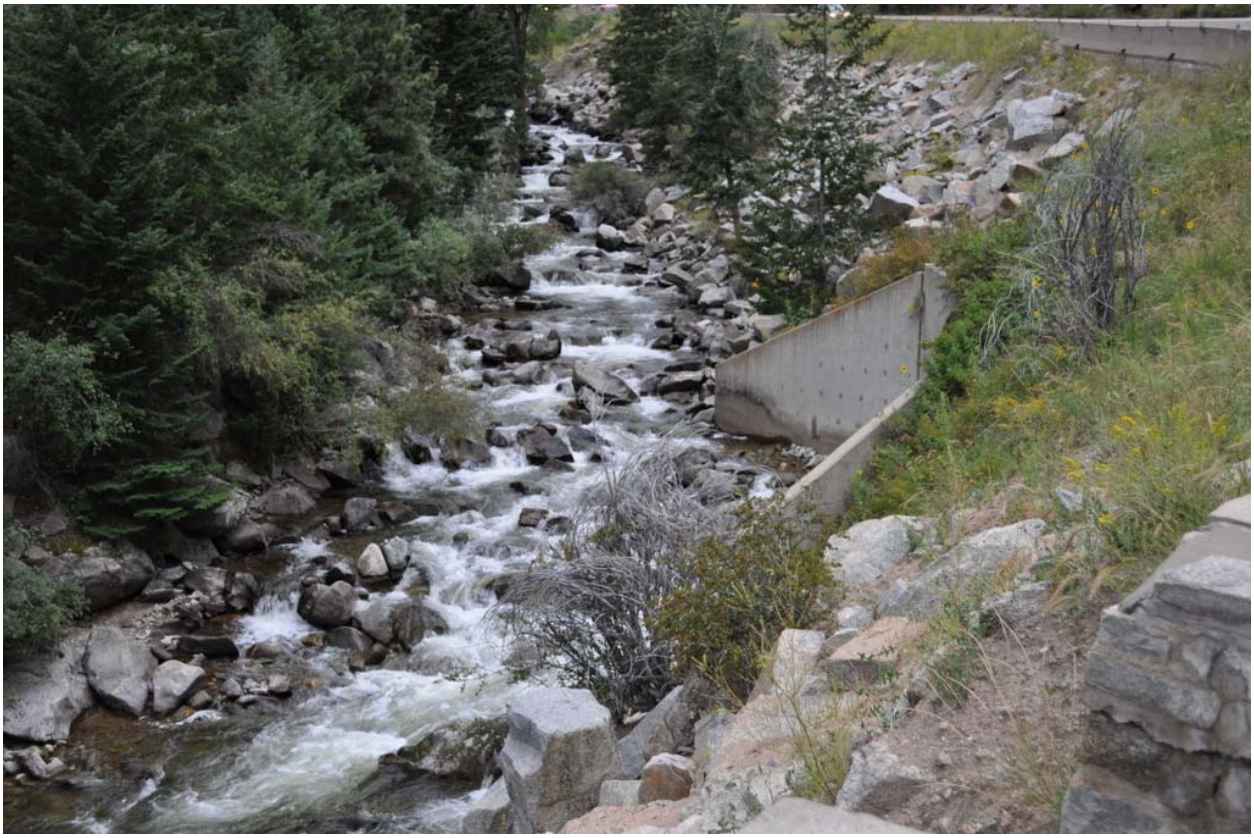

*Boulder Canyon, Boulder, Colorado  Photo by Flow Research*

The **Energy Monitor** is part of the Worldflow Monitoring Service. Other publications include the **Market Barometer** and **Flash Reports**. **Worldflow Online** provides more in-depth information and analysis about the instrumentation business.

Here is our upcoming **Worldflow** schedule:

*Q3 2015*
**Market Barometer** — October 2015
**Energy Monitor** — November 2015

*Q4 2015*
**Market Barometer** — December 2015
**Energy Monitor** — January 2016

*Q1 2016*
**Market Barometer** — February 2016
**Energy Monitor** — March 2016

# *Issues and Perspectives:* Flow Calibration

*By Jesse Yoder, PhD, Flow Research*

## The Growing Need for More Calibration Facilities

The topic of flow calibration is of interest to flowmeter manufacturers, end-users, and flow calibration labs alike. Flowmeters need to be calibrated before they are sent into the field. This is usually done either by the manufacturer or by an independent flow lab. After the flowmeter has been in service for a period of time, it often needs to be recalibrated. This can be done either by the manufacturer it would be bought from, by some other manufacturer, or by an independent flow lab.

Sending a flowmeter to a calibration facility is probably the surest way to verify the correct operation of the meter, and to bring it back into the proper performance specifications. However, this can be a costly operation. Companies do not always have a "back-up" meter that they can substitute for the meter that is being recalibrated. In addition to packing and shipping costs, there is the cost of recalibrating the meter, and the time that the meter is out of service. However, for some meters, especially those used for custody transfer, this is the only viable solution. This especially applies to ultrasonic and turbine flowmeters.

## Calibration vs. Recalibration

It is important to distinguish between calibration and recalibration of flowmeters. After flowmeters are built, they need to be initially calibrated before being sent out into the field. Most flowmeter manufacturers have their own flowmeter calibration facilities for performing this initial calibration. An exception is flowmeters that need to be tested under special conditions that may not be easy to duplicate for a flowmeter manufacturer. For example, large line size gas ultrasonic flowmeters need to be tested under high pressure conditions with high speed flowing natural gas. The facilities to do this typically cost millions of dollars. Therefore, flowmeter manufacturers are likely to send these meters out to an independent flowmeter facility to be initially calibrated. The same reasoning applies to large line size turbine flowmeters (e.g., over 12 inches in diameter).

## Gas and Liquid Calibration Facilities

While many calibration labs do calibrations on flowmeters for both gas and liquid measurement, most labs build separate facilities for these purposes. The reason is that the fluid medium used to measure the gas and liquid meters is different, and the methodology used is different. Flowmeters used for gas flow measurement are generally calibrated using air, or using a specific type of gas. Flowmeters used for liquid measurement generally are calibrated with water or some other type of liquid, and they rely on piston provers for calibration purposes.

There are many highly reliable independent flowlabs in the United States, Canada, and Europe. Included in these are Colorado Engineering Experiment Station, Inc. (CEESI), Trans Canada Calibrations (TCC), NMi Euroloop and VSL (the Netherlands), pigsar (Germany), and National

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# *Issues and Perspectives:* Flow Calibration

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Engineering Laboratory (NEL) in the United Kingdom. There are also a number of labs in China and other parts of Asia. The large flowlabs such as CEESI, NMi Euroloop, and VSL have their gas and liquid labs built in separate locations.

In addition to the independent labs, many flowmeter manufacturers have their own calibration facilities that can also serve for recalibration purposes. Some limit their services to their own customers, while others perform calibrations as a service for their own customers and for other end-users as well.

### More Flowmeters Sold Means More Calibrations Needed

Simple math dictates the need for more calibration facilities, especially for gas flow measurement. Even though the market for turbine flowmeters is growing slowly, a large number of new turbine meters are sold every year worldwide. Many of these are for gas flow measurement. The ultrasonic flowmeter market, by contrast, continues to grow, especially multipath ultrasonic flowmeters for custody transfer applications. Many of these are large flowmeters, but the smaller ones also need to be calibrated. Eventually, perhaps within 3–5 years, many of these flowmeters sold in 2015 will need to be recalibrated. This is in addition to the existing installed base of turbine and ultrasonic meters that were sold 3–5 years ago that may need recalibration this year. And the meters sold in 2015 also need an initial calibration.

Some flow calibration facilities report that they have waiting lists for flow calibrations. End-users also report having to wait three months or more for certain flowmeters to be recalibrated, especially large size ultrasonic and turbine meters. The growth in the flowmeter market is relentless, with most flowmeter types showing positive unit growth each year. There appears to be no corresponding growth in flowmeter calibration facilities. If flowmeter growth is outpacing the growth of calibration facilities currently, what will the situation be like in five or ten years? This problem is so critical that it may need to be addressed by an industry wide task force, rather than being left up to individual flowmeter manufacturers and independent flowlabs.

The US Congress is notorious for not looking beyond the next election in considering legislation. Public companies very often gear their focus to next quarter results. Who in the flowmeter industry is looking at calibration needs five or ten years down the road? Or are the manufacturer and independent flowlabs focused too much on this or next year's profits? This is not necessarily a bad thing, as long as it does not come at the expense of long-term planning.

### New Fluid Types Generate the Need for New Calibrations

As if measuring existing fluids such as natural gas and petroleum liquids is not enough, new fluids are becoming increasingly important and new types of flowmeters are being created to measure them. Two of the most important new flowmeter types are multiphase flowmeters and liquefied natural gas (LNG) meters.

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# *Issues and Perspectives:* Flow Calibration

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Multiphase flowmeters measure the relative amount of gas, oil, and water in fluids coming out of oil and gas wells. These flowmeters are very expensive (some cost over $500,000), though recently costs have come down with innovative technological developments. Multiphase flowmeters are extremely valuable because they provide information about the state of the producing well and the field it is in, and because they make it possible to determine the relative amounts of oil, gas, and water coming out of a well before these fluids are run through a separator.

LNG is a difficult measurement because it has to be made at cryogenic temperatures. The temperature of LNG is at -161° Celsius, which is equivalent to -259° Fahrenheit. Several companies, including GE Measurement and McCrometer, have developed LNG meters. Other companies can perform this measurement using cryogenic meters.

LNG is increasingly playing a role in the world's energy story. Because China, Japan, and many other Asian countries were not blessed with an abundance of fossil fuels like countries in Europe, the Middle East, and North America, they are importing LNG on ships from these regions. To do this, natural gas is shrunk 600 times its volume at a liquefaction plant. It is then placed on a ship for export. At its destination, it is turned back into natural gas at a regasification plant. It is then transported by pipeline to utilities and other destinations for distribution. There are a number of measurement points along the way.

VSL is building an LNG calibration facility that is expected to open in Rotterdam, the Netherlands, in 2016. Right now the need for recalibrating multiphase meters is less critical because many of them are new and they are so expensive that they are relatively small in number. But both multiphase and LNG flowmeters will need to be calibrated in the future, and this is yet another opportunity for flowmeter calibration facilities.

### What Needs to be Done

There appear to be a number of industry wide issues that need to be addressed by more than a single company or flowlab. An industry-wide consortium that would look at the future of calibration facilities would be a welcome development. Flow Research has formed a Flowmeter Recalibration Working Group (FRWG), currently with 13 members, that is addressing the topic of recalibration frequency. This group may also be an ideal vehicle for addressing the broader issue of flow calibration needs over the next ten years, since it is composed of representatives from the leading independent flowlabs, along with members from many of the larger flowmeter companies.

Whether it is the FRWG or some other group that is formed independently, it seems clear that some long-term thinking and planning needs to be done if end-users are going to be able to have their flowmeters calibrated in a timely fashion in the next five to ten year period, and beyond. The challenge is clear: develop sufficient flowlab capability to handle flowmeters that measure existing fluids, and also develop the capability to calibrate emerging technology flowmeters, including multiphase and LNG meters. Whether the industry as a whole is robust enough to meet this challenge remains to be seen.

# *Global Spotlight:* International Energy Agency

## International Energy Agency

International Energy Agency
9, rue de la Fédération
75739 Paris Cedex 15 France
http://www.iea.org/

It is easy to confuse the IEA with the EIA, for obvious reasons. The EIA is an agency of the US government that focuses on energy and collects very valuable data on worldwide oil and gas production, reserves, consumption, imports, and exports (www.eia.gov). The IEA (www.iea.org) is an international consortium of countries that was formed after the 1974 oil crisis. The IEA was initially designed to help countries co-ordinate a collective response to major disruptions in the supply of oil. While this remains a key aspect of its work, the IEA has evolved and expanded. It is at the heart of global dialogue on energy, providing authoritative statistics and analysis.

The IEA is an autonomous organization that works to make available reliable, affordable, and clean energy for its 29 member countries and beyond. The IEA examines the full spectrum of energy issues and advocates policies that will enhance the reliability, affordability and sustainability of energy in its 29 members countries and beyond.

The four main areas of IEA focus are:

- **Energy security**: Promoting diversity, efficiency and flexibility within all energy sectors;
- **Economic development**: Ensuring the stable supply of energy to IEA member countries and promoting free markets to foster economic growth and eliminate energy poverty;
- **Environmental awareness**: Enhancing international knowledge of options for tackling climate change; and
- **Engagement worldwide**: Working closely with non-member countries, especially major producers and consumers, to find solutions to shared energy and environmental concerns.

When it was founded, the main objectives of the IEA were:

- to maintain and improve systems for coping with oil supply disruptions
- to promote rational energy policies in a global context through co-operative relations with non -member countries, industry and international organizations
- to operate a permanent information system on the international oil market
- to improve the world's energy supply and demand structure by developing alternative energy sources and increasing the efficiency of energy use
- to promote international collaboration on energy technology, and
- to assist in the integration of environmental and energy policies.

Since the 1980s, the IEA has been building good working relationships with countries beyond its membership, in particular major energy consuming, producing and transit countries. A complete understanding of energy markets requires appreciating the views of all important players – their concerns, the challenges they face and the solutions they are considering. IEA countries

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# *Global Spotlight:* International Energy Agency

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account for just under half of the world's energy consumption, but all countries participate in global markets, and emerging economies increasingly are confronting the same energy challenges as developed nations.

Since the 1980s, the IEA has continued to build good working relationships with countries beyond its membership, in particular major energy consuming, producing and transit countries including Brazil, China, India, Indonesia, Mexico, and South Africa. Co-operation with these and other partner countries covers a wide range of activities, among them:

- jointly holding topical workshops on topics such as emergency response policies, energy efficiency and energy market regulation
- co-operating on surveys of energy sectors in partner countries, or their preparedness for major disruptions to oil and gas supplies
- helping experts and groups from partner countries join the IEA network of Energy Technology Initiatives (Implementing Agreements) and the International Low-Carbon Technology Platform
- holding training and capacity-building activities to spread best practices in energy policy and energy statistics.

The IEA also co-operates with the other international organizations and forums that work in the field of energy. It plays an active role in discussions with producer countries and with the Organization of the Petroleum Exporting Countries (OPEC), particularly within the International Energy Forum (IEF). In addition, the IEA works closely with the International Renewable Energy Agency (IRENA).

This engagement with partner countries and other international organizations is an integral part of the Agency's efforts to provide all stakeholders – from policy makers to business leaders – with a truly global view of the world's energy system.

**Member countries**

- Australia
- Austria
- Belgium
- Canada
- Czech Republic
- Denmark
- Estonia
- Finland
- France
- Germany
- Greece
- Hungary
- Ireland
- Italy
- Japan
- Korea
- Luxembourg
- The Netherlands
- New Zealand
- Norway
- Poland
- Portugal
- Slovak Republic
- Spain
- Sweden
- Switzerland
- Turkey
- United Kingdom
- United States

The IEA is made up of 29 member countries. Before becoming a member country of the IEA, a candidate country must demonstrate that it has:

- as a net oil importer, reserves of crude oil and/or product equivalent to 90 days of the prior year's average net oil imports to which the government (even if it does not own those stocks directly) has immediate access should the Co-ordinated Emergency Response Measures (CERM) – which provide a rapid and flexible system of response to actual or imminent oil supply disruptions – be activated
- a demand restraint program for reducing national oil consumption by up to 10%
- legislation and organization necessary to operate, on a national basis, the CERM and
- legislation and measures in place to ensure that all oil companies operating under its jurisdiction report information as is necessary

# *Oil & Gas and Refining*

*This section covers important events in the oil, gas, and refining industries, which include companies producing petroleum, hydrocarbon liquids, and natural gas and extracting oil. It also includes petrochemical companies.*



## In the News

### Apache agrees to sell Australian operations for $2.1 billion

Houston, Texas; April 8, 2015 — Apache Corporation announced an agreement to sell its Australian subsidiary Apache Energy Limited to a consortium of private equity funds managed by Macquarie Capital Group Limited and Brookfield Asset Management Inc. for cash payment of $2.1 billion. The transaction is expected to close mid-year 2015 and is subject to necessary government and regulatory approvals and customary post-closing adjustments. Effective date of the sale is October 1, 2014.

Assets of Apache Energy Limited and its subsidiaries averaged production of approximately 49,000 barrels of oil equivalent per day in March. With the announcement of this sale, Apache is fully exiting its exploration and production business in Australia, but will retain its 49-percent ownership interest in fertilizer producer Yara Pilbara Holdings Pty Limited. On April 2, 2015, Apache announced the completion of sale of its Wheatstone LNG project and related oil and natural gas properties to Woodside Petroleum Limited for $2.8 billion.

John J. Christmann, IV, chief executive officer and president, said the "announcement represents a notable step in Apache's strategic portfolio repositioning. Over the last five years, we have transitioned Apache's primary growth engine to North America onshore through the announcement or completion of approximately $17 billion of asset purchases and $17 billion of asset sales. Following the sale of our Australian assets, approximately 70% of Apache's production will come from North America onshore. Our robust North American position is complemented by our North Sea and Egyptian regions, which have an extensive inventory of prospects and assets that generate free cash flow." *www.apachecorp.com*

### Paul Simons named IEA Deputy Executive Director

Paris, France; April 28, 2015 — Mr. Paul Simons, a senior United States diplomat with a strong background in energy and economic policy, has been selected to be the new Deputy Executive Director of the International Energy Agency. Mr. Simons will take up his position on July 8, 2015.

"We look forward to welcoming Paul Simons to the IEA," said Executive Director Maria van der Hoeven. "He brings a range of diplomatic and management skills that will be valuable to the Agency, especially as we work to deepen relationships with countries beyond the current IEA membership."

In his role as Deputy Executive Director, Mr. Simons will support the Executive Director in providing leadership and strategic direction to the Agency, including advancing the global engagement strategy, strengthening co-operation with non-member countries as well as initiatives with key partner countries. Mr. Simons will also have overall responsibility for co-ordinating internal operations, including the Energy Data Centre, communications and budget activities.

*www.iea.org*

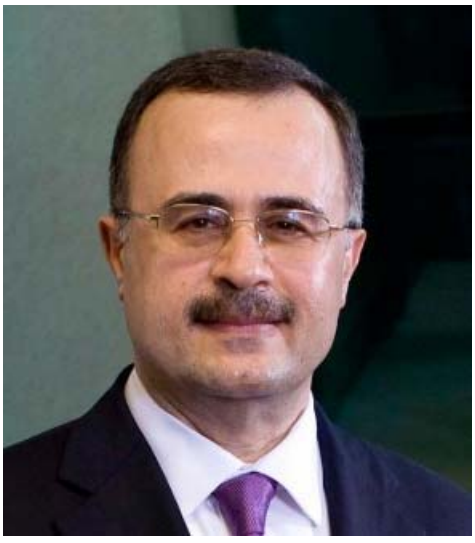
## In the News

# H.E. Khalid Al-Falih appointed Chairman of the Board and Mr. Amin H. Nasser acting President and Chief Executive Officer of Saudi Aramco

Dhahran, May 1, 2015 — Saudi Aramco has announced that His Excellency Mr. Khalid A. Al-Falih has been appointed Chairman of the Board of the Saudi Arabian Oil Company (Saudi Aramco).

*H.E. Khalid Al-Falih*
*(Saudi Aramco 2012 photo)*

Saudi Aramco has also stated that Mr. Amin H. Nasser has been named as the acting President and Chief Executive Officer of the Saudi Arabian Oil Company (Saudi Aramco) until further notice.



*Mr. Armin H. Nasser (Saudi Aramco 2015 photo)*

Mr. Amin H. Nasser is a member of the Board of Directors of Saudi Aramco and he held the position of Senior Vice President, Upstream since 2008.

Mr. Nasser joined Saudi Aramco after graduating with a bachelor's degree in petroleum engineering from King Fahd University of Petroleum and Minerals in Dhahran in 1982. From November 1982 to February 1991, he had various assignments with the Production Engineering, Drilling and Reservoir Management departments. From March 1991 to May 1997, Nasser held various supervisory positions in the Engineering and Producing departments.

Mr. Nasser became manager of the Ras Tanura Producing Department in June 1997. He also was manager of the Northern Area Producing Engineering Department, Safaniya Offshore Producing Department and the Safaniya Onshore Producing Department. Nasser was appointed chief petroleum engineer in April 2004 and executive director of Petroleum Engineering and Development in May 2005.

He was named vice president of Petroleum Engineering and Development in April 2006 and then as acting business line head of Exploration and Producing (E&P) in August 2007. In 2008, he became E&P's senior vice president.

*www.saudiaramco.com*

## In the News

### BP and Sinopec set up joint venture marine bunkering business

May 19, 2015 — BP and Sinopec Fuel Oil today announce the formation of a 50:50 marine fuels bunkering joint-venture, BP Sinopec Marine Fuels Pte Ltd. Based in Singapore, one of the largest and busiest ports in the world, the joint venture will build out from its partners' existing bunkering locations and activities. In addition to marine bunkering in Singapore, the joint venture will provide marine bunker sales in key global locations.

The ports served by BP Sinopec Marine Fuels Pte Ltd will be: Singapore; Fujairah, United Arab Emirates; Antwerp, Belgium; Rotterdam and Amsterdam in the Netherlands; Tianjin, Qingdao, Shanghai, Ningbo and Shenzhen, China.

BP is an established and leading global provider of marine fuels, and Sinopec is a leading provider within China. Both companies have a long history of working together in China and overseas, and this agreement represents a significant continuation of the relationship.

*www.bp.com*


### Shell announces receipt of binding offer from DCC Energy to acquire its Butagaz LPG business in France

May 19, 2015 — Shell announced that it has received a- binding offer of €464m million ($529 million) from DCC Energy for its Butagaz Liquefied Petroleum Gas (LPG) business in France.


In reply to this offer, DCC Energy has been granted exclusivity while Shell consults with the staff councils of both Butagaz and Shell France. The transaction is also subject to obtaining regulatory approvals following these consultations. It is expected to complete in 2015.

All other Shell Businesses in France – Aviation, Commercial Fleet, Lubricants, Retail and Specialties – will continue to operate as before.

The transaction is consistent with Shell's strategy to concentrate its Downstream footprint on a smaller number of assets and markets where it can be most competitive, and is part of an on-going exit from the LPG business globally.

*www.shell.com*

## In the News

### LUKOIL and GAZPROM sign agreements on the supplies of gas

June 19, 2015 — Vagit Alekperov, OAO LUKOIL President, and Alexey Miller, OAO GAZPROM Chairman of the Board, held a working meeting at the Saint Petersburg International Economic Forum.

The parties discussed the implementation of the General Agreement on strategic partnership and, in particular, on the purchase of gas produced by LUKOIL.

The Companies have signed Additional agreement on the supply of gas from LUKOIL fields in Bolshekhetskaya Depression for 2017–2024.

Also the Contract was signed on the supply of gas up to 2024 from Northern Caspian fields developed by LUKOIL. Gas will flow into the gas transportation system of GAZPROM near the town of Budennovsk. The volume of gas supplies each year will be determined by the technical features and modes of operation of the gas transportation system of GAZPROM, as well as depending on the commissioning of the Northern Caspian fields.

Earlier, LUKOIL and GAZPROM signed a General Agreement on strategic partnership for 2014–2024, aimed at developing cooperation in the supply of hydrocarbons, the production of oil and gas and chemical products, placement of available resources of oil and gas condensate at processing plants located in Russia and abroad. The agreement also provides for cooperation in the development of productive capacity and infrastructure, their scientific, technical, environmental and human resources, as well as in other areas.

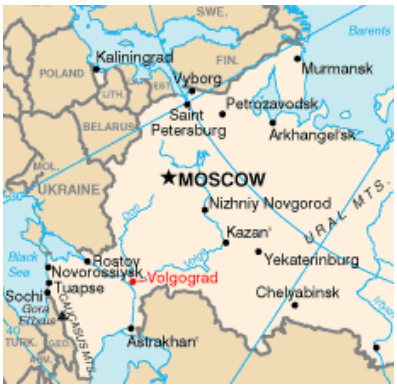
*www.lukoil.com*

### LUKOIL puts the primary oil refining installation (ELOU AVT-1) into operation in the Volgograd region

June 25, 2015 — Today in Volgograd, Vagit Alekperov, President of OAO "LUKOIL", Arkady Dvorkovich, Deputy Prime Minister of Russia, Kirill Molodsov, Deputy Energy Minister of Russia and Andrei Bocharov, Governor of the Volgograd region, took part in the ceremonial launch into operation of the primary oil refining installation (ELOU AVT-1).

ELOU AVT-1 is the largest installation among those active at the Volgograd refinery. Its capacity is 6 million tons of oil per year. Unlike other atmospheric vacuum pipe heaters, ELOU AVT-1 is equipped with stabilizing and secondary distillation of gasoline sectors that allow for immediate obtainment of LPG- and high octane gasoline components. The unit has a modern control system and fully complies with the Russian safety legislation.

Vagit Alekperov, President, OAO "LUKOIL": "The construction of the new installation was carried out in accordance with the program of modernization of OAO "LUKOIL"'s refining capacities. The installation was put into operation as part of the large-scale program of modernization of refining capacities that is being implemented by the company. The launch of ELOU AVT-1 will increase the efficiency of oil refining and the capacity of the Volgograd refinery to 14.5 million tons of oil per year."




*www.lukoil.com*

# Oil & Gas and Refining

## Upcoming Trade Shows

**Asia Pacific Oil & Gas Conf. and Exhib.**
October 20–22, 2015
Bali Nusa Dua Convention Center
Bali, Indonesia
*www.spe.org*
This upstream technical event, co-organized by the Society of Petroleum Engineers (SPE) and the Society of Indonesian Petroleum Engineers (IATMI), covers insights into the region's oil and gas industry, current trends, emerging technologies and state-of-the-art innovation.

**North Sea Flow Measurement Workshop**
October 20-23. 2015
Quality Tønsberg Hotel
Tønsberg, Norway
*www.tekna.no*
Presentations and discussions of measurement technology related to oil and gas. Main focus is on the practical application of this technology. High number of delegates from over 30 countries offers excellent networking opportunities.

**Gastech 2015 Conference and Exhibition**
October 27–30, 2015
Singapore Expo
Singapore
*www.gastechsingapore.com*
The world's largest award winning exhibition for the global gas industry and its related industry sectors. Hosted by B Group, a world leader in exploration and LNG. See website for associated free-to-attend events.

**FLNG USA Conference 2015: Moving Forward into FLNG Delivery**
November 2–5, 2015
DoubleTree by Hilton Hotel Houston Greenway Plaza
Houston, Texas, USA
*www.icbi-events.com*
One of the world's leading events for the offshore gas industry is a unique gathering of LNG offtakers, energy companies, FPSO operators/designers, shipyards, marine engineers, systems providers and financiers. It brings all the key players under one roof.

**Deepwater Operations Conf.& Exhib.**
November 3–5, 2015
Moody Gardens Hotel & Convention Center
Galveston, Texas, USA
*www.deepwateroperations.com*
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**The World LNG Fuels 2016**
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## Industry Pulse

### API: Industry embraces new pipeline safety framework

Washington; July 8, 2015 — The American Petroleum Institute announced a new pipeline safety management system standard. This new standard which was built on the industry goal of zero incidents was created with engagement and guidance from the National Transportation Safety Board (NTSB), the Pipeline and Hazardous Materials Safety Administration (PHMSA), and other key stakeholders to further enhance pipeline safety.

"Pipelines are safe and efficient, but we are always looking for new ways to make them better, which is why industry is embracing this new standard," said API Midstream Director Robin Rorick. "It's also a great example of what can be done when industry, regulators and all key stakeholders work together to achieve a common objective, which is to protect the public, the environment and provide the fuels Americans need."

API developed and published Recommended Practice 1173 under its American National Standards Institute (ANSI) accredited process and is the American National Standard (ANS) on the subject of pipeline safety management systems. API's rigorous process is open, transparent and ensures that the best minds from government, academia, the public and industry fully participate in the development of API standards.

"We continue to be committed to safety and this standard raises that bar even further," said Rorick. "This new standard gives operators a holistic framework to identify and address safety concerns for a pipeline's entire life cycle."

API thanked the NTSB and PHMSA for their guidance and cooperation in creating RP 1173. The RP will build upon existing safety requirements to further monitor and measure the effectiveness of pipeline activities with a "plan, do, check, and act" philosophy that requires periodic reviews and applies changes or corrections to activities as needed.

API is the only national trade association representing all facets of the oil and natural gas industry, which supports 9.8 million U.S. jobs and 8 percent of the U.S. economy. API's more than 625 members include large integrated companies, as well as exploration and production, refining, marketing, pipeline, and marine businesses, and service and supply firms. They provide most of the nation's energy and are backed by a growing grassroots movement of more than 25 million Americans.

*www.api.org*

### Enbridge, TransCanada, Kinder Morgan working together to evaluate aerial-based pipeline safety technologies

Edmonton, Alberta; April 28, 2015 — Three North American pipeline industry leaders – Enbridge Pipelines Inc., TransCanada Corporation, and Kinder Morgan Canada – have signed a Joint Industry Partnership (JIP) agreement to conduct research into aerial-based leak detection technologies, in the interest of enhancing across-the-board pipeline safety.

This partnership illustrates a spirit of collaboration among TransCanada, Kinder Morgan and Enbridge in the continued common pursuit of industry-wide safety and operational excellence. It also demonstrates the partners' com-

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mitment to investing in the leading-edge tools and technologies that can bolster safety and reliability, while at the same time addressing public demands for responsible pipeline development.

The goal of the project is to identify technologies capable of viably detecting small leaks from liquid petroleum pipeline systems to improve pipeline safety. The project is expected to involve laboratory research and field trials to evaluate the feasibility of commercially available aerial-based leak detection technologies, for use with crude oil and hydrocarbon liquids pipelines. The partnership includes a funding commitment from all three companies. Data analysis will be conducted by Alberta Innovates - Technology Futures, and testing will be carried out by project research partner C-FER Technologies (1999) Inc. of Edmonton.

A previous Joint Industry Partnership (JIP) – which was established by TransCanada and Enbridge, and now includes Kinder Morgan – has already yielded groundbreaking leak detection research using a state-of-the-art pipeline simulator known as the External Leak Detection Experimental Research (ELDER) test apparatus.

"Pipelines are widely accepted as the safest and most efficient way to transport oil and gas, and TransCanada continues to strive for zero leaks or safety incidents on our pipelines," says Vern Meier, TransCanada's Vice President of Pipeline Safety and Compliance. "Joining forces with Kinder Morgan and Enbridge helps us maximize research potential and reach new levels of technological innovation to improve our industry as a whole."

Kinder Morgan, Enbridge, and TransCanada have each committed $200,000 to this partnership agreement. All three companies involved in this partnership agreement will share equally in the new knowledge and advancements that can be applied directly to improve safety and efficiency in their respective operations.

Potential technologies to be tested may include infrared camera-based systems, laser-based spectroscopy systems, and flame ionization detection systems, with sensors suitable for mounting on light aircraft or helicopters. Representatives of Enbridge and C-FER Technologies are currently surveying commercial vendors of these airborne leak detection technologies to validate their feasibility for liquid hydrocarbon pipelines. Project research and trials are expected to begin during the third quarter of 2015.

*Helicopter with forward-looking infrared (FLIR) technology*

"The challenge with airborne leak detection systems is not with the aircraft, but with selecting appropriate sensors to detect liquid hydrocarbon leaks before they reach the surface," says Brian Wagg, Director of Business Development and Planning for C-FER Technologies.

"This program helps operating companies understand which technologies are best suited for detecting these leaks, and will provide vendors with unique information on what leaks actually look like. This information will help those vendors fine-tune their systems to detect leaks with greater reliability."

*www.enbridge.com*

### ExxonMobil, Korea Institute of Technology and Korea Gas Corporation to collaborate on research and development

Houston, TX; June 18, 2015 — ExxonMobil has signed a memorandum of understanding with the Korea Institute of Energy Technology Evaluation and Planning and the Korea Gas Corporation (KOGAS) to hold discussions concerning natural gas technologies and new energy technologies.

The multi-year agreement will focus on the natural gas value chain, including cryogenic materials, hydrogen production and fuel cell utilization, energy efficiency technologies and technologies associated with robotics and automation. *www.exxonmobil.com*

### Scientific breakthrough will help preserve Saudi Arabia's groundwater

Dharan; April 15, 2015 — A breakthrough study by some Saudi Aramco scientists, engineers and environmentalists, supported by the company's Environmental Protection Department (EPD) regulations, has identified an alternative source of injection water that will help to conserve the Kingdom's scarce groundwater reserves.

In the late 1970s, Saudi Aramco began the process of replacing all low total dissolved solids (TDS) – groundwater being used for waterflood operations with processed seawater from the Qurayyah plant. The company had also been considering the extension of this practice to the few remaining fields that are still using groundwater with much higher TDS. However, today, there is an alternative – secondary treated sewage effluent (TSE).

Traditionally, sewage and other waste water are collected from urban areas for safe disposal. This is mainly sanitary wastewater and rain water, while, in some instances, the wastewater may contain minimal amounts of industrial waste. These are all collected and transported through the sewer system to the municipality wastewater treatment plants for treatment prior to disposal. Currently, a small portion of the treated effluent is being reused while efforts are ongoing to improve and upgrade the distribution network's capacity for increased TSE utilization.

TSE is considered a valuable source of water given its quality and many potential uses, one of which is irrigation. This is by far the most common application of TSE today, as more than 74 percent of Saudi Aramco's generated sanitary wastewater from its facilities and communities is being treated and used for irrigation.

Maximizing wastewater reuse is one of Saudi Aramco's Water Conservation Strategy pillars. The drive to enhance water source sustainability and explore use of TSE as an alternative for existing reservoir injection waters aligns with this conservation policy. Saudi Aramco subsequently carried out a study to evaluate the use of TSE from nearby cities such as Riyadh that is currently being disposed and not beneficially reused for water injection at the Nuayyim and Khurais fields.

The study concluded that TSE is an environmentally reliable and compatible alternative to current injection waters used to recover oil (i.e., aquifer water or seawater). Furthermore, the TSE has been found to reduce scale and limit any incompatibility effect to the reservoir formation. *www.saudiaramco.com*

## New Projects

### *North America*

## ExxonMobil begins production at Hadrian South in Gulf of Mexico

Irving, Texas; March 30, 2015 — Exxon Mobil Corporation announced it began production in the deepwater Gulf of Mexico at Hadrian South with facilities tied back to the nearby Lucius project, reducing additional infrastructure requirements.

Daily gross production from Hadrian South, ExxonMobil's deepest subsea tie-back in nearly a mile and a half of water, is expected to reach approximately 300 million cubic feet of gas and 3,000 barrels of liquids from two wells.

Hadrian South is a subsea production system with flowlines connected to the Anadarko-operated Lucius truss spar, which started production in January. With the startup of Hadrian South and Lucius, ExxonMobil's total Gulf of Mexico net production capacity has increased by more than 45,000 oil-equivalent barrels per day. ExxonMobil holds a 46.7 percent interest in Hadrian South and a 23.3 percent interest in Lucius.

Hadrian South is located approximately 230 miles offshore in the Keathley Canyon area of the Gulf of Mexico in about 7,650 feet of water. The discovery well, Hadrian-2, was drilled in 2008 and the appraisal well, the Hadrian-4 sidetrack, was completed in 2009.

ExxonMobil operates Hadrian South; co-venturers Petrobras and Eni hold 23.3 percent and 30 percent, respectively.

Hadrian South adds to ExxonMobil's Gulf of Mexico production operations, where the company has produced oil and gas for more than 60 years. *www.exxonmobil.com*

## ExxonMobil announces Cold Lake project expansion starts production on schedule

Irving, Texas; May 11, 2015 — Exxon Mobil Corporation announced that bitumen production began on schedule at the $2 billion Cold Lake Nabiye project expansion in northeastern Alberta, Canada.

The expansion is producing about 20,000 barrels per day and volumes are expected to increase during the year to peak daily production of 40,000 barrels. Nabiye will access 280 million barrels of recoverable resources during its expected 30-year lifespan.

"ExxonMobil has the project management experience, engineering expertise and effective contractor interface to deliver superior cost and schedule performance along with safe, reliable facilities that will operate for decades," said Neil W. Duffin, president of ExxonMobil Development Company. "Nabiye will contribute important new production to ExxonMobil as we continue to bring new projects on line."

ExxonMobil expects to increase production volumes this year by 2 percent to 4.1 million oil-equivalent barrels per day, driven by 7 percent liquids growth. The volume increase is supported by the ramp up of several projects completed in 2014 and the expected startup of seven new major developments in 2015, including Hadrian South in the Gulf of Mexico, expansion of the Kearl project in Canada, Banyu Urip in Indonesia and deepwater expansion projects at Erha in Nigeria and Kizomba in Angola.

The project was planned and executed by ExxonMobil Development Company on behalf of the Cold Lake project operator, Imperial Oil Limited, ExxonMobil's majority owned Canada affiliate. *www.exxonmobil.com*

## New Projects

### Husky Energy begins steam operations at Rush Lake

Calgary, Alberta; May 21, 2015 — Husky Energy has started commercial steam operations at the 10,000 barrels per day (bbls/day) Rush Lake heavy oil thermal project in Saskatchewan, approximately eight weeks ahead of schedule. Like the Company's other thermal projects, Rush Lake is expected to ramp up to full production in a short time period.

"Rush Lake is the latest in a series of long life, low sustaining capital thermal projects we are advancing in our heavy oil business," said CEO Asim Ghosh. "Five years ago, we had two heavy oil thermal projects in production and by the end of 2016, we will have ten projects onstream."

Current production from thermal projects is approximately 44,000 bbls/day. Including Rush Lake, heavy oil thermal production is expected to add another 34,500 bbls/day over the next 18 months.

•The 10,000 bbls/day Edam East project is scheduled to come onstream in the third quarter of 2016.

•The 3,500 bbls/day Edam West thermal development has been reconfigured to a capacity of 4,500 bbls/day and is set to begin production in the fourth quarter of 2016.

•The 10,000 bbls/day Vawn project is expected to start up in the fourth quarter of 2016.

The projects build on the Company's strong track record of using proven thermal technologies and modular, repeatable construction templates to access heavy oil deposits in the Lloydminster region. With low operating costs, good netbacks and low execution risk, these projects offer good returns even in a low price environment.

Additional projects are under evaluation over the medium and long term. The Company's growing heavy oil thermal business is further supported through its integrated Downstream business. *www.huskyenergy.com*

### Exxonmobil announces Kearl expansion project starts production ahead of schedule

Irving, Texas; June 16, 2015 — )--Exxon Mobil Corporation announced that production at its Kearl oil sands expansion project in Alberta, Canada, started ahead of schedule and is expected to double overall capacity to 220,000 barrels of bitumen a day.

The expansion project is ultimately expected to reach 110,000 barrels per day. Kearl will access approximately 4.6 billion barrels of resource for more than 40 years.

“The ahead-of-schedule startup of the Kearl expansion demonstrates ExxonMobil’s project management expertise and highlights our ability to safely and successfully execute complex projects,” said Neil Duffin, president of ExxonMobil Development Company. “The improved understanding gained from the initial Kearl development phase was applied to the expansion project to produce this outstanding result.”

The expansion project consists of three additional trains that use proprietary paraffinic froth treatment technology to produce bitumen. The process reduces energy requirements and environmental impacts by not requiring an onsite upgrader, which avoided a multi-billion dollar capital investment and associated operating expenses. Energy needs are further reduced through the installation of energy-saving cogeneration facilities.

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