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Are investors prepared to capture the liquefied natural gas opportunity that emerges from the recession?

By Steve Edwards, David Haake and Omar Ishaq

Despite the current global financial crisis, which has led to a fall in energy demand and prices, the market for liquefied natural gas is expected to regain its steep growth trajectory in the mid and long terms, spurred by anticipated increases in demand, particularly in emerging markets. In this update to our 2007 study, we find the exact extent of this surge in demand and related investments in infrastructure is difficult to project, however, given complex risk management issues, volatility of natural gas prices and availability of competing fuels. To capitalize on opportunity when it arises, investors must be prepared to mobilize quickly and establish flexible business and operational models for an unpredictable, high-stakes future.

The liquefied natural gas (LNG) industry has developed slowly over the last half century because, in most heavy-consuming nations, the domestic energy supply has been sufficient to meet demand. However, as energy consumption has continued to increase around the world (most dramatically in emerging nations), it has become more difficult for many nations to satisfy their energy needs locally. Complicating the situation further, more than a third of the world's natural gas reserves are located in low-consumption countries, far from where energy demand is highest.[1] Increasingly, nations are turning to the mobility and flexibility of LNG to resolve these imbalances.

Indeed, from 2006-2015, the global market for LNG is expected to increase by 70 percent and more than triple by 2030.[2] Not surprisingly, investors are anxious to grab their share of this opportunity.

The rise in energy demand led to a peak in energy prices around mid-2008, followed by a recession-generated steep decline. As the short-term impact of the global recession subsides, however, natural gas prices are expected to stabilize again through 2011 and then increase for the foreseeable future.[3] These higher gas prices will make it economically feasible for businesses and

nations to again invest in LNG. The cumulative 2007-2030 investment in gas supply infrastructure is expected to be US$ 5.5 trillion (in 2007 dollars).[4] Out of this, US$440 billion is expected to be made specifically in LNG infrastructure.[5]

However, the same high prices that spur frenzied investment in LNG could eventually become detrimental to the industry. The International Energy Agency forecasts suggest that high natural gas prices may prompt consumers to turn to other fuels, reflected in the fact that modern renewable technologies may well overtake gas to become the second-largest source of electricity, behind coal, soon after 2010.[6]

The question is: will investors be able to scale their LNG infrastructure quickly enough to capitalize on this bubble of opportunity? And equally important, how can they make their businesses flexible enough to withstand the cyclic nature of this industry?

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Because of its "mobility," LNG will play a critical role in satisfying rising energy demand around the world. But global economic conditions are forcing a re-evaluation of investment priorities.

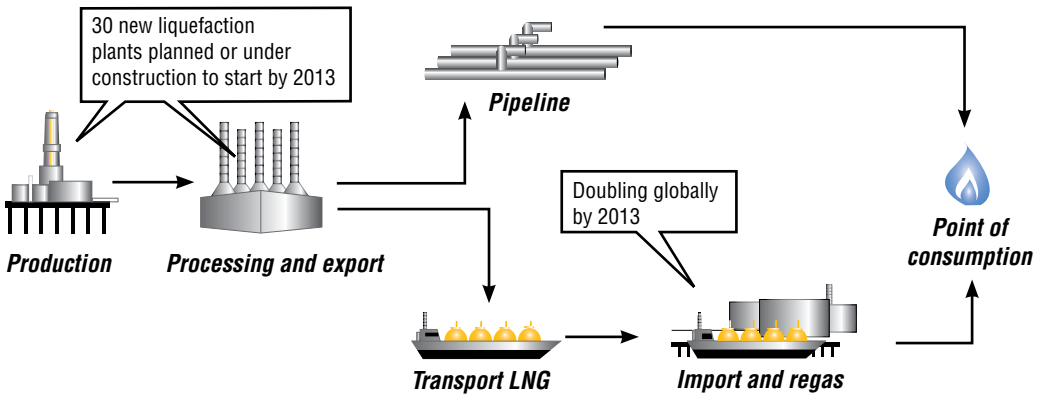
LNG: The opportunity…

Driven by population and economic growth, global primary energy demand is expected to increase by 45 percent between 2006 and 2030, with 87 percent of projected growth coming from non-OECD countries.[7] As a result, their share of world primary energy demand is expected to rise from 51 percent to 62 percent.[8] China and India are expected to account for 51 percent of incremental world primary energy demand in 2006-2030.[9] Even established nations such as the United States are likely to see energy use rise by more than 11 percent between 2007 and 2030.[10]

Most of the world's known gas reserves are concentrated in just a few regions – far from where energy is needed most – and so LNG, as a means of delivery, has become a more attractive alternative in recent years. Industry analysts anticipate LNG's share of inter-regional natural gas trade will rise from 52 percent in 2006 to 69 percent in 2030.[11]

Not surprisingly, investors are anxious to capture their share of this revenue opportunity. Many were rushing to establish the infrastructure necessary to capitalize on this upswing in LNG demand before the recession shocked the world energy market, halting a great number of these projects (see Figure 1). The industry was considering proposals to more than double the world's 2008 regasification (regas) capacity by 2013, with more than 100 new plants under planning or construction globally.[12] On the production side, 30 new liquefaction plants were in some stage of planning or construction to start operation by 2013.[13] Investors are no doubt urgently re-evaluating their portfolio of LNG investments, trying to decide which to reactivate, which to mothball and which to accelerate going forward.

FIGURE 1.
An investment of US$440 billion is expected over 2007-2030 in expansion of LNG infrastructure.



Source: "World Energy Outlook 2008," International Energy Agency; "Natural Gas Market Review 2008," International Energy Agency.

…and the unpredictability

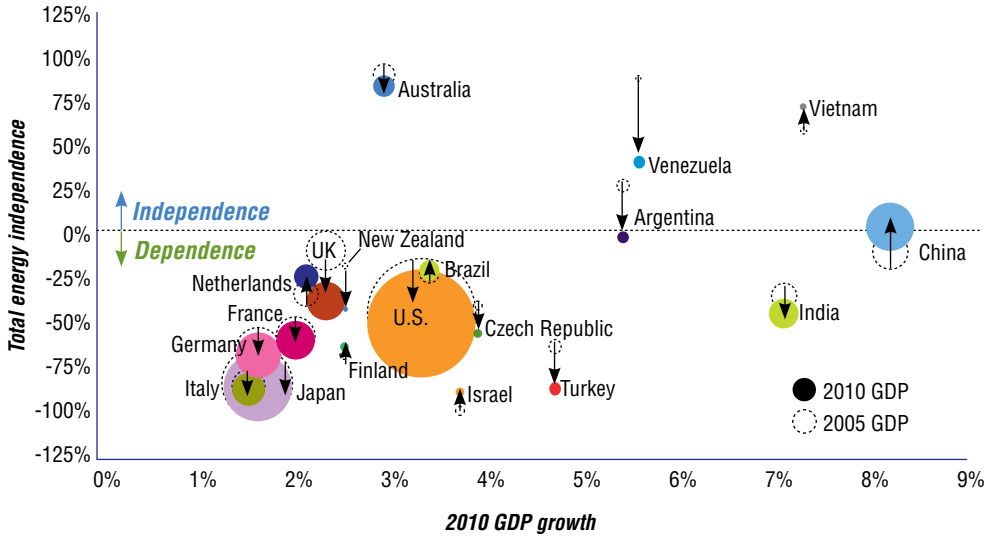
Yet, the demand for LNG – perhaps more than other energy sources – is characterized by unpredictability. There are inherent uncertainties in any industry based on *constrained natural resources*. New natural gas sources are increasingly difficult and expensive to find and develop, more and more remote, and production volumes are harder to anticipate and realize.

Geopolitical issues also aggravate the economics of LNG supply and demand. Most nations strive for energy self-sufficiency, but for many, this desire for independence is outpaced by GDP growth and its corresponding energy demands (see Figure 2).

Often, governmental control of the supply of natural gas is used as political leverage on the world stage. Complicating the situation further, many of the particularly gas-rich areas of the world are fraught with political instability. The facilities and infrastructure that produce and transport LNG are prime targets for terrorism. In some cases labor strife, trade embargoes – and even piracy – threaten LNG shipments.

The most volatile factor influencing demand for LNG is *alternative fuel prices*. LNG is inherently caught up in a tug-of-war between the price of natural gas and that of oil, with coal emerging to dominate in the not-too-distant future. Lower natural gas prices tend to raise overall demand for gas. The price must also

FIGURE 2.
Most economies are becoming increasingly energy dependent.



Notes: The size of the two bubbles for each nation represent the size of the country's gross domestic product in 2005 as compared to 2010. The position of the bubbles represent their energy independence in those same two years. The energy independence percentage is calculated as the amount of domestic production in excess of consumption divided by overall consumption. A positive value indicates a measure of independence, while a negative value represents the degree of dependence on energy imports.
Sources: IBM Corporate Economics analysis; "Annual Energy Outlook 2006," U.S. Department of Energy, Energy Information Administration.

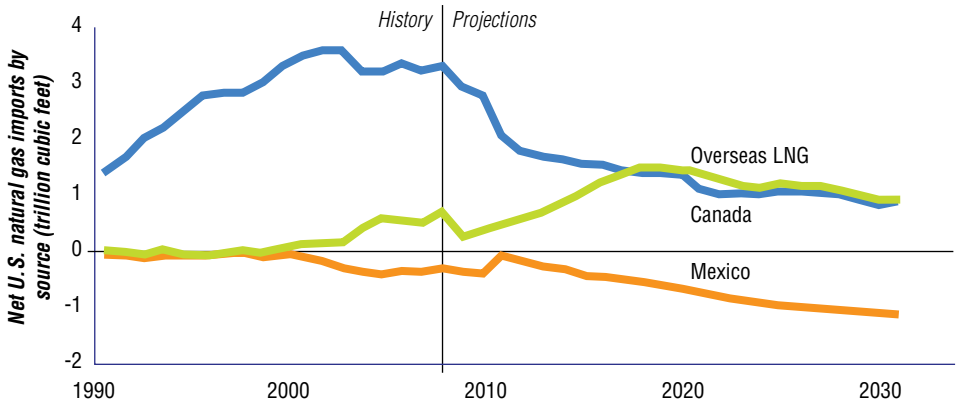
LNG must contend with the uncertainty of constrained natural resources, geopolitical issues and, most of all, fuel prices, making the precise window of opportunity difficult to predict.

remain high enough to support the higher costs of LNG delivery, but not increase too much or consumers will switch to alternative fuels. The threat of substitution is substantial: nearly 20 percent of today's current natural gas usage in the United States can be easily switched to other fuels (primarily through dual-fired power plants that can use either coal or gas).[14]

As the most "mobile" form of natural gas supply, LNG imports are particularly vulnerable to regional and even local price shifts. When higher natural gas prices decrease overall demand, LNG imports tend to be the first cut. When unexpected spikes in demand occur, buyers often close the gap with LNG. When Asian demand spiked in 2008 (while supply remained tight overall), LNG shipments to the United States plummeted, as domestic gas proved a cheaper alternative.

For LNG, this competition among fuels creates a window of opportunity. But the extent and duration of this opportunity are difficult to project precisely. The International Energy Agency predicts that high natural gas prices would ultimately lead to a shift in demand towards coal.[15] The U.S. Department of Energy forecasts that high LNG prices will spur domestic supply, leading to a decline in U.S. imports over the long run (see Figure 3).[16] As a result, LNG industry participants face difficult choices about how much to invest, where, and how fast.

FIGURE 3.
High LNG prices are expected to increase domestic production of natural gas in the United States, leading to a fall in imports over the long run.



Source: "Annual Energy Outlook 2009," U.S. Department of Energy, Energy Information Administration.

Complexity and risk

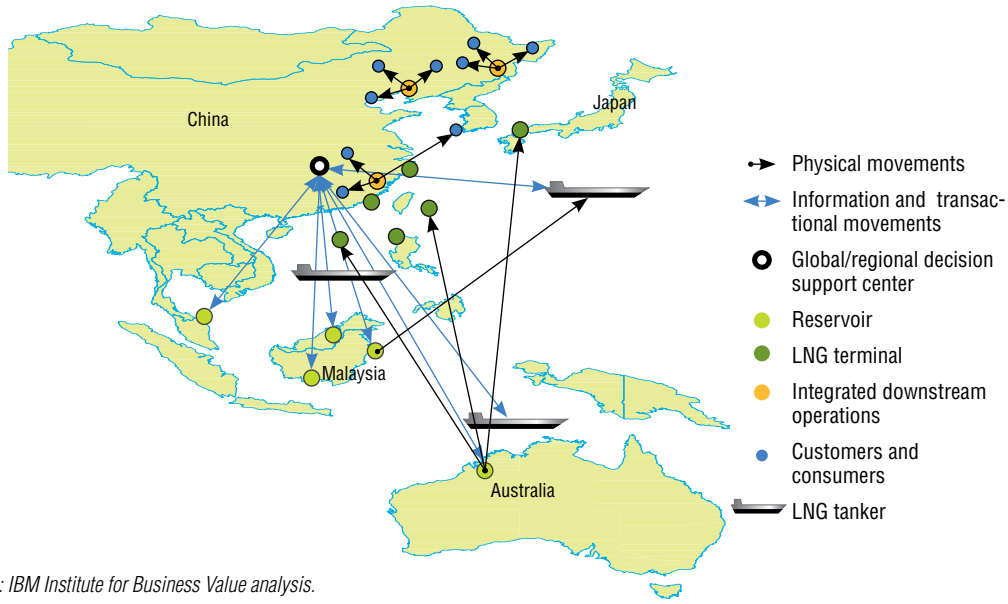
As the LNG supply chain becomes larger and more flexible – with more globally distributed liquefaction and regas facilities – the nature of the LNG business is changing, with commensurate increases in complexity and risk.

The supply chain – or more precisely, the *LNG value chain network* – has become inordinately more complex to manage. Historical point-to-point delivery has evolved into an intricate network of origination points, transportation partners and shipping destinations. Each player must manage a complex value chain of new assets, joint ventures, investments, purchase/supply agreements and logistics – constantly monitoring both physical and transactional flows in order to react in real-time as situations change (see Figure 4).

As the supply network expands and importers demand more purchasing flexibility, the industry's historical long-term contracts are steadily giving way to *commodity marketplaces*. In the 1990s, less than 2 percent of all natural gas transactions were spot trades; by 2007, that figure had grown to 11 percent.[17] We expect this trend to accelerate as existing long-term contracts expire. The industry impact could be substantial, given that contracts for a large amount of gas sold each year to Asian countries will be up for renewal over the coming decade. A commodity-like market structure is quickly falling into place, with LNG pricing mechanisms already established in both the Atlantic and Pacific Basins.

In addition to the financial complexity introduced by the expanding commodity market, LNG ventures face another possible side

FIGURE 4.
This example illustrates the major physical and transactional movements that must be managed as part of an LNG value network.



Source: IBM Institute for Business Value analysis.

It's important for LNG ventues to focus on actions that facilitate long-term flexibility.

effect. The thinner margins that often accompany commodity trades will likely *expose operational inefficiencies* in the supply chain previously hidden by higher-margin, long-term contracts.

As always, production, storage and transport of a fuel such as natural gas requires the utmost attention to *safety, reliability and regulatory compliance*. The general public and the governments that represent them are understandably concerned about protecting the environment. Even with superior safety records, LNG ventures face a daunting image challenge, given the magnitude and visibility of their projects.

The scale and complexity of the LNG business is matched only by the *financial stakes involved*. By almost any measure, LNG ventures are massive, encompassing thousands of acres of shoreline, thousands of employees to build and operate, millions of design documents and often billions of investment dollars. Constructing a regas terminal, for example, typically costs about US$900 million – and the price tag for a gas liquefaction plant begins in the billions.[18] Consider also that these investments usually have a five-year lag for engineering and construction before payback begins and are based on a 30-year business case.

Because of the magnitude of the investment (and the risk), most LNG projects are accomplished through joint ventures. These capital projects involve a complex collaboration among engineering firms, equipment suppliers, producers, pipelines, liquefaction plants, shippers, regas facilities, and storage and distribution networks. However, the joint venture structure, in turn, *complicates visibility* of investments, assets, inventory and financials. Each investment partner brings to the venture its own business practices and technology standards, making holistic assessment and management of the business extremely challenging.

Early readiness, enduring flexibility

So how can industry players and nations protect the investments they are making to meet global energy demand? How can they mitigate risk amid ever-increasing complexity?

It is important for new LNG ventures to focus on actions that can accelerate successful scale-up, while positioning themselves for long-term flexibility. We believe investment partners should consider four key actions early in the joint venture process:

- Focus constrained joint venture resources on differentiated areas of the new business.
- Instill a culture of safety.
- Increase visibility for improved decision making.
- Establish a reusable business model and associated infrastructure.

Focus constrained joint venture resources

By nature, most joint ventures operate with limited staff. Adding to the challenge, most of the specialized skills required by new LNG ventures are in short supply. These ventures are often competing with the petroleum and utilities industries for a shrinking pool of talent and expertise.

Thus, it is crucial for investors to focus their scarce resources on areas of the business that are most strategic, as well as those that carry the highest stakes because of safety risks or the degree of capital involved. Equally important, investors should consider turning low-risk, low-investment functions over to external specialists that can often perform those activities more economically and at a higher level of quality.

Instill a culture of safety

In the LNG industry, safety must be a core value, designed into the business from the start. This can be institutionalized through the implementation of formal, enterprise-wide safety practices and broadly communicated expectations of safety performance. Where possible, the expected level of performance should be explicitly stated and measured using standard, industry-accepted metrics.

Clear communication channels – up and down the management chain – must be established to surface and correct potential safety issues as they arise. Leaders must continuously reinforce an environment where the disclosure of problems is encouraged and employees are motivated to do the right thing, even when it might seem difficult.

Practically every decision a joint venture makes – from where facilities are located to whom they partner with – should involve a safety element. Achieving a positive return on investment is inexorably linked to safe and reliable operations. For LNG ventures, safety is not a cost; it's an investment.

A key example of instilling safety is through operator training. Many LNG ventures are essentially start-ups, with no operations history and few experienced staff. Using design data from process equipment, automation and information technology, sophisticated operator training simulators can be developed to support comprehensive training for new hires – long before they must help commission new LNG facilities. Would an airline allow pilots to fly a jet on which they had not been simulator trained and certified? The LNG industry must make a commitment to safety to the public, employees and regulators. Early hiring and professional training of operations staff is critical to success.

Increase visibility for improved decision making

The sponsors and owners of LNG ventures often lack access to operational, financial, logistical and asset management information associated with the new business. Conflicting business practices, incompatible processes and technologies, and different information standards can make it difficult to share information across corporate boundaries.

It is critically important to flatten these hurdles early in the venture. All investment partners need a common view of information to facilitate decision making and more timely responses to business changes. As they work to improve visibility, investors should implement processes and infrastructure that can transition smoothly from design and construction phases to ongoing operations.

Establish a reusable business model and associated infrastructure

New joint ventures present partners with a fresh start, an entrepreneurial environment where they can adopt industry-leading processes, practices and technologies. Partners can bring the best from their respective companies, while escaping ineffective processes and current infrastructure limitations.

The goal should be to merge diverse partner interests into a flexible business model with components that can be reused in future

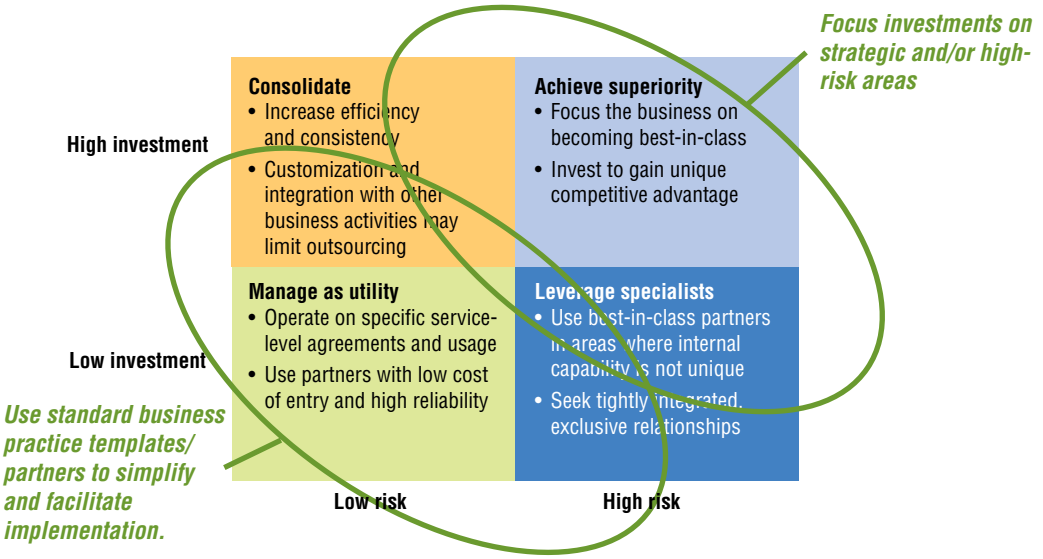
Standarization early in a venture helps mitigate risk and accelerate implementation.

ventures. Standardization – of processes, business practices, technology platforms and such – lays the groundwork for reuse. Standardization *early in the venture* is even more beneficial, as it helps mitigate risk and accelerate implementation timelines. Too often, new ventures postpone process, technology and measurement standardization decisions until forced by the construction schedule. Agreeing upfront on key processes, infrastructure and metrics helps prevent delays that might otherwise occur.

Using today's digital technologies for example, it is possible to electronically exploit facility design data within its new operational systems even before factory acceptance testing, helping smooth site acceptance testing, plant commissioning and both initial and long-term operations. These key steps in handover of the facility from the engineering, procurement and construction provider to the owner/operator can be streamlined and enhanced if technologies are in place early enough to leverage.

In low-risk, low-investment areas of the business, investors should consider using a centralized services approach or possibly outsourcing to speed implementation and reduce risk (see Figure 5). In strategic areas, investors will also want to invest in infrastructure for standardization and automation. Financial information sharing, asset management and procurement are some of the key areas to evaluate for standardization opportunities.

FIGURE 5.
Early investment in standardized aspects of the business model reduces variability and focuses efforts on accelerating implementation without compromising safety.



Source: IBM Institute for Business Value.

Ready for the race?

In those very early stages, when a LNG joint venture is initially forming, investors make critical decisions that impact their long-term odds of success. Delaying those important decisions simply piles risk onto an already risky endeavor.

As a participant in a new LNG venture, here are some questions to help you assess your level of preparedness:

- How quickly can we adapt to changing conditions? Are we locked into an inflexible business infrastructure that cannot be scaled easily or hard-wired processes that constrain innovation?
- What specific steps are we taking to manage the safety risks involved in our project? Do our employees understand the safety-related aspects of their roles and the decisions they are making?
- Do all of our investment partners have access to the information they need? Do we have the necessary information to make fast and accurate decisions as situations change?
- In which areas of our business could standardization and established governance processes help reduce costs and risk? Where could we use partners to accelerate start-up, improve performance or share risk?
- How modular and reusable are our processes and business practices? What specifically do we plan to redeploy in our next LNG venture?
- Overall, how confident are we that our current LNG project will achieve its expected return on investment?

Given the inherent volatility of this business, it is uncertain how long the present upswing in LNG demand will last. We believe focusing on the four key action areas we've outlined can help investors move quickly enough to capture the current LNG opportunity, while remaining flexible enough to thrive amid a chaotic and cyclic industry.

DPLNG: Preparing for scale-up from start-up

In 2006, the Guangdong Dapeng (DPLNG) regas terminal received its inaugural shipment: 66,000 tons of LNG arriving from Australia. The terminal is part of a US$3.6 billion investment that also includes the LNG transportation infrastructure and pipeline system that connects several fast-growing cities and five new power plants in Southeast China. DPLNG has 11 shareholders, including the China National Offshore Oil Corporation, which owns 33 percent of the venture, and BP, the lone foreign shareholder, which controls a 30-percent stake.

DPLNG is China's first LNG regas terminal. It is a government-endorsed pilot that will serve as a template for other future facilities. Being first has presented the business with some unique challenges: it had no precedents for forming a Chinese LNG joint venture or designing appropriate management practices and business processes. It has been a pioneering effort in almost every way.

In addition to facing first-of-its-kind pressures, the venture must also be capable of scaling operations in step with the region's ever-increasing energy needs. Its strategy for achieving this objective has centered on standardization, optmization and reuse. It selected business processes and technology standards strategically – not only to support the complexity of its current business, but also to facilitate replication in future regas terminal projects.

During construction, business practices were created based on business templates so that when the physical infrastructure was ready, the business infrastructure was available too. This approach allowed the business to move more seamlessly from construction to operations.

The choice of standardized business processes and supporting technologies made it easier to integrate and coordinate with the facilities' myriad upstream and downstream partners. But perhaps more importantly, designing the business with reuse in mind from the start has led to standard, industry-leading practices that can be repeated in subsequent ventures.

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Steve Edwards is the IBM Global Industry Leader for the Chemicals and Petroleum industries. He has been consulting for over 25 years with his recent focus involving cross-border business transformation and associated technologies for super major and national oil companies. Recently, he has devoted significant time in key oil and gas territories including Russia, China and India, as well as in Central and Eastern Europe, Latin America, North America, Australia and the Middle East. Mr. Edwards is a Fellow of the Institute of Management Consultants and an affiliated member of the Institute of Chartered Accountants in England and Wales. He is a frequent speaker at conferences including the Oil and Money Conference in London, China Business Forum Beijing, and Oil and Gas World Economic Forum Moscow.

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