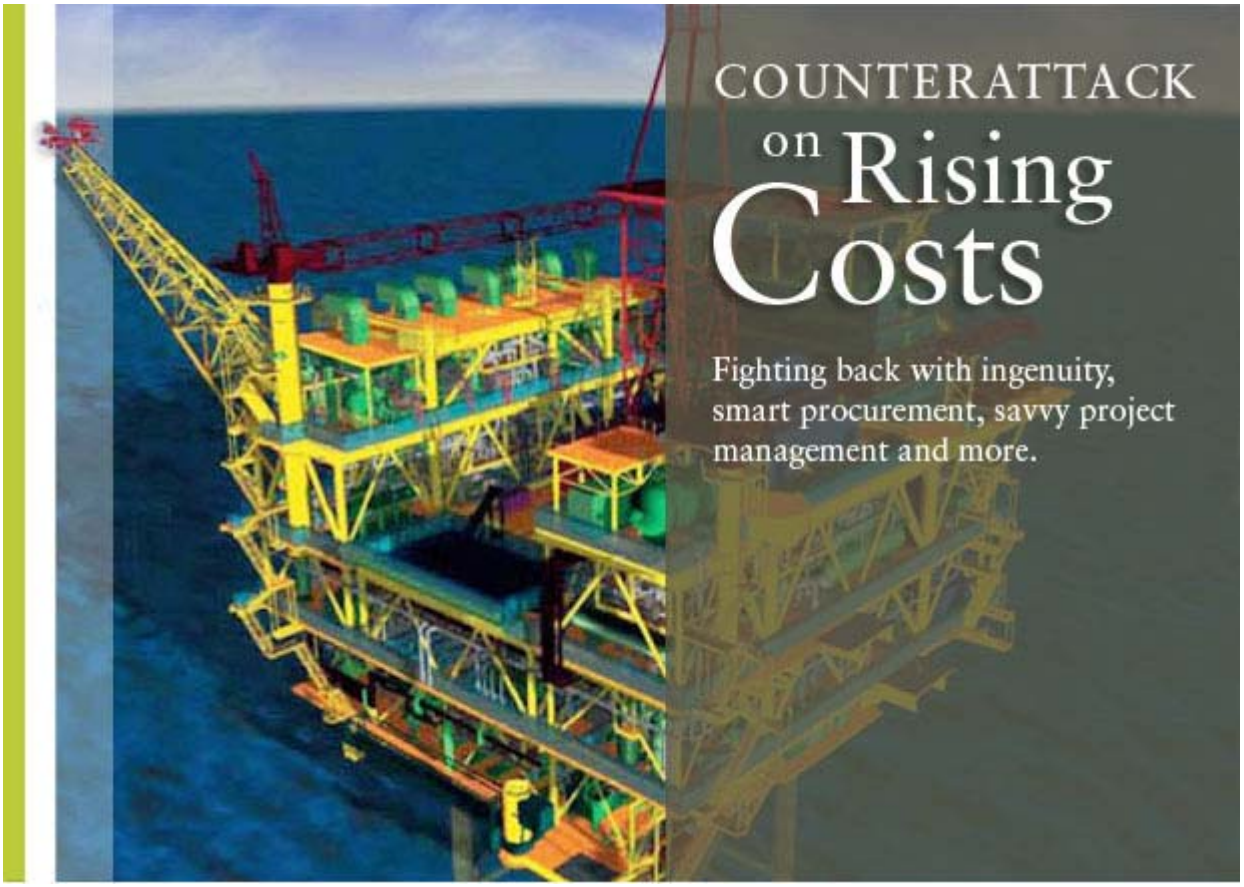
Line Rider
Global Employee eMagazine



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Also in This Issue

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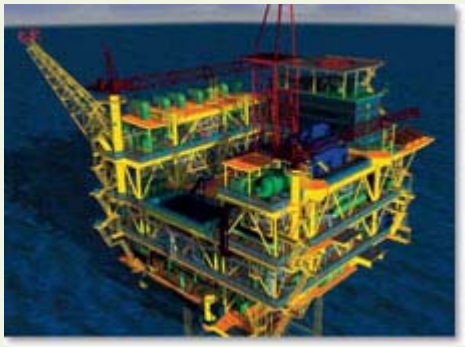
Counterattack on Rising Costs

Fighting back with ingenuity, smart procurement, savvy project management and more.

Standing nearly 1,700 feet (518 m) tall, Chevron's Benguela Belize-Lobito Tomboco (BBLT) oil-production platform in Angola is a striking example of world-scale offshore engineering with a world-scale price tag of about $1 billion.



With a price tag of more than twice its sister platform, Tombua-Landana will be the second compliant piled tower (CPT) in western Africa and will join the Benguela Belize-Lobito Tomboco CPT and Chevron's Petronius CPT in the U.S. Gulf of Mexico as one of the tallest free-standing structures in the world.

But even more striking is that BBLT's very similar sister platform, Tombua-Landana, is expected to cost more than twice that much, George Kirkland, executive vice president for Upstream and Gas, told a company forum last year. A near-replica using designs and multiple lessons from BBLT should cost less, not more, right?

Not today. Rampant cost inflation has become business-as-usual for the global oil and natural gas industry, reflecting dramatically higher oil and gas prices, surging energy demand, booming construction, more technically demanding developments and other factors. And the trend isn't just upstream.

"Project costs for us are up 30 to 40 percent in just the last couple of years," says Dave Koning, Global Refining's manager of capital projects and turnarounds, who estimates that three big projects at Chevron's major U.S. refineries alone could each cost about $50 million more than planned in the alternative development phase (see related story in this issue "Transforming the Refining Business").

Tracking the Trend

Virtually everything has spiked, affecting both projects and operations: valves, compressors, labor, pipe, drilling rigs, tankers, tanks, deepwater wellheads (and the mammoth equipment to install them), instrumentation and more. A booming global economy – especially China's expansion – has exacerbated the whole situation, driving up the price of key commodities, notably steel, nickel and titanium.

The upswing started around 2003 and got steadily worse, according to Cambridge Energy Research Associates (CERA), which tracks costs with help from Chevron and our competitors. Last year, CERA reported a 43 percent to 52 percent increase in the previous 18 to 24 months alone. The rate of increase is decelerating and may reach a plateau for

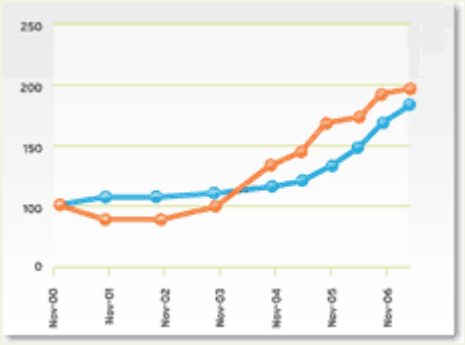
projects in late 2007 or 2008, CERA said in a recent update. But that will still leave projects 70 percent to 100 percent more expensive than in 2000.

Fighting Back

Waging a broad counterattack, Chevron people and organizations have responded with structural changes, smart procurement and savvy project management, among other efforts. In the past year, the corporate Strategy & Planning committee has held two special sessions on the cost challenge, and Chairman Dave O'Reilly has asked everyone to keep cost management a high priority – especially through reliability and efficiency.

Refining is pitching in with more aggressive project-management tactics, like ordering costly components earlier to lock in prices and avoid delivery delays. Upstream has deployed four Base Business processes to support improved production, reliability and cost efficiency throughout Chevron's oil and gas operations. Global Marketing is refocusing its portfolio of service station assets. Teams of employees throughout the company are using an improved suite of small-project tools from the Project Resources Company (PRC), Chevron's project-management consultancy, to capture efficiencies on thousands of jobs representing some $6 billion in work.

Leading the charge on multiple fronts is Procurement & Supply Chain Management with about 4,000 employees working across multiple business units. Among the standout success stories: the Global Downstream Transportation Optimization Process. It delivered nearly $75 million in operating-cost savings for 2003 through 2006 by streamlining fuel-trucking contracts and operations, says Ronaldo Marques of Downstream Procurement.



Rising Oil Price, Rising Costs.

Buying Smarter

Last year, Chevron operating companies saved almost a billion dollars through the use of procurement processes and tools – equivalent to 3 percent of the global spend on goods and services, according to Leo Lonergan, chief procurement officer.

Procurement leads and supports Chevron's cornerstone Category Management Process to ensure the best deals in the biggest spending areas. Drilling & Completions, the largest category, covers a whopping $7 billion per year. A proactive rig contracting strategy that leverages Chevron's enterprise strength has provided significant savings and secured rig capacity for the business units' long-term deepwater programs. Astute rig-contracting saved an estimated $400 million in 2006.

The group also fosters Chevron's eProcurement system. The company will likely spend more than $30 billion this year buying goods and services for projects and operations, notes Leo. Last year, $11 billion went through eProcurement; and on a year-to-date basis Chevron is on track to exceed $17 billion in 2007. Ultimately, online buying should save $150 million per year – and still bigger savings will come as the system drives more spending to hand-picked strategic and core suppliers.

Taking the Long View

Meanwhile, Procurement supports the Total Cost of Ownership (TCO) strategy that is taking hold throughout Chevron. The idea is that the "first cost," or price of an item such

as a compressor matters – but the equipment's safe, reliable long-term performance matters even more. In addition, managing the complete supply chain from initial design to final disposition is a key to the strategy.

To leverage TCO, Procurement in 2006 strengthened its partnership with PRC, the company's full-time driver of Capital Stewardship. Today, every major capital project has a procurement professional as part of the project team, says Leo, working with suppliers to help ensure that every piece of Chevron's projects is bought right and built to last, promising billions of dollars in reliability cost efficiencies over the long haul.

So while "Cost Reduction" remains a pillar of Chevron's 4+1, Leo offers a fresh take on the challenge: "I like to avoid the negative connotation of Cost Reduction and instead talk about cost management or value creation."

Incident Costs and Reliability

TCO is why reliability stands so tall among cost-management strategies. The company's Cost of Incidents in 2006 was about $1.7 billion. As noted at this year's Operational Excellence Forum, improvements in reliability could transform much of that negative number into a positive one.

To help make it happen, Refining created a Reliability Center of Excellence. Corporate Health, Environment and Safety has deployed the global Operational Excellence Management System. And the Chevron Reliability University, created two years ago, is growing fast. Among its recent alumni is the chairman, who attended the Reliability for Leaders (RU-214) course, one of 24 courses currently available.

"High reliability is the key to cost management," he says.

Technology's Contribution

Can technology help Chevron conquer rising costs?

Chief Procurement Officer Leo Lonergan says that our operating companies saved almost a billion dollars last year through the use of smart procurement processes and tools.

"Technology cannot generally provide the quick fix to cost management, and in many cases, additional expenditures are incurred to implement a technology solution to provide longer term gains," says Don Paul, Chevron's chief technology officer. "More accurately, I would categorize technology's role is as a primary, long-term weapon against cost and risk. Continuously applying and integrating it into our business will drive up productivity, efficiency and reliability."

Many of technology's cost benefits are cumulative, he adds. For example, because of Chevron's heritage of investment in catalysis science and technology, the company is a world leader in converting heavy, complex and lower-cost crude supplies into the market's finest fuels (see "Under Pressure" article in this issue, about the lab that helps us achieve this).

Technology's cost benefits are also often indirect, says Don, noting that costs per square mile for capturing and processing seismic data have fallen dramatically over the years thanks to more powerful computing and information systems.

The response of Chevron and the industry, however, has been to take advantage of the drop in unit costs to dramatically increase the size and scale of 3D seismic surveys. Now, entire prospective trends can be imaged and interpreted in an integrated picture. This in turn, leads to a sharp reduction in exploration risk, greater precision in finding and developing oil and gas fields, and ultimately, improved capital investment performance per barrel.

In this case, investing more in seismic technology has notably lifted Chevron's exploration program to No. 1 in the industry as seen with major discoveries such as Tahiti and Jack.

So, while long-term gains in cost efficiency are among technology's constant benefits, some of the biggest wins come from converting technical challenges into business success. A good example, says Don, is Chevron's sour gas management project at the Tengiz oilfield in Kazakhstan.

Prices Trumping Costs?

Tengiz is but one huge investment of many. We have a record $19.6 billion capital budget for 2007 and a lineup of large, exciting projects around the world. Clearly, the big-picture arithmetic has been in the industry's favor – Chevron alone earned $7.26 billion in 2003, $17.1 billion in 2006, and $10 billion for the first half of 2007.

"Oil and gas prices have risen faster and higher than costs," explains Bob Howard, an adviser on George Kirkland's staff.

As a result, adds Wes Lohec, strategic planning chief for Chevron International Exploration & Production, "Costs have been somewhat overshadowed by the priority to get more production online."

Bob says Upstream looks at each investment individually and decides what to do based on the economics, always remembering that oil prices could retreat.

"We're spending more, and we're making more," he says, but Upstreamers haven't forgotten the leaner years. "During the '80s and '90s, we learned how to operate profitably with low prices, and we continue to honor those principles. Upstream's operating expenses are up overall, but we're still within our targets because our people remain focused on this."

Offshore rigs – including drillships like *Discoverer Deep Seas*, pictured here – are any oil company's biggest ticket items. But forward planning helps. Contracts for nearly $6 billion (gross) in forward rig commitments have assured Chevron several years' coverage for enterprise deepwater drilling. The fleet will include three new-generation drillships, positioning us to achieve our "Clear Leader" drilling aspiration.

Globally deploying standard Base Business processes has boosted output and captured savings throughout Upstream. Surface Equipment Reliability, for example, has improved the efficiency of field work planning and improved reliability across all business units. North America Upstream tracks the performance of more than 700 compressors via Surface Facility Optimization, capturing significant fuel savings and incremental production.

Efficiency, Offshoring, Restructuring

Some costs have warranted corporate-wide attention. Chevron's energy bill, for example, used to average about $3 billion a year. Due mostly to higher oil and gas prices, it's now over $5 billion – but we have improved our energy efficiency some 27 percent per unit of output since starting our Energy Index in 1992.

Globalization has created opportunities as well, such as offshoring. Chevron and Downstream have moved Finance and other functions to Manila, Philippines, where today more than 1,000 employees and contractors handle work formerly done in higher-cost North America.

Structure and portfolio strategy can also drive down costs. Global Marketing has launched the "20/20" optimization campaign, with cost efficiency as a key objective. It recently closed 20 percent of its Thailand service stations, for example, retaining the volumes in the remaining stations at a lower overall cost. Also under 20/20's multi-faceted strategy, letting others own more branded stations will shed costs like utilities, maintenance and taxes.

Centralized and globalized services groups are also saving Chevron money, says Louie Ehrlich, vice president, Services & Strategy for Downstream and its chief information officer. The groups naturally seize on new efficiencies in information technology (IT) and capturing benefits of scale for customers, says Louie. Standardization and consolidation of servers and support for SAP systems has saved Downstream $4 million per year, he says. More savings have come as IT project work is outsourced to India. Downstream also shifted dozens of Latin America telecommunications contracts to a single vendor, cutting cost and improving service.

Making Good Decisions

Can individual employees help cut costs when big efforts like globalized Procurement, global reliability drives and business restructuring do most of the heavy lifting? Absolutely – starting with individual safety and looking out for others, which every day help Chevron protect people and keep a lid on cost of incidents.

The chairman has also asked people to use videoconferencing instead of travel for meetings where possible. And he wants everyone to focus on important work activities and discontinue or defer work on lower priorities.

"Making good decisions about work priorities is critical," he says.

Transforming the Refining Business

Investment will boost capacity, flexibility and reliability.

With equity capacity to process 2 million barrels of crude oil daily, Chevron's refining system is among the largest in the world.

But how will it adapt to better capture value from continuing growth in global energy demand and deliver more resilient returns through margin cycles?

"Industry forecasts show global demand for energy increasing by 50 percent over the next 25 years," says Jeet Bindra, president of Global Refining. "Most of that growth is concentrated in Asia–Pacific and North America. With over 80 percent of our fuels refining capacity located in those two regions, that looks like good news for Chevron."

To help meet that burgeoning demand, Chevron is planning to selectively expand investments in major refinery improvement projects over the next several years. The projects are aimed at:

- building the "reliability refinery" through operational excellence;
- growing scale through targeted investments at existing refineries;
- gaining greater flexibility to convert a wider variety of feedstocks into high-value products demanded by the marketplace.

Improving Refinery Reliability

One of the least–costly and effective ways to increase available capacity is to operate our assets more reliably (see).

Building a Larger-Scale, Flexible Refinery System.

"In 2005, the magnitude of lost–profit opportunities was equivalent to the earnings you'd expect from a good–sized refinery," says Mike Wirth, Downstream's executive vice president, speaking about the impact of unplanned downtime. "We had an entire new refinery, what I call the 'reliability refinery,' waiting within our own system."

In early 2006, Chevron committed to capturing and fortifying this reliability refinery by raising refinery utilization rates at our operated refineries six percentage points above 2005 by the end of 2008. In 2006, Refining delivered a year–over–year utilization gain of five

percentage points. Mike attributes that to a lot of hard work, disciplined execution and a focus on root cause. While the commitment was nearly met in the first year, a rigorous effort continues to build capabilities, standardize processes and enhance equipment to further improve and sustain reliable operations.

“Disciplined execution over the last five years has put us among the best in safety in our industry, and we’re applying the same drive and discipline to achieve ever greater levels of reliability,” says Bruce Chinn, general manager of Reliability for Global Refining. “Our commitment is absolute. Safe and reliable operations are not only good for our people but also for our bottom line.”

Building Scale and Flexibility

Refining is executing a disciplined and balanced investment program to increase economies of scale and expand margins. Projects have been completed, and more are being planned to add capacity and build a larger-scale system by investing to incrementally expand existing facilities – a process known in the industry as “capacity creep.” This approach to building scale is faster and more cost–effective than building new refineries.

For example, Refining completed an expansion of its fluid catalytic cracker unit at the Pascagoula Refinery at the end of 2006, which increased the refinery’s capacity to manufacture gasoline by roughly 10 percent to about 5.5 million gallons per day. It is also engaged in a project that could result in a new continuous catalytic reformer (CCR) being installed to further increase gasoline production at the refinery by approximately 15 percent.

Pascagoula Refinery’s General Manager Roland Kell says the new CCR would update important refinery technology by replacing two process units constructed more than 30 years ago, resulting in a significant increase in Chevron’s ability to provide reliable gasoline supplies to key markets in the eastern United States.

Flexibility gives Refining broader options when it comes to deciding what types of feedstocks to process. It has been building capabilities to more effectively convert less costly, difficult–to–refine crude oils into high-value, clean–burning transportation fuels. At the same time, these improvements enable closer integration between Upstream and Downstream to increase shareholder value.

Take the Pembroke Refinery in the United Kingdom for example. Recently completed modifications will allow the refinery to process significantly greater volumes of equity crude from the Caspian region containing mercaptans, a sulfur compound that’s undesirable in products such as jet fuel. Downstream expects this throughput increase to strengthen the equity crude market for Caspian production while benefiting the refinery’s gross margin. Another project is being scoped that could almost double the volume of Caspian crude processed in the future to accommodate growing equity production from the region.

Refinery Upgrading and Integration.

Other significant flexibility upgrades are progressing toward completion by year–end,

including a heavy oil upgrade project at our joint–venture refinery in South Korea and a couple of projects at the El Segundo Refinery that will allow heavier and higher–sulfur crude oils to be processed.

Having a scaled-up, more flexible system is expected to translate into greater earnings resiliency, with stronger returns in margin up–cycles and mitigated impacts from lower margins in down-cycles. Together with a focus on more consistent investment through the margin cycles, Downstream expects to deliver strong, competitive returns over the long term.

In Search of Greater Value

2006 was a year of “bests” for Downstream – its safest year yet, best–ever refinery utilization and energy efficiency, and its highest earnings. Will we look back on 2006 as a watershed year for Downstream?

If Downstream effectively executes its strategy of improving base–business returns through operational excellence and selectively growing, with a focus on integrated value capture, the best may be yet to come.

“This recent record of accomplishment is gratifying, but there is still more to do,” says Mike Wirth. “We’re intensely focused on operating with excellence, boosting efficiency, reliability and safety while growing our volumes and margins. Our goal is to be a top competitor at every stage of the business cycle, and we’re putting more building blocks in place to accomplish that.”

Under Pressure

With more heavy oil and other "challenged" crudes entering the energy market, Chevron's High Pressure Process Center has never been busier.

The oil is one of a bottom grade of refinery raw materials politely known as "challenged." This bad boy of heavy crudes is so difficult to process it's not even good for road tar.

But the people at Chevron's Energy Technology Company (ETC) High Pressure Process Center (HPPC) in Richmond, California, don't see it that way. They are developing proprietary processes to enhance the conversion of challenged feedstocks into high-value products such as light transportation fuels.

To the untrained eye, they're a tangle of pipes and hoses, but each process unit acts like a mini-refinery, testing challenged feedstocks for potential to convert into high-value fuel products.

HPPC is a research center that offers internal and external Chevron clients a refinery in miniature to test the processing performance of any raw hydrocarbon material they want to convert into fuels or lubricants.

With increased quantities of the challenged stuff entering the energy system, HPPC's breakthrough technologies will help to shape Chevron's future success in the global marketplace.

In collaboration with Global Downstream Technology, Technology Marketing (TEMA) and ETC research groups, HPPC has been experimenting with a variety of processes, catalysts (substances that create the chemical changes in refining) and feedstocks (the raw materials) for 40 years and applying the results throughout Chevron's refining business.

The roots of HPPC's success lie in the accuracy, repeatability and reliability of the research. Its 27 process units, each one a scaled-down commercial refinery, are highly sophisticated with capabilities for handling recycled gas and liquids. HPPC's technicians have performed thousands of feedstock and catalyst performance comparisons with this equipment.

"Quite simply, what we do is add hydrogen and remove contaminants such as sulfur, nitrogen and heavy metals. That's our specialty," says Richard Threlkel, Resid R&D team leader for Global Downstream Technology.

“We can impose whatever temperature profile customers want to simulate commercial reactors. We measure everything in and everything out. Because of the quality of the data, we can compare across pilot plants: Does it work better at this temperature or formulation? Does it last longer? Perform better halfway through? That’s what processing is.”

Not Your Typical Office Environment

Step inside the lab and fluorescent ceiling panels illuminate process units in every direction, each one with its own unique tests in progress. To the untrained eye, the scene looks like a tangle of dark blue and stainless steel pipes, floor-to-ceiling metal grids, yellow wires, and black hoses rising up like giant elephant trunks.

Tubes are wrapped in thickly padded insulation to retain heat. Computer screens are flashing the latest test data. Switches and pressure gauges are everywhere. One unit alone contains 15 miles of wire, more than 1,000 process control points and almost a mile of high-pressure tubing.

Hydroprocessing, a common refining process tested at the HPPC lab, is used to manufacture high-value products from so-called “challenged” feedstocks.

A new gasoline process to produce octane boosters is being tested at one process unit. This process is far enough along that a larger unit is now being built and will be installed in a Chevron refinery.

Another process unit is dedicated to Isodewaxing® – a Chevron-trademarked process used to convert wax into base oils for lubricant manufacture. Twenty-five years ago, researchers used this same machine to support a new project to produce lubricants at Richmond Refinery. Today it is processing wax made from natural gas using the gas-to-liquids (GTL) process, to generate high-quality base oils. This work is sponsored by the Sasol Chevron GTL joint venture.

Plant Safety is a Priority

Lab technicians working 12-hour shifts around the clock seven days a week check reports every two hours to ensure everything is going according to research specifications. Parts needing repair or replacement often come from the nearby Richmond Technology Center workshops. The technicians are constantly troubleshooting plants, making condition changes and turning around process units from one test to the next. They work closely with the researchers who are supervising the testing and are ever alert should something go wrong.

So what could go wrong?

“You can have a plant plug up – this occurs when you have a solid inside a line and you still have hydrogen coming in,” explains lab plant operator Matt Jones. “It will eventually ‘coke up’ and turn to rock. It’s a big problem and, if it occurs, I need to find out where the plug is by looking at gauges, checking pressure and backflowing it with solvent or cycle oil to try to get it out. I have to correct the condition, find out why it happened and make sure it doesn’t happen again.”

“We never compromise safety,” adds Art Dahlberg, Distillates R&D team leader for Global Downstream Technology. “We work with pretty hazardous stuff. Safety is always the first

thing we think about when we build a new plant. There's a rigorous process we go through to set up and/or change things on a plant.

"We can be proud of our safety record," adds Art. "During the construction process, shakedown, startup and early operation of our most complex plant, we achieved 12,000 man-hours without a safety incident."

Staffing for the Future

Hiring and training the right people to operate the plants is critical to HPPC's long-term success. Trainer Tom Miller notes that "normal" pilot plants no longer exist. Previously, plants were "cookie-cutter" and one person ran one operation; now they are all different and one operator runs all operations on several entire plants.

Many of the company's senior operators with 17 years or more of experience are either moving on to other positions or retiring, resulting in a new workforce with an average of less than two years experience.

Ricard Scheuerman (left), manager of Experimental Systems at HPPC, and plant operator Matt Jones study data from a process test at HPPC, Richmond.

"We recognize the need to capture all the 'tribal knowledge' from our senior operators so we can pass it on," says Tom.

Operator new hires come from diverse working backgrounds: former airplane engineers, retailers, electricians, car mechanics, plumbers and industrial painters are on the team. But new operators spend their first three weeks with trainers learning about plant science fundamentals and lab safety before shadowing more seasoned workers actually monitoring the plants.

Team leader Jim Everard says, "We share the purpose of the testing as well as the results with our operators. We want them to know that although they may not have thought of the process, they are the ones who made it work and are important to the outcome."

Recognizing the HPPC Quality Difference

To customers, it's that outcome that really counts. Chevron refineries and in-house engineering groups as well as licensees from refineries all over the world engage HPPC and its partners in Chevron to test their oil using various catalysts and processes. Lab data are essential in designing new commercial plants – and the scale factor is enormous. From one-gallon-per-day pilot plants to 40,000-barrel-per-day commercial plants, data from the pilot plants need to accurately match commercial performance.

Work being done to convert crude oils into high-value transportation fuels is a core Chevron technology and can give us a competitive advantage. Thanks to the vision and dedication of those working at HPPC, even the bad boys of the class can clean up and make something of themselves after all.

Sunny Side Up

The demand for solar power is heating up.

While an important contributor to Chevron's suite of efficient and renewable energy sources, solar power suffers from a somewhat low profile - in more ways than one.

It's flat and black but there's more science going on inside a solar panel than meets the eye.

Solar's seemingly inert arrays of black rectangular photovoltaic (PV) panels are often out of sight or barely visible on rooftops, and this efficient energy source has sometimes been overshadowed by more headline-grabbing transportation alternatives such as biofuels and hydrogen.

Yet Chevron, through our subsidiary Chevron Energy Solutions (CES), has quietly been developing solar energy projects since 2003. Today our portfolio stands at roughly 15 megawatts of installed or contracted solar capacity.

In fact, Chevron is one of the largest solar energy project developers in the United States. CES's projects have involved the installation of more than 80,000 solar panels for customers in education, government and industry.

Yet truly solar is old news. Solar panels were invented by Bell Laboratories in 1954, but the photoelectric effect on which the technology is based was first observed in 1839 by Henri Becquerel. Albert Einstein was awarded a Nobel Prize in 1921 for his explanation of how the photoelectric effect works.

Solar power generates 20 watts of electricity per square foot (0.1 square meter) of solar panel at full sun – enough to power two compact fluorescent light bulbs. It represents the fastest-growing energy source worldwide, increasing about 40 percent per year.

CES has amassed an impressive solar project track record, and currently is one of the largest installers of solar power in California. Key installations include:

- a 500-kilowatt solar PV installation, the Solarmine, located about 40 miles from Bakersfield in California's San Joaquin Valley, connected to the local electric distribution system, providing power to oil-well pumping units and processing plants in Chevron's Midway-Sunset oil field;
- a 910-kilowatt solar power system atop the roof of the U.S. Postal Service's Mail Processing and Distribution Center in Oakland, California;
- more than 780 kilowatts of solar electric and energy-efficient cogeneration projects at both Foothill and De Anza colleges, in Los Altos Hills, California, including a moving solar-paneled parking structure that tracks the sun as it generates power;

- a 403-kilowatt solar-paneled parking canopy at the U.S. Postal Service's West Sacramento Processing & Distribution Center;
- a hybrid solar/fuel cell power plant comprising a 250-kilowatt high-temperature hydrogen fuel cell; a 185-kilowatt solar PV sun-tracking system mounted on a parking canopy; and a stationary 100-kilowatt roof-mounted solar PV system at the U.S. Postal Service's Processing and Distribution Center in San Francisco, California;
- a 6,300-square-foot PV panel installation atop the University at Buffalo (NY)'s Norton Hall;
- a 191-kilowatt solar PV generation system atop a 20,000-square-foot carport structure at Pierce College in Woodland Hills, California.

Among the projects currently under construction are:

- 5 megawatts of solar PV arrays at several San Jose Unified School District facilities, the largest solar power and energy-efficient facilities program in K-12 education in the United States;
- a 1-megawatt solar panel-topped parking structure system at California State University, Fresno – the largest of its kind at any university in the United States, it will provide 20 percent of the power used at the school;
- more than 2.5 megawatts of solar photovoltaics at three Contra Costa Community College District campuses in California.

Villages Prosper from Children's Lessons in Health

In Venezuela's Orinoco River Delta, survival rates among the indigenous populations have improved since their children became health "campaigners."

According to an old African proverb, "it takes a village to raise a child." But deep amid the marshes formed by the Orinoco River throughout eastern Venezuela's Delta Amacuro State, quite the opposite is proving true: it's the children who are helping to raise villages of indigenous Warao to their highest health survival rates ever.

PROJECT PHOTO GALLERY

At Home on Water

A Warao family on the Orinoco River. The Warao live in stilted huts over the flooded marshland.

These natives of the Orinoco River Delta were once nomads; today, the Warao (translated from their native language meaning "boat people") live in stilted huts over the flooded marshland. They travel by canoe, their children learning to paddle before they learn to walk. They live in poverty, their economy based on fishing and trade in their beautiful wood carvings.

The Warao's stunningly high mortality rates have been associated with lack of health education and healthcare services, hygiene–related infectious diseases, and injuries and accidents associated with lifestyle.

But this all began to change a few years ago with the help of the Fundación La Salle, an organization that works with the state to educate local populations and help make them self–sustaining, also now working in partnership with Chevron.

Through this partnership and the pioneering work of a young physician, Gabriela Mena, Fundacón La Salle had learned that reaching out to the children in the region was the best way to teach communities about health and sanitation issues.

"It was very hard to talk to the old men. They have their ways," Gabriela explains. "So I began with the women. I really wanted them as nurses but they have so many things to do: they're in charge of the house all day long. And usually they have so many children to care for that often they cannot pay attention."

Written for 8 to 16 year-olds in Warao and Spanish dual languages, this health training manual is aimed at preventing the most common illnesses of the region.

So the foundation turned its attention to the children of the village. They were eager to learn, and Gabriela began teaching them in their Warao language how to take care of their health. And they could teach their families.

The lessons these communities have been learning over the last decade have been hard. A cholera epidemic that killed many Warao in 1996 might have been easily prevented had there been chlorine in the water the community used for drinking. Now children are taught how to put chlorine in the water, and their families have learned from them.

Children have become the perfect campaigners to take their health messages to the villages.

To implement this program, Fundación La Salle developed a bilingual Warao–Spanish health training manual for the prevention of the most common illnesses of the region. Written for children between 8 and 16 and based on the lessons taught in school, it is the essential training tool for the children–turned health campaigners. The manual was funded by Chevron and designed, edited and published by Fundación La Salle.

Today, 1,500 manuals have been printed and distributed throughout the Warao communities of the Delta Amacuro state, with a population estimated at 53,000. It is also used by nurses and other medical professionals trained by the regional health department who care for Warao populations.

In two and a half years Fundación La Salle's work in Punta Pescador has prospered, with 16 health promoters caring for the community. Chevron's support for the village – offered in partnership with local organizations and government agencies – has extended to improvements in its infrastructure, including the school, health clinic and fishing station, installation of rainwater storage equipment, and preventive maintenance to public buildings.

Letters to the Editor

Stories in the last issue on a potential new energy source, methane hydrate, and on Master Driver "Junior" Conol prompted many comments and questions from our readers.

Danger to the Planet or Great Potential?

When we first started to use oil and coal, we never thought of the outcome years into the future, and now we are battling global warming and melting glacial ice etc. We have seen this escalate in only a few decades. If arctic ice is melting, eventually it will affect the permafrost. What would happen if this started to thaw? Could all of these trapped gasses in methane hydrate ("Frozen Energy," June 2007) be released into the atmosphere? What will fill the void when the icy methane hydrate is removed? How will global warming be affected if all of this is unfrozen and ends up in the atmosphere as by−products of combustion or otherwise?

Barbara Baker, Richmond, California, United States

Editor's comment:*This article describing a potential new energy resource generated many letters and some excellent questions. We have obtained responses from experts Emrys Jones, Gulf of Mexico Deepwater Hydrates Joint Industry Project manager, and John Balczewski, manager of Hydrates as a Resource – both of Chevron's Energy Technology Company (ETC). To Barbara's point, Emrys and John respond:*

"Your evaluation of the potential influence of methane hydrates on the environment (whether from natural or artificial causes) is insightful. Scientists are currently debating the role that natural hydrate formation and dissociation may have played in the Earth's history. The speculated influence is due to both the enormous size of the accumulations and the strong role that methane plays as a greenhouse gas (GHG) (over 20 times more potent a GHG than CO2). Rising sea levels during interglacial warming periods like today (sea levels have risen about 130 meters (400 ft) since the peak of the last ice age about 18,000 years ago) raise the pressure over oceanic hydrate deposits and result in formation of new hydrates. This traps methane gas that would otherwise leak out to the atmosphere. Over time this decreases the methane in the atmosphere and helps counteract global warming. Paradoxically, rising air temperatures in polar regions during interglacial periods decreases the hydrate deposits there due to the warming of permafrost. No one yet claims to understand all the potential interactions. Development of hydrate deposits as a vast new source for methane has GHG emissions implications that are positive in comparison to future alternatives such as expanded use of coal, and may buy valuable time for mankind to bridge from our hydrocarbon−fuelled world to whatever will come next."

After giving the article a good read, I began to wonder if we weren't missing a different kind of opportunity concerning methane hydrate; this seems like an efficient and stable method for transporting and storing methane gas. If we could figure out how to make our

own methane hydrate, wouldn't this have some potential in getting natural gas from the wellhead (possibly an offshore platform) to the market? Also, methane hydrate seems to offer a lot of potential, in a lot of different areas, for safe, economical storage of methane gas.

Eric Johnson, Bakersfield, California, United States

Emrys and John respond: "Spot on analysis, Eric. A number of companies have been investigating this. A Japanese consortium has a pilot hydrate plant in operation, and ETC's Remote and Unconventional Gas group is actively tracking this and other industry developments. The "plus" of hydrates is that you could eliminate the need for very expensive LNG plants and LNG tankers. The "minus" is that you end up transporting a lot of water along with the methane, special production plants would be required and the transport ships would have to have special equipment to prevent hydrate dissociation during long ocean voyages. It all boils down to economics, doesn't it?"

I have a couple of thoughts on the methane hydrate article. The first is a clarification on generation (I am an exploration geoscientist): the idea that hydrates form from biogenic gas must be an earth−bound issue, unless the 60−mile [96.5−km] thick methane hydrate layer on Saturn has implications for bacteria having existed there at some time (unlikely, I think). The second thought that struck me was that the methane hydrates on Saturn could eventually be an energy source for use on earth. If our hydrates here might supply energy for hundreds of years (of course with consequences to climate), what would the magnitude of the Saturn resource be in terms of years (assuming it would someday be economic)?

Patrick Ditty, Houston, Texas, United States

Emrys and John respond: "You bring up some interesting points! Titan is the largest moon of Saturn and the only moon in the solar system with a dense atmosphere. Titan's atmosphere, like Earth's, is full of nitrogen. But it also has methane, ethane and traces of other organic molecules. Scientists believe that the recipe for Titan's atmosphere is very similar to the Earth's at the time when life began here. The tantalizing possibility of discovering signs of life on Titan was one of the reasons for the deployment of the 2005 Huygens space probe to the surface. It may tell scientists more about the kind of chemical reactions that set the scene for the emergence of life on Earth. We agree, however, that the modern−day methane in Earth's hydrate deposits is almost certainly "locally manufactured" either from biogenic activity (byproduct of bacterial growth) or from thermogenic sources (i.e. conventional natural gas that has migrated up into the hydrate zone). The main point is that, regardless of locale, when water and methane molecules are placed together in the right combinations of temperature and pressure, hydrates naturally form. Regarding the potential of Titan as a resource for Earth, we like your out−of−the-box thinking!

Honoring Excellent Drivers

Chevron is a wonderful Company: to honor its excellent drivers in such a grand way ("A Master of His Craft," June 2007) is so heart warming. I wish the best for [Mr. Conol's] wife.

Barbara Wright, San Ramon, California, United States

The story on Mr. Conol in Hawaii is great. What an achievement! Stories like this one do as much for safety as any training because they inspire others to try and match such accomplishments.

Donald Clowers, Nederland, Texas, United States

'Chevron's Got Talent'?

The photo contest ("Human Energy – Capture It!", June 2007) got me thinking about other ideas that might be fun. Some sort of trivia contest, like Jeopardy? An online singing contest, like American Idol? Contests like this raise camaraderie and create a welcome diversion from the stress of the workday. Thanks for that.

Bill Fox, Bellaire, Texas, United States

Glad to Serve

I will recommend Line Rider e-magazine to all employees. It is both informative and educative. It opens my eyes to the great and vast amount of resources available to us on earth. All we need to do is discover and utilize them. Parents should get enlightened through Line Rider and then in turn enlighten the younger generation. I doff my hat to the production crew. Good job and more strength as we look forward to more exciting editions.

Oluseun Olatoye, Escravos, Nigeria

I read *Line Rider* this morning and found it very interesting. It is very informative and lets us know what is going on around the world. Thanks and keep up the good work.

Jeff Fullmer, Salt Lake City, Utah, United States